1916.

WESTERN AUSTRALIA.

A Discussion of Australian Forestry,

With Special References to Forestry in Western Australia,

The necessity of an Australian Forest Policy and Notices of Organised Forestry in other parts of the World;

Together with Appendices relating to—
Forestry in New Zealand,
Forestry in South Africa,
and Control of the Rabbit Pest,

By

D. E. HUTCHINS,

École Nationale des Eaux et Forêts, Nancy,
formerly of the Staff of the Indian Woods and Forests Department,
and late Conservator of Forests, South Africa,
and Conservator of Forests, British East Africa, F.R Met. Soc., etc., etc.

Issued under the authority of the Minister Controlling Forestry in Western Australia
the HON. R. T. ROBINSON,
Attorney General and Minister for Mines.

PERTH :
BY AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.
1916.

t 713/26

1916.

WESTERN AUSTRALIA.

A Discussion of Australian Forestry,

With Special References to

Forestry in Western Australia,

The necessity of an Australian Forest Policy, and Notices of Organised Forestry in other parts of the World;

Together with Appendices relating to—
Forestry in New Zealand,
Forestry in South Africa,
and Control of the Rabbit Pest,

By

D. E. HUTCHINS,

École Nationale des Eaux et Forêts, Nancy,
formerly of the Staff of the Indian Woods and Forests Department,
and late Conservator of Forests South Africa,
and Conservator of Forests, British East Africa, F R. Met. Soc., etc., etc.

Issued under the authority of the Minister Controlling Forestry in Western Australia,
the HON. R. T. ROBINSON,
Attorney General and Minister for Mines.

PERTH:
BY AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.
1916.

1689/16

Karri Log showing bulk of timber: Denmark, W.A.

TABLE OF CONTENTS.

Preface .. .. xxi.
Introductory citation .. .. xxiii.

DIVISION I.

PRELIMINARY OBSERVATIONS ON THE PRINCIPLES OF MODERN FORESTRY,

CHAPTER I.

ESTABLISHMENT OF FORESTS AS NATIONAL ASSETS.

		Page.
1.	Prompt "Demarcation" essential for conserving natural Forests	1
2.	Requirements of a good Demarcation	2
3.	Soil contrasts in Forestry and Agriculture	3
4.	Utilisation of lower class forests	3
5.	First class inalienable forests	4
6.	Demarcation promotes settlement	4
7.	Financial loss to States through non-demarcation, necessitating resumption ..	5
8.	Pernicious political influence on forestry as a rural industry	5

CHAPTER II.

PRESENT AUSTRALIAN DEMARCATIONS AND THOSE OF SOME OTHER COUNTRIES.

(A.) *Forest Demarcation in the various Australian States.*

Victoria	6
New South Wales	6
South Australia	7
Queensland	7
Tasmania	8
Western Australia	8

(B.) *Forest Demarcation in some other Countries.*

India	9
Japan	10
East Africa	10
South Africa	10

CHAPTER III.

TOTAL EXTENT OF PERMANENT FOREST NECESSARY FOR AUSTRALIA.

9.	The three rainfall divisions of Australia which govern Forest growths—	
	Dry Australia	11
	Dryish Australia	11
	Fertile Australia	11
10.	Minimum Forest demarcation for industrial populations	13
11.	Limitations of Artificial exotic plantations	13
12.	Federal finance necessary to re-afforest Tasmania	14
13.	Tropical Australia—absence of data—Meteorology unreliable	15

CHAPTER IV.

FIXITY OF TENURE FOR DEMARCATED FOREST LANDS AND RE-PURCHASE OF FREEHOLDS.

		Page.
14.	Non-alienable tenures under trustees indispensable	16
15.	Trustees for Western Australian forests an urgent necessity	16
16.	Alienation evils and redemption costs	17
17.	Alienation evils exemplified in Victoria	17
18.	Re-purchase of alienated forest lands in Europe and America	19

CHAPTER V.

FOREST FIRES—THEIR EFFECTS AND THEIR PREVENTION.

19.	Protection from Fire can be completely secured	20
20.	Western Australian Fire Risks	20
21.	Consequences of Forest Fires	21
22.	Fire-proof Forests	21
23.	Forest Fires in India	21
24.	Occasional Forest Fires seldom cause Permanent Injury	21
25.	Rapid new growth after Fires	21
26.	Forests only totally destroyed by Repeated Fires	22
27.	The Trinity of Fire-protection	22
28.	Watch-Towers and the Hill-top Forester	22
29.	A French example—The Esterelle Forest	23
30.	A Portugal example—The Leiria Forest	23
31.	American Railways and Forest Fires	24
32.	Fires due to Pleasure Parties and Travellers	24

CHAPTER VI.

NATURAL PREVENTIVES OF INJURY TO FOREST BY FIRES.

33.	Fire-Paths: Forsyth's Indian practice	25
34.	Fire-Paths in Western Europe and South Africa	25
35.	Permanent Fire-breaks: (1) Grassed track; (2) Non-inflammable trees	25
36.	Other preventive measures; Permanent Watchers a useless expense unless organised	27
37.	Impracticable proposals	27
38.	Erroneous Popular Notions concerning Forest-fires	28
39.	A Forest is not a "Park"	28
40.	Forests of Beauty—The "*Bosquets*" of Versailles	28
41.	Tree-top fires in South Australia	29
42.	South Australian fire-breaks	29
43.	Victorian practice needlessly expensive	29
44.	Australia's vast losses from Forest Fires	30

CHAPTER VII.

THE "BUSH FIRES" OF AUSTRALIA AND TASMANIA.

45.	Victoria loses £250,000 worth of timber in two years	30
46.	Bush-fires in Victoria in 1914	31
47.	Bush-fires in New South Wales, 1915	31
48.	Bush-fires in Tasmania, 1914–1915	32
49.	Government culpability for Forest Fires	33
50.	Fire damage to Municipal Water-catchment areas in Australia, due to their non-protection	34

CHAPTER VIII.

Forest Fires in other Countries.

		Page.
51.	Fire protection in South Africa—present practice	35
52.	"Native" Forests Fire-resisting	35
53.	Planted or artificial forests must be fire-protected	35
54.	Recovery of the Cedarberg forest in Cape Colony	35
55.	A valuable by-product due to fire protection	36
56.	Wattle fires and forest fires in Natal	36
57.	American forest-fire obtuseness reflected in Australia: the cause and its mis-application	37
58.	Canadian original forests now two-thirds burnt off	37
59.	United States' losses of forest timber from Railway engine sparks in 1910	37
60.	Remarkable growth of Australian Eucalypts in other countries, and their low average timber yield in Australian forests	38
61.	Low yields due to direct injury to trees	38
62.	Low yields due to burnt soil	39
63.	Low yields due to "Soil Sickness"	39
64.	Filling up the Forest, and affording Fire-protection restores the quality of the soil	39

CHAPTER IX.

Debit and Credit Sides to Forest Fires and Forest Regeneration.

65.	Eucalypt and Acacia forest in Australia regenerate naturally after a forest fire	40
66.	Procedure when utilising the fire-method for the regeneration of forests	41
67.	Bush fires habitually caused by the Blacks when pursuing game	41
68.	Trees 400ft. in height in an organised forest producable in a single life-time if protected from fire	42
69.	Fire-protection must be part of a general scheme for dealing with virgin forests or burnt out areas	42
70.	Undivided Departmental control absolutely essential	43
71.	Foresters to reside within their areas; extent of their charge	43
72.	Anomalous staff arrangements obtaining throughout Australian forestry	43
73.	Excess yields of Eucalypts in foreign countries, due entirely to fire protection	44
74.	National Parks and "Natives Reserves" may become dangerous fire risks	44

CHAPTER X.

Forest Organisation—the Forest Station.

74a.	Note on the founding of the Forest Station in Cyprus	44
75.	Selection of the Central Station—An African example	45
76.	Size of the Forester's area	45
77.	Foresters an armed force, with special status	45
78.	The "Resident Forester" a life appointment for a special man	46
79.	Absentee Foresters the rule throughout Australia	46
80.	Meteorological Observatory in the forest	47
81.	The choice of a Nursery site	47
82.	Village for forest labourers	48
83.	Education of the Workmen's Families	48

CHAPTER XI.

Cost of Organisation.

		Page.
84.	The present total area of Australian intensive Forestry	48
85.	Total yearly forestry wages for Australia including the permanent forestry officers	49
86.	A complete Australian organisation will cost £4,000,000 yearly, and bring in £16,000,000 yearly	49
87.	The costliness of the present ill-organised system	49
88.	The Forester's Cottage—its location and functions	50
89.	A Cape Town example of a Forester's Cottage	50
90.	Building materials recommended to be used for the Forester's Cottage	50
91.	Cost of the Building	51
92.	Structural details of the Cottage	52
93.	The disuse of Paint on the woodwork	52
94.	Land for the Forester's Private Benefit	53
95.	The Forester's Wife	53

CHAPTER XII.

Forest Roads and Tramways.

96.	Absence of Forest Roads a cardinal defect in Australian Forest policy	53
97.	Main roads indispensable for economy	53
98.	The choice of Metal Roads and their Construction	54
99.	South African practice in laying out Forest Roads	54
100.	Excessive width and cost of Australian roads; the retardation of Tasmania due to this cause	54
101.	Excessive width of the roads in Australian cities	55
102.	Economical forest roads, of grassed track	55
103.	The best grasses for binding forest roads	56
104.	Long tramways in forests should be made by Government and a higher price charged for the timber	56
105.	Tramway construction absorbs timber-companies' dividends: Some Australian illustrations	56

CHAPTER XIII.

Forest Grazing.

106.	Animal food raised in Europe from forest products	57
107.	Grazing *versus* Forestry considered as rural and economic questions. British and Australian data	57
108.	Bad effects of grazing in Australian forests is directly due to a Wrong System of Control	58
109.	Wattle Bark as illustrating losses due to improper grazing regulations	58
110.	Conditions rendering light grazing permissible	59
111.	Danger of ill-used tree areas reverting to worthless scrub; the disastrous experience of Queensland	59
112.	Forest pastures a stock refuge in times of drought	59
113.	Forest grazing by Goats; its use and abuse. The Goat a "Forest-feeding Animal."	60
114.	Forests and Goats as factors in Dairy-farming	60
115.	Trees have converted certain barren lands into Pastures	62
116.	Forest demarcation must include pastures for the cattle which will be employed in the forest	62
117.	Pig grazing on forest products in Europe and South Africa	62
118.	Grazing is not a by-issue: it is an essential part of Forest Management and insusceptible of Divided Control	63

CHAPTER XIV.

THE TOURIST TRAFFIC AND THE AESTHETIC SIDE OF FOREST COUNTRIES.

		Page.
119.	Tourists do not see Australian forests advantageously	63
120.	Organised Forests would attract tourists, as exemplified in other countries	64
121.	The Tourist Club of France and its help in the National Forestry. The contrast with Australian Tourist Bureaus	64
122.	Choice scenery forest areas not yet utilised in Australia	65

CHAPTER XV.

FOREST AND GAME.

123.	Game development in Australia awaiting Organised Forestry	65
124.	Present Australian practice is "Game Laws without Game-keepers," and "Nature Reserves" without Fire-protection	66
125.	Game Departments in Europe and Africa are administered by the Forestry Departments	66
126.	Australia's need of more introduced Game	66
127.	Game under a Large Organisation produces Large Revenue	67
128.	Organised Forestry restricts or destroys rabbits and vermin	68

DIVISION II.

PRACTICAL FORESTRY.

CHAPTER I.

FOREST WORKING AND MANAGEMENT.

129.	"Working Plans" essential to secure continuity of System and to avoid repetition of errors	69
130.	Contrast between Russian and Australian Working Plans	70
131.	Official Working-plans for private forests in the United States	70
132.	Japan has 5,000 Working-plans for 5,000 square miles of forest	70
133.	Character of Working-plan required for Australia	70
134.	Catastrophe to Forest Management: The "Settler's" invasion	71
135.	Choice of the felling-system to be adopted	71
136.	Fixing the period of "Forest-rotation"	72
137.	Thinning, in relation to Forest and to Forest Plantations	72
138.	Sustaining the yield; White Ants and "piped" trees	72
139.	Laying out "Coupes" or Yearly Cutting Areas	73
140.	Burning-over "Coupes" after cutting	73
141.	Regularising the Irregular Forest	74
142.	Systems of "Forest-regenerating"	74
143.	"Clear-cutting" and "Burning-over," advisable for Eucalypt forest	74
144.	"Selection-fellings" in Virgin Forest; a critical question	75
145.	Clear-fellings would be fatal to the Brush Forest of East Australia	76

CHAPTER II.

THE IMPROVEMENT OF WESTERN AUSTRALIAN FORESTS BY INTERPLANTING EXOTIC TREES.

		Page.
146.	The Jarrah Forest as viewed by a Forester	76
147.	The Jarrah as a timber tree	77
148.	Jarrah timber as Railway sleepers	77
149.	The measures necessary for improving the Jarrah Forest	78
150.	Demarcation urgently necessary, as replanting Jarrah Forest is impracticable	78
151.	Jarrah timber the most valuable crop Jarrah Forest lands will ever produce	79
152.	The Jarrah forest wants filling up with conifers	79
153.	The climate of the Jarrah forest will suit the Cluster-pine	79
154.	The light in the Jarrah forest is ample for pine growth	80
155.	The Cluster-pine recommended for interplanting with Jarrah	81
156.	Advantages and disadvantages of Insignis-pine for interplanting with Jarrah	81
157.	The choice of Pines for filling the open forests of Western Australia	82
158.	The Rabbit pest in the mixed forest	83
159.	Successful interplanting of Eucalypts and Pines in South Africa	83
160.	Successful interplanting of Eucalypts and Pines in Australia	83
161.	The Karri forest easy to manage	84
162.	The rapid re-growth of Karri	84
163.	Karri trees, probably the tallest in the World	84
164.	Dimensions of Karri trees actually measured	85
165.	Desirable that the biggest trees be exactly located	85
166.	How to distinguish Karri wood from Jarrah	85
167.	The Yate as a cultivated forest tree	86
168.	The limitations of the Blackbutt tree	87
169.	Wandoo a close second to Jarrah timber	87
170.	Tuart a tree of the calciferous drift sands	87

CHAPTER III.

THE INLAND FORESTS OF WESTERN AUSTRALIA.

171.	A forest destroyed by the Mining Industry	88
172.	The "firewood" tax on Gold production	89
173.	Introduction of the Mesquit tree suggested	89
174.	Necessity for an Arboretum at Kalgoorlie	89
175.	Blue Gum grown at a profit in a Kalgoorlie climate	90
176.	The coppice re-growth of Western Australian timber trees	91
177.	Mallet bark trees said not to coppice	91
178.	The deficiency of Pole-trees in Australian forests	92

CHAPTER IV.

DUES—ROYALTIES—FELLING PRACTICE.

179.	Computation of Royalties by the "Metric tickey" Standard and from gross Forest Revenue	92
180.	Various Royalties compared	93
181.	Low royalties indicate absence of a correct Forestry policy	94
182.	The importance of felling when the sap is down	95
183.	Evils of the minimum "felling-girth" system	95
184.	Considerations which should determine felling-girth	96
185.	Selection of the most suitable trees for felling	97

CHAPTER V.

"Timber Working" or Exploitation of Australian Forests.

		Page.
186.	Timber-getting as a branch of business	97
187.	State Governments entering into Timber business	98
188.	A timber-getting business without a Manager	98
189.	The New South Wales System of "Lumbering"	99
190.	The South African System of "Lumbering"	99
191.	The true place of the Saw Mill in Forest improvement	100
192.	The value of "Concessions" when rightly applied	100
193.	The regrettable absence of Pit Sawing in Australian Forests	101
194.	Hewing Licenses and their attendant Evils	101
195.	Abnormally low "Stands" of timber in Australian Forests	102
196.	Normal Stands of Pine Timber in Europe	103
197.	Average Stand in the Karri Forest	104
198.	Average Stand in the Apalachian Forest, U.S.A.	104
199.	Average Stand of Blue Gum in the Nilgiris; India	104
200.	The probable Stand of mixed Eucalypt and Pine Forest	105
203.	Forest Stands of various timbers in other countries	106
204.	Australia's maximum Stand to be double the European maximum Stand	106
205.	The main features for working a Western Australian Forest	107
206.	The four stages of working a Forest by working-plan	108

CHAPTER VI.

The Cultivated Forest.

207.	Winning the most valuable crop the soil can give	108
208.	No conception in Australia of the "Cultivated" Forest	108
209.	Australian official view of Forest Lands is "Forest Waste"	109
210.	The difference between the "Wild" and the "Culitvated" Forest	109
211.	Four years of "Cultivated forest" growth equals a century of Virgin Forest growth	110

CHAPTER VII.

Tan Bark Wattles.

212.	Natal farms grow profitably an Australian poor soil product	111
213.	Wattle-planting cannot compete with Wild Wattle	112
214.	The choice of Wattles for growing in Western Australia	112
215.	The largest Wattle Plantation in Australia	112
216.	The Pycnantha Wattle in various countries	113
217.	A West Australian Sand-binding Wattle	114
218.	The tannin dry extract from Quebracho-bark	114
219.	Australian tan-wattles need a tariff protection	114

CHAPTER VIII.

Forest Haulage Animals.

220.	Hauling gear not economical	115
221.	Dray horses costly to keep	115
222.	Mules the cheapest animal for its keep	115
223.	Oxen the best haulage teams	115
224.	Tame Buffaloes the best heavy draught animals	116
225.	Sentimental objection to Cow teams for haulage	116
226.	Forest grazing for the haulage animals	117

CHAPTER IX.

Forest Plantations.

		Page.
227.	Seeds for Australian Plantations should be a Federal business	117
228.	Forest seed not in ordinary private business channels	117
229.	Government seed comes up true to name	118
230.	Method of packing succulent seed for long transport	118
231.	Vendors of pure seed in Australia and elsewhere	118

CHAPTER X.

Softwood Planting in Australia.

232.	Australian consumption of Softwoods	119
233.	Western Australia's imports of Softwoods	119
234.	Curtailment of Australia's supplies inevitable	119
235.	Failure of Home Supplies in Europe and America	120
236.	Southern range of the Wild Pines of the Northern Hemisphere	121
237.	Pines though easily Naturalised become subject to Disease	121
238.	The Insignis Pine in Australia	122
239.	Pines profitably planted for Railway sleepers in South Africa	122
240.	Conditions determining relative Pine growth in Australia and South Africa	122
241.	Pines have not occupied poor soils from choice, but under stress in the struggle for existence	123
242.	The Cluster-pine recommended for the sandy tracts of Western Australia	123

CHAPTER XI.

Present Pine Plantations in Australia.

243.	South Australia producing plantation timber for Fruit Cases	124
244.	Victoria's estimated stand of Insignis timber = £180 per acre	124
245.	The Pines that progress in Victoria	125
264.	Softwood Forests twice more valuable than hardwood forests	125
247.	Exaggerated notions of vast Australian Forests	126
248.	Australian Forests have not yet got their Best Trees	127

CHAPTER XII.

The forming of Australian Forest Plantations and Forest Nurseries.

249.	Distinction between "Tree Plantations" and "Tree Naturalisation"	127
250.	Systems of planting in Nurseries	128
251.	Cost of the Bamboo-tube system of Planting	129
252.	Dry-Country transplanting needs special care	130
253.	The "Failure" Patches from sowing broadcast	130
254.	The choice of Planting-distance	130
255.	Risks incidental to pruning	131
256.	Weeding essential to success in dry climates	131
257.	The system of "Cut and Mulch"	131
258.	"Thinning" in its woodcraft and Economic Phases	132
259.	The selection of a Plantation Site	132
260.	Deep Soil indispensable to successful Plantations	132

CHAPTER XIII.

CONSIDERATIONS OF THE COST OF PLANTATIONS.

		Page.
261.	Wages costs of Plantations	133
262.	"Failure Patches" to be replanted once only	134
263.	Interest charges against Plantations limit the profitable sizes of trees	134
264.	Trees planted in sandy soil need Manure	134
265.	The Hamel Plantation in Western Australia	135
266.	Planting Conifers with other Trees	135
267.	Mixed Trees are an insurance against Pests	136
268.	Extensive Plantations not advisable in Western Australia	136
269.	The general forward movement in Plantation Enterprise throughout the World	137

CHAPTER XIV.

ORGANISATION OF DEPARTMENT.

270.	Training and recruiting Australian Forestry Staffs	137
271.	Anomalous position of the Staff in Western Australia	138
272.	Chief Officers should be selected from countries having similar climates	138
273.	Foreign travel indespensable for supplementing local knowledge	139
274.	A Plea for a Federal School of Forestry	140
275.	Foreign Forest Schools available to Australian Students	140
276.	Training the Rank and File	140
277.	The Trained Workers of the Forest of Dean	141
278.	The Forester's Work not a "Government Job"	141
279.	The Units of a fully organised Forest Establishment	141
280.	The Forester's status and condition of service	142
281.	The useful functions of a Forestry Department in State Administration	143
282.	The Forestry Department as Trustee for Public Scenic grounds	143

CHAPTER XV.

OFFICIAL ADMINISTRATION.

283.	Conservators' Conferences promote Unity of Action	144
284.	Importance of Departmental Yearly Reports	144
285.	The Model for the Yearly Report	145
286.	The usefulness of Yearly Reports increased by a "Ten minutes Summary"	147
287.	Biennial and Triennial Reports with Yearly Interim Reports advocated	147

DIVISION III.

POPULAR FORESTRY.

CHAPTER I.

THE GENERAL LACK OF INTEREST IN FORESTRY THROUGHOUT AUSTRALIA.

288.	Australia's anomalous mental attitude	149
289.	Experience of British Association—the great forest problem untouched	149
290.	Paucity of Australian forest literature	150
291.	Three million books in Public Libraries; not twenty on "modern" forestry	150
292.	A missing link in a University Library	151
293.	Commonwealth Governor-General utilises Melbourne "Cup Week" to break ground for correct forestry	151
294.	The dawn of an increased interest in real forestry	151

CHAPTER II.

How to arouse a correct Public Opinion on Forestry.

		Page.
295.	Better defined teaching in the Public Schools wanted	152
296.	The example of Japan	152
297.	The " Arbor Day " in Australian Schools	152
298.	Arboretums at Forest Plantations	153
299.	Examples of Arboretums in South Africa	153
300.	Arboretums in Europe, America and Japan	154
301.	Arboretums non-existent in Australia, the parks are merely ornamental ..	154
302.	Sydney's Centennial Park contrasted with the Versailles Park of France ..	155
303.	An ideal site for a Tasmanian Arboretum	155
304.	The " National Park " near Adelaide	155
305.	Suggestion for an Arboretum at Perth	156
306.	An Arboretum at Canberra, the Commonwealth Capital, must be maintained by irrigation	156

CHAPTER III.

The Educational Value and the Utility of Suburban Forests.

307.	The place of Suburban Forests in Social Life	156
308.	The Forests suburban to Paris	157
309.	The forest of Soignes at Brussels: its local popularity and educational value to Democracy	157
310.	Other Suburban Forests in Europe	158
311.	Suggested Suburban Forest sites in Australia	158
312.	The purchased sites, an easily redeemed outlay. The example of Burnham Beeches, in England	159

CHAPTER IV.

The Australian Forest League and the work of Kindred Societies elsewhere.

313.	The League's recent birth and Great Mission. Its need of a Journal	160
314.	Australian Leagues, to be effective, must first acquire Political Influence.. ..	160
315.	Help which Foreign Countries get from Forest Leagues or Societies	161
316.	An Australian Text-book required for Australian Forestry	161
317.	Facts to be presented in Text-book	161

CHAPTER V.

Popular Misconceptions regarding Forestry.

318.	Error 1—That forestry means " costly " planting	162
319.	Error 2—That hardwoods and slow-growing timbers have most durability and strength	163
320.	Error 3—That the American " backwoods " typify the ideal " permanent forest "	163
221.	Error 4—That all good land is more profitable under Agricultural settlement than under Forestry	164
322.	Error 5—That intensively Working a forest necessarily destroys it	165
323.	Error 6—That Forestry and Botany mean practically the same thing ..	165

DIVISION IV

ECONOMICS OF AUSTRALIAN FORESTRY.

CHAPTER I.

EXPORTS, IMPORTS, AND HOME SUPPLIES.

		Page.
324.	Costs of Imported Timber	167
325.	Estimated cost of future Imports	167
326.	Annual imports of timber per head of population in Australia and other countries	168
327.	Australia's timber imports for next 30 years, £6,000,000 a year	169
328.	The National Debt equalled by the unavoidable timber bill	170
329.	Factors affected by retail price of timber	170
330.	Losses of Export Markets; former customers become competitors	170
331.	Europe's unlimited market for Cheap Hardwood	171
332.	Australia's annual exporting power limited to half-a-million sterling	171
333.	Tan bark export industry; continuous shrinkage of home supplies	171
334.	The sources of supply in the existing forests	172
335.	The crux of an export trade is the area of accessible good forest	172

CHAPTER II.

PRIMARY VALUE OF FOREST PRODUCTS.

336.	Value of home timbers at Mill and in Forest	172
337.	Misleading comparisons of official forestry values	173
338.	Primary valuations by the "Metric tickey" standard or by politically-influenced "Royalties"	173
339.	Waste of forest timber indicated by "Sawn Timber" Statistics	174
340.	Primary value in the forest of trees producing 667,554,000 super. feet of sawn timber, equals £2,000,000	174
341.	Home trade has lost the stimulation derived from cheap abundant raw material	174
342.	Exports of certain timbers now prohibited on account of scarcity	175

CHAPTER III.

THE LESSONS OF THE PAST.

343.	Summary of the losses due to a Century of Bad Forestry	176
344.	Further losses due to the Retardation of Settlement and Population through bad Forestry	177
345.	The idle capital represented by virgin forest	178
346.	Urgent need of the true facts being made widely known, and forest economics set forth in Official Publications	178

CHAPTER IV.

STATISTICAL ABSTRACTS TO 1913.

Forest Reserves and Forest Working:—

	Forest Reserves. Misleading Official Figures	179
	Forest Field Staff of each State	180
	Forest Expenditure in each State	180
	Forest Department Revenue in each State	181
	Timber "worked" in each State	181, 182
	Forest Revenues obtained by each State against feet of timber worked	182

Arboriculture and Forest Nurseries :— Page.
Area of Forest Plantation in each State 183
Expenditure on Plantations and Nurseries in each State 183
Yearly Distribution of Trees to the Public 184

Exports and Imports :—
Exports of Timber from Australia 184
Imports of Forest Produce, including Paper-pulp, Resin, etc. 184, 185
Exports and Imports of Tan Barks 185, 186
Subsidiary Wood Industries, including Firewood and Furniture 186, 187
Bulk in cubic feet of the Wood Imported into Australia, and its value 187
BALANCE OF TRADING IN TIMBER IS AGAINST AUSTRALIA 188
MAGNITUDE OF THE AUSTRALIAN FIGURES EXPRESSING IMPORTS OF FOREST PRODUCE 189
THE NEEDED STIMULUS MUST ORIGINATE IN FEDERAL CONTROL 189

DIVISION V.

FACTORS INFLUENCING AUSTRALIAN TRADE IN TIMBER AND FOREST PRODUCTS.

CHAPTER I.

TARIFF INFLUENCES.

Page.
347. Difficulty of applying a Tariff on Raw Products 190
348. Forest Interests should be Paramount in a Protectionist Country 190
349. An Australian Timber-famine approaching and inevitable 191
350. Low Tariff tends to create a fashion for the use of imported timbers in Buildings and Furniture 191
351. Present Australian tariff the main cause of the drain on the country for imported timber 192
352. The Wattle-bark Industry can be retrieved—Tariff not absolutely necessary .. 192

CHAPTER II.

POLITICAL INFLUENCES.

353. Evil Influence of Politics on Forestry manifest throughout all Australia 193
354. Political Mistakes cannot be recalled in a work framed to run continuously. Some Australian examples 193
355. Demoralising Effect on Department and Staff of Political Interference .. 195
356. Advantages of a Federal Control exemplified by Indian Forestry 195
357. Proposals for a Commonwealth Forestry Department 196

CHAPTER III.

THE INFLUENCE OF HOME INDUSTRIES.

358. Seasoning-kilns, and Hardwood Flooring-boards 197
359. Advantages of the "Hardwood" Floor 197
360. Contrasts due to using "Softwood" Floors 198
361. Paper-making from Wood-pulp and the coming exhaustion of Foreign "Pulp" supplies 198
362. The Choice of Trees to be cultivated in Australia for Wood-pulp making 198
363. Bamboo-growing for Paper-pulp 199

CHAPTER IV.

EMPLOYMENT FOR RURAL LABOUR.

		Page.
364.	Rural Depopulation in Britain and France	200
365.	The Excess of City Populations in Australia is the great Social Problem of the Commonwealth	200
366.	Australia's problem of "The Unemployed" partly solvable by State Forestry	200
367.	Forestry and "The Unemployed Whites" in South Africa	201
368.	Western Australia's second greatest rural industry hanging in the balance	201
369.	Australia's Governor-General speaks out	202
370.	Extra-tropical Forests produce more Timber and employ more Labour than Cold-country Forests	202
371.	Forestry *versus* Sheep-farming as Labour-employing Powers	203

CHAPTER V.

WORLD-WIDE EFFECTS OF FORESTRY ON THE "LABOUR MARKETS."

372.	Forestry labour in Belgium	204
373.	Forestry labour in Germany	204
374.	How the labourers' "Living Wage" is maintained by Forestry	205
374*a*.	Employment in an ordinary Australian Forest—800 acres to 3,000 acres per man	205
375.	The Labour Party in Britain demands State Forestry as a "Distress Preventive" and Emigration-check	205
376.	The despairing "Small Holder" in Australian Forests	206
377.	Private Forests detrimental to rural and Municipal Employment	206
378.	Amount of employment requisite for working Australian "Forest Reserves" and probable cost	207
379.	Employment calculated on basis of Annual Expenditure	207

CHAPTER VI.

THE RELATIONS OF FORESTRY TO PUBLIC FINANCE.

380.	Climate-effect of Forestry on Public Works and Local Areas	208
381.	Forest Revenues misappropriated by State Governments	208
382.	Forestry as a factor in Australian National Credit and Thrift	209
383.	Loan money must be the form of the National invested capital	209
384.	The amount of capital required for annual investment in Australian Forestry	210
385.	The question of State Loans or a Federal Loan for Australian Forestry	210

CHAPTER VII.

A LOAN POLICY AND THE FINANCING OF FORESTRY.

86.	Urgency of an immediate "Forest Loan" policy	212
87.	Annual Value of Australia's output of Forest Products	212
388.	The Forests and the Railways are Australia's two greatest Permanent Assets	213
389.	The financial attitude throughout Australia in regard to Forestry	213
390.	The financing of the South African Forestry operations	214
391.	The financing of Forestry in Portugal	215
392.	The financing of Forestry in France	216
393.	The financing of Forestry in Western Australia	217

CHAPTER VIII.

THE PUBLICATION OF INFORMATION ACQUIRED BY OFFICIAL GOVERNMENT INQUIRIES AND TECHNICAL RESEARCHES.

394.	Royal Commissions on Forestry	217
395.	Geology and Forestry	218
396.	Mining and Forestry	218
397.	Education and Forestry	219
398.	Agriculture and Forestry	219

DIVISION VI.

SPECIAL TO WESTERN AUSTRALIA.

CHAPTER I.

LEGISLATIVE ENACTMENTS—FOREST REGULATIONS UNDER THE LANDS ACT.

		Page.
399.	A fundamental "Forest Act" required	220
400.	Advisory Boards to be avoided	220
401.	Present "Regulations" inelastic	220
402.	"Standard" felling sizes prevent "clean cutting"	221
403.	Surveys should be at cost of Government	221
404.	Lease period should be proportionate to capital outlay	221
405.	Auction sales advisable if competition obtainable	222
406.	Government's right to cut timber free for public purposes	222
407.	Lessee to furnish monthly certificate of logs milled	222
408.	Cutting areas closed after two years' cutting	222
409.	Cutting not to be in advance of one month's mill requirements	222
410.	Mill sites on "Permits" obtainable on annual rental	222
411.	Royalty computed on 23 working days monthly and 50 per cent. wastage per load	223
412.	Timber to be cut in order of succession; "sleeper" timber last	223
413.	Tuart and Wandoo not to be cut for export	223

CHAPTER II.

TECHNICAL INVESTIGATION OF AUSTRALIAN TIMBERS BY G. A. JULIUS.

414.	Nature of investigations	224
415.	Reliability of the Tests	224
416.	Importance of the identification of the Timbers tested	224
417.	The strongest Australian timbers	225
418.	Test for strengths as "beams."	225
419.	Karri timber for beams	226
420.	Relation of density to strength	228
421.	Moisture and sap variations corresponding to localities of growth	228
422.	Market factors affecting hardwoods	229
423.	Importance of a correct felling season	229
424.	Natural and artificial seasoning of timber	230
425.	Deformation during seasoning	232
426.	Reputation for durability of Australian hardwoods founded on Jarrah	233
427.	Sleeper tests of durability	233
428.	Spike-holding power of sleepers	234
429.	Wood-working characteristics not investigated	234
430.	Low inflammability of hardwoods	234
431.	The extraordinary strength of Yate	235
432.	Two varieties of Yate	236
433.	Summary of results	236
434.	Importance of preserving the natural Jarrah forest	237
435.	Some further tests desired	237
436.	Suggested publications in pamphlet form of Julius' results	238

CHAPTER III.

INFORMATION RELATIVE TO THE MALLET BARK INDUSTRY.

437.	Two kinds of Mallet bark	239
438.	Mallet-bark export	239
439.	Tannic acid percentage	240
440.	Mallet-bark trees need protection	241

CHAPTER IV.

INFORMATION ON THE SANDALWOOD INDUSTRY OF WESTERN AUSTRALIA AND INDIA.

		Page.
441.	The Western Australian Sandal tree	241
442.	The Indian Sandal tree	241
443.	Trade factors prejudicial to Western Australian sandalwood	242
444.	Sandal distillation in Western Australia	242
445.	Sandalwood not a forest tree, but a parasite	242
446.	The export trade in Sandal	243
447.	Conservation of Sandal in India	243
448.	Other countries producing Sandal	244
449.	Sandalwood working in Mysore	244
450.	How to conserve Western Australian Sandal	244

CHAPTER V.

THE USEFUL TREES RECOMMENDED FOR PLANTING IN WESTERN AUSTRALIA.

451.	List recommended by Ednie Brown	246
452.	Reasons for special selection of Trees	246
453.	Trees recommended enumerated in Alphabetical order	246

DIVISION VII.

ARBORICULTURE—PUBLIC AND PRIVATE.

CHAPTER I.

STIMULATING ARBORICULTURE BY STATE ASSISTANCE AND STATE NURSERIES.

		Page.
454.	Distinction between Arboriculture and Forestry	267
455.	Growing trees for profit	267
456.	Fruit trees grown with the field crops	268
457.	Government aid to Arboriculture	268
458.	Free issues of tree plants lead to abuses	270
459.	Nurseries for flowers and shrubs distinct from Nurseries for trees	270
460.	The correct guiding principle of Government distribution of seeds and trees	271
461.	Arboriculture involves continued attention after planting	272
462.	Municipal Arboriculture	272
463.	State distribution of trees to farmers	273
464.	The national importance of Arboriculture	273

CHAPTER II.

ROADSIDE TREE GROWING, AND ITS CONTROL.

465.	Roadside Fruit trees in Europe	274
466.	Roadside trees for shade	274
467.	The English neglect of roadside tree-planting in Cypress	275
468.	Australian climatic conditions demand roadside trees	275
469.	The choice of trees for roadside planting	276
470.	Private forests not usually commercial investments	277
471.	Private forests a relic of feudalism	278
472.	Private forests need State Aid and oversights	278

DIVISION VIII.

PRESENT CONDITION OF FORESTRY IN EACH OF THE AUSTRALIAN STATES.

CHAPTER I.

FORESTRY IN WESTERN AUSTRALIA.

		Page.
473.	Forest Area less than proper proportion	280
474.	Vitality of the Karri forest	280
475.	The beginnings of a working forest policy	281
476.	Constructive forest policy not yet inaugurated	281
477.	Forest revenues appropriated to General State purposes	282
478.	The crisis in Westralia's forest policy	282
479.	Official estimate of forested areas	282

CHAPTER II.

FORESTRY IN SOUTH AUSTRALIA.

480.	A false start	283
481.	A better position attained	284
482.	Present expenditure well directed	284
483.	Schools for teaching forestry	284
484.	Practical investigations and research work	285
485.	Softwood plantations well developed	285
486.	Canary Pine proved best for South Australia	285
487.	Eucalypt planting in dry areas a questionable policy	286
488.	Magnificent pine growth at Whyte Park	287
489.	The economic position of forestry in South Australia	287
490.	Extending the forest areas by purchase	288
491.	Fire precautions	288
492.	Pine planting in the Coorong sand waste	289
493.	The fostering of Arboriculture in South Australia	289

CHAPTER III.

FORESTRY IN QUEENSLAND.

494.	An ill-defined position	290
495.	Nature's bounty to Queensland	290
496.	Scandalous waste of red Cedar	291
497.	Boom and delusion	291
498.	Financial phases of present position	292
499.	The half-round railway sleeper	292
500.	Forest organisation still in the incipient stage	292
501.	Unknown potentialities of Queensland forests	293
502.	The "Prickly Pear" pest	293
503.	The "Prickly Pear" dies in shade	294
504.	Nature's hint to kill a pest	294
505.	Forest Department a mere appanage to Lands Department	294
506.	Sawmill working of the Forest	295
507.	Railway sleepers	295
508.	The realisation of over-matured forest timbers	296
509.	Three valuable Queensland trees nearly extinct	296
510.	Reckless destruction of valuable softwoods	296
511.	Sparseness of the Eucalypt forest	297
512.	The Camphor tree an unappreciated asset	297
513.	The Chinese "Coffin tree"	298
514.	The position can be restored	298
515.	The public immorality of the present position	299
516.	Area of forest reserves required for Queensland	299
517.	Queensland arboriculture	300

CHAPTER IV.

Forestry in New South Wales.

		Page.
518.	The fatal dual control over the forests	301
519.	Defects of the New South Wales system	302
520.	Appalling Government ignorance of scientific forestry	302
521.	Softwood importation in 1913 nearly £4,000 daily	302
522.	Disastrous consequences of following wrong ideals	303
523.	New South Wales once had the premier hardwood forest	304
524.	The lesson of the Dorigo forest	304
525.	Reckless destruction of softwoods	305
526.	The cost of rectifying a bad policy	307
527.	Plantations to produce softwood	307
528.	Where plantations may succeed	308
529.	"Hogan's bush" the last bit of forest near Sydney	309
530.	Forestry and the Saw-millers	309
531.	An efficient Staff effectually muzzled	310
532.	Low royalties	310
533.	Valuable timber museums and poor Library	310
534.	Arboriculture in New South Wales	311
535.	Tree planting for profit	311
536.	Shade Trees	311
537.	Sydney University and Forestry	312

CHAPTER V.

Forestry in Victoria.

538.	A correct start made at last	312
539.	The valuable work of a Royal Commission	313
540.	The definiteness of the future forest policy	314
541.	The growing public interest in forestry	314
542.	The remnants of splendid Victorian forests	314
543.	Melbourne a city without a forest	315
544.	Victoria's giant trees	315
545.	The record heights established	316
546.	Woodcraft policy *versus* Political Relief Works	317
547.	Extent of present cutting areas	318
548.	Fire protection the crux of Victorian forestry	318
549.	Water carriage not now favoured in organised timber forest	319
550.	Considerations affecting Victorian "Working-plans"	319
551.	Political intermeddling not quite obviated	320
552.	Softwood plantations and softwood importations	320
553.	Forest sowing of softwoods not yet begun	321
554.	Permanent dedications of Areas annually increasing	321
555.	Royalties too low	322
556.	Creswick Forest School	322
557.	Forest Revenue and Expenditure	323
558.	Buying Tasmanian timber while over-matured Victorian timbers left standing	323
559.	Details of revenue and expenditure	324
560.	Sawn timber outputs	324
561.	Melbourne Water Supply catchment area forest	324
562.	How forests improve water catchment areas	325
563.	Melbourne's catchment area has not suitable forest	326

Arboriculture of Victoria.

564.	Melbourne Botanical Gardens	327
565.	Melbourne Street Planting	328

CHAPTER VI.

Forestry in Tasmania.

		Page.
566.	Tasmania only one-fourth ploughable	329
567.	The real land question ignored	329
568.	Tasmanian Forestry the worst in Australia	330
569.	An ideal area for growing softwoods	330
570.	No trial plantations yet attempted	331
571.	Forest area merely a rough estimate	332
572.	Reckless timber grants	332
573.	High durability of the four chief softwoods	332
574.	The Tasmanian hardwoods	334
575.	Typical forest country described	335
576.	Personal experience of burnt forest country	335
577.	Hobart's water supply and forest	336
578.	The National Park exposed to Fire risks	336
579.	A hopeless situation	337
580.	Railway dangers to the National Park	337
581.	Government culpability for bush-fires	337
582.	Mount Wellington and Table Mountain compared	338
583.	Fatalistic attitude of Tasmanians with regard to bush-fires	339
584.	Hobart an ideal city to have a suburban forest	339
585.	Natural advantages discarded	340
586.	The best remaining Tasmanian forest	341
587.	Settlement has occurred only on the best forest land	341
588.	Tasmania's loss reacts on Australia	342
589.	Vallambrosa's climate that of Tasmania	343
590.	Utopian schemes for a bankrupt State	343
591.	Tasmania's poverty is a needless crime	344
592.	A voice in the Tasmanian wilderness	344
593.	Japan and Tasmania compared	344
594.	The waste in the virgin forest	345
595.	A scheme to make paper pulp in Tasmania	345
596.	Limited grazing area in the forest country	346
597.	Tasmanian wattle-bark	346
598.	Tasmania still has a tan-bark trade	347
599.	Tasmania's lack of a rural population	348
600.	Tasmania's forest can pay off her State debt	348
601.	Tasmania's timber trade	349
602.	Trade in dressed timber	350
603.	What Tasmania is losing under the present system	351
604.	Loss and waste in working by license	351
605.	Organised forests would make Tasmania the Norway of the South	352
606.	Fruit cases will become more expensive	352
607.	Fire paths will give more grazing area	353
608.	Handicaps to Saw-milling	353
609.	Timber working with minimum of profit	354
610.	Capital needed to restore Tasmania's forests	355
611.	The vigorous growth of Blackwood	355
612.	Special features of some Tasmanian woods	356
613.	Tasmania has a forest climate and rainfall	356
614.	Forest education the only cure for Tasmanian apathy	357
615.	Energy of the Saw-millers	357
616.	The hope ahead	357
617.	The first beginnings made	358
618.	Tasmanians do not fully utilise their sunshine	359
619.	What the cities would gain by Arboriculture	359
620.	The atmosphere and streets of Hobart	359
621.	The Hobart "Domain"	359
622.	Tasmania must reform or be absorbed	359
623.	The climate of Oregon on Tasmania's North-East coast	360

DIVISION IX.

RECAPITULATORY DIGEST.

	Page.
Early Destruction of Forests	362
Results of Destroying the Forest	363
Forest fires	364
Fire-protection	365
Doubtful expenditure in thinning and "cleaning up"	367
Demarcation	368
Area of Forest Reserves necessary	369
Organisation of the Forest	371
Federal Forestry	372
Politics and Forestry	373
Royalties	375
The Rural Industry of Forestry	375
Imports of Timber and Forest Produce	377
The £588,000,000 Loss in the next Thirty years	379
Timber Working	380
Forest Departments and their Revenues	381
Thinning and Planting	382
The Routine of future Forest Work	382
Arboriculture	383

APPENDICES.

I.	Forestry in New Zealand	387 to 396
II.	Forestry in South Africa	397 to 402
III.	Control of the Rabbit Pest	403 to 408
IV.	Compound Interest Table	409
V.	Interstate Commission's Report on Timber Tariff Investigations	411 to 416

Index 417

LIST OF ILLUSTRATIONS.

	Facing Page
Karri log, showing bulk of timber, Denmark, W.A.	Frontispiece
Jarrah Virgin Forest, Collie District, W.A.	76
Karri regrowth, 30 years old, Karridale Concession, W.A.	84
Karri Virgin Forest, Donnelly River, W.A.	86
Gimlet Gum as a shelter for stock, Kellerberrin, W.A.	88
Salmon Gum Forest—loading mining timber at Three Springs, W.A.	92
Vegetation of the inland forest country, W.A.—Spring time	110
Insignis Pine, 12 years old, Hamel, W.A.	135
Destruction of Forest for Agriculture	164
An Orchard in the Jarrah country	206
Jarrah regrowth, 25 to 30 years old, Jarrahdale Concession, W.A.	221
Regrowth of *Eucalyptus pilularis*, Queensland	291
Oyster Bay Pine (*Callitris rhomboidea*), Tasmania	333
Stringy-bark, regrowth after a forest fire, Port Esperance, Tasmania	344

MAPS.

Map of Australia, showing rainfall and forest areas	12
Map of the forests suburban to Paris	157
Map of Western Australia, showing forest reserves	180

PREFACE.

Among the many distinguished members of the British Association who visited Australia in 1914 was the well-known forester, Mr. D. E. Hutchins.

A graduate of l'École Nationale des Eaux et Forêts, Nancy, France, he began his Forestry career in the Woods and Forests Department of India. After some years of tropical experience, he was transferred to Cape Colony where he remained for 23 years, and was, it is universally acknowledged, the greatest factor in spreading a love of forests and an interest in arboriculture in that almost treeless country. Mr. Hutchins made a special study of extra-Tropical Forestry and introduced into South Africa species from all parts of the extra-Tropical world, and among them the silva of Australia claimed his special attention. To-day all through those colonies, from Cape Point to the Limpopo River, may be seen extensive plantations of the Australian Eucalypts. With the development of the East African colonies Mr. Hutchins, who was then Conservator of Forests in Cape Colony, was chosen by the Colonial Office to organise a Forest Department in British East Africa. At various times during his career he has been called upon to visit and report on the Forestry problems of different countries. His report on the Forestry in Cyprus was furnished to the Colonial Office, and is a particularly interesting work.

Retirement from the Public Service brought with it the long-wished for opportunity to visit Australia and observe in their natural habitat the trees he had planted so successfully in South Africa. The Chief Forest Officer in England, in his letter introducing Mr. Hutchins to the Forest officers in Australia wrote:— *"Mr. Hutchins has probably had a wider experience in extra-Tropical countries than any man living."*

So distinguished a forester with so wide and varied an experience of extra-Tropical Forestry is indeed one eminently fitted to criticise what has been done and to advise what should be done to improve the Forests of Australia. The Government of Western Australia felt that in the interests of the State, which possesses so much forest of special character, the opportunity of consulting a forester with such ripe experience and matured judgment was one not to be missed. Mr. Hutchins in taking the work in hand found that it was impossible to treat the forests of Western Australia as an entirely separate problem, with the result that the matter which forms this volume embraces all the States of the Commonwealth and also New Zealand.

Every care has been exercised to interfere in no way with Mr. Hutchins' views or expressed opinions. His candid and trenchant criticism and his evident appreciation of the factors influencing colonial progress entitle his conclusions to the fullest consideration. They are expressed in verbiage free from the conventional phrasing of strictly official reports.

The Editor's work has been strictly limited to the slight re-casting of the manuscript necessary to adapt it to the book form in which it is now published.

C. E. LANE-POOLE,
Conservator.

Forest Department,
Perth, 12th October, 1916.

P.S.—While the pages of this volume were passing through the Press, the Report on timber by the Tariff Investigation Committee was laid before the Commonwealth Parliament. The introductory chapter of the report so strikingly confirms Mr. Hutchins' contentions that the whole chapter has been reprinted as Appendix V. to this work. C. E. L.-P.

INTRODUCTION.

"Au plus profond des bois la patrie a son coeur,
Un peuple sans forest est un peuple qui meurt."

With these words, from a modern French poet, the head of the French Forest Service closed the Paris Forest Conference of 1913. It was a great gathering of Foresters, held just a year before the outbreak of the present war. We met Foresters from most parts of the world (except Germany), even from America and Japan. It was a unique opportunity of coming into touch with the latest phase of modern Forestry. I was glad to have been able to attend.

The papers read and the debates form a large volume. They are in French, but French Forestry is surpassed by that of no other country, and it has the advantage of extending to the Mediterranean, where, in France and Algeria, the climate and the cultivated trees are the same as in Australia. My forest training was done at Nancy, and I shall have frequent occasion to refer to French Forestry in these pages.

D. E. HUTCHINS.

Wellington, N.Z.
28th December, 1915.

Division I.

PRELIMINARY OBSERVATIONS ON THE PRINCIPLES OF MODERN FORESTRY.

CHAPTER I.

Establishment of Forests as National Assets.

1.—*Prompt "Demarcation" essential for conserving natural Forests.*

Fertile Australia which, in the Extra-tropics, is about one-seventh of the whole—and which is the only part which has any interest for economical tree-growing—was practically an unbroken forest when the Englishman first landed in the country. It was the duty of the first settlers to have demarcated out from this forest area those portions—about one fourth or fifth of the whole—which were most economically suited for retention as forest. These should have formed the permanent State forests of the country. This was a duty owed to the country by the first Englishmen when they came into their inheritance. It was a duty owed to the country equally by the British Government, the first British State Governors, and the Settlers. All equally failed. There was no State Forestry in England: why should Australia want it?

When preaching "forest demarcation" in Australia and the millions of money that have been lost through the neglect of it, I have more than once been asked the question—What is forest demarcation?

By forest demarcation in a new country I understand the forest survey of the country by forest experts, and the picking out from the general forest area of the country those parts which are best fitted to be *kept in perpetuity* as the national forest estates of the country.

2.— *Requirements of a good Demarcation.*

The first two requisites for the good demarcated forest are: (a) a deep moist soil; (b) accessibility. If there is good timber already on the ground so much the better.

(a) In a damp country timber can be grown nearly anywhere; the forest makes its own soil. But in all country subject to drought (and there is little in the extra-tropics not subject to drought) subsoil moisture is the first necessity for a good growth of timber. Subsoil moisture is not necessary for crops, least of all for grazing, hence the necessity of picking out first and foremost in a new country the areas with good subsoil moisture best suited to be retained as forest.

(b) And after the moisture consideration comes the accessibility consideration. No common products of the land are as heavy as timber. Twenty-one tons per acre per year as a maximum production have been obtained for many years in succession from quick-growing timbers, and productions somewhat less than this are common enough. Among agricultural products only sugar can equal this for weight, and that scarcely affects forest demarcation in Australia. There is very little good demarcated forest that will have an average yield of less than 200 *cubic feet per acre per year*; taking 60 lbs. per cubic foot as an average weight for hardwoods we have 200 x 60 = 12,000 lbs. = 6 tons (short or metric tons of 2,000 lbs. English).

The following list shows average yields for various classes of agricultural produce in Australia:—

Weight of Agricultural Produce.

Apples.—Average in Tasmania, 6 tons (short) (p. 41, Brit. Ass. Federal Handbook).

Wheat.—The Australian average for the last few years is 12 bushels—say 800 lbs. or one-third ton (short). Tasmania 50 bushels, mainland 30, are good crops.

Oats.—Nearly double that of wheat.

Maize.—Average yield for the Commonwealth, 1902-12, is 28.64 bushels, say one ton (Brit. Ass. Federal Handbook, p. 402). Average for Commonwealth, 10 years, 1¼ tons (long), say under 1½ tons (short).

Lucerne.—5 to 10 tons green, but this is not usually transported far.

Potatoes.—10-year averages for Commonwealth, Tasmania 4 tons, Victoria 3, South Australia 3, New South Wales 2½, Western Australia 3⅓ tons.

Sugar.—Queensland 17 tons, New South Wales 25 tons, Victorian beet 5½ tons.

The above is the more common ton of 2,000 lbs.

Thus, as far as possible, demarcated forest should be close to railways, waterways, towns, or industrial centres.

Want of demarcation has lost to Tasmania the advantage of splendid natural harbours, and of unique waterways (for Australia) in its finest Blue-gum forests. South Australia has lost its one area of good accessible forest on Mount Lofty. Queensland has lost its most accessible forest in the hardwood belt north of Brisbane. New South Wales has lost all the good forest in the timber belt near to the capital on both sides. Melbourne, except for fires, has fared better; and Perth may yet retrieve the position with careful demarcation, redemption, and planting.

Besides the weight of the produce to be transported, there is the important consideration that National Forests are the people's play-grounds—"Suburban forests" (p. 157)—demanding proximity to the towns and villages.

There are forests close to industrial centres in France and Germany which yield yearly from £1 to £2 net, even up to £5 net, per acre. Not long ago an eminent French forester was showing me on a large-scale wall map the situation and value of the various State forests of France. He wound up a very interesting talk on the subject with this remark. "These forests," said he, pointing to those near Paris, "financially are carrying on their backs those 'others,'" pointing to the Alpine forests. It is not that many of the Alpine forests are not much better than those near Paris, but it is the timber on the spot which gives their value to the suburban forests of Paris. Thus, in demarcating forests, it may be laid down as an axiom that the first consideration is that of accessibility. Here the want of

forest demarcation has hit the Eastern States of Australia severely. Of the four million acres which Victoria has set aside as national forest, not much above a quarter of a million is of much economic use to-day. This position is being rectified, but necessarily at some cost. The softwood forests are being laid down in accessible situations, and some of the accessible hardwood is being bought back. We have seen (Rural Industry, p. 203) that Forestry may give employment to 30 men as against one man on sheep, but this is with the proviso that the forest timber is close to its market. It cannot walk 1,000 miles to its market, feeding itself on the way like a flock of sheep, yet this is the popular "backwood's forest" idea of Australia.

3.—*Soil Contrasts in Forestry and Agriculture.*

After depth and accessibility (or possible accessibility) the important point coming before the forest demarcator is quality of soil. I place quality of soil after depth and accessibility, because quality of soil is less important in forestry than in agriculture. To a great extent the forest will make and keep its soil: forest is naturally a soil improver, agriculture a soil exhauster. So that as regards Forestry and Agriculture, forest should occupy soil that is deep and penetrable by roots, but poor in an agricultural sense.

The general rule is that only quick-growing trees will give an economical return on good soil. Thus, if there is a question of plantations, quick-growing trees, such as Insignis pine, could economically occupy a much better soil than Jarrah. An extreme case of a poor-soil forest is that of a tree so slow-growing as the Tasmanian Huon-pine. From sections, I have computed that Huon-pine takes about 365 years to make one foot in diameter. Such a tree could naturally only be kept on soil which is nearly valueless. At the other extreme we have forest soil north of Brisbane which will sometimes yield up to £50 an acre, net, when put under bananas.

The present timber crop is usually the determining factor for the first timber reservations. It is the proverbial "bird in the hand" ! And as regards permanent demarcation, it is valuable from the common-sense point of view that where good timber once grew it will grow again. With such forest as a good Karri area there is no further question as to demarcation suitability. The ground is bearing one of the most valuable crops, and a crop which must rapidly rise in value with the coming timber scarcity. Nothing has to be done but to protect the regrowth from injury by man, especially his fires and cattle. The Karri forest is a "cut and come again business" with the most valuable crop the ground can carry, now on it. South Africa is paying £12 to £15 an acre to establish such Karri forests.

4.—*Utilisation of lower class Forests.*

It is usually necessary to have second-class forest reserves, held for the present under a more temporary tenure. In Victoria such reserves are called timber reserves. Obviously, there is much forest land of which the destiny cannot be settled straight away. In South Africa forest of this class is termed "undemarcated forest." The term is, to a certain extent, misleading, since this forest has boundaries, although the boundaries are not fixed in the same sense as the "demarcated" forest.

There is a third class of forest land, which exists usefully in many countries. It is leased or alienated forest land over which the Government retains certain forest rights. Thus, where there is timber of a particularly valuable class, the land may be leased with a reservation of this class of timber. Sometimes such a reservation works satisfactorily, but as a rule it does not; the lessee or grantee has so

many opportunities of destroying timber that exists for someone else's benefit. As a rule it is preferable for such lands to be ordinary demarcated forest under the Forest Department, and temporary grazing leases issued at the discretion of the Conservator.

As mentioned (p. 243) in speaking of Sandal in the State of Mysore in Southern India—the model native State, as it has been termed—Sandal (*Santalum album*) is a royal tree, and this reservation is well known and respected throughout the State. Sandal trees spring up naturally in various parts of the country; they are left till mature, and then taken out by Government. For many years the State of Mysore has drawn a revenue of about one million rupees (£67,000) yearly from Sandal. It is right to mention the case of this third-class reserve here because it may be of much practical use in Western Australia in the conservation of Sandal. (*See* p. 244.)

The chief use of this class of reserve will be to preserve certain valuable timbers on grazing lands, held temporarily for final settlement later. The final settlement of such lands must not be too long delayed, or the natural reproduction of the valuable timber will be lost.

5.—*First class inalienable Forests.*

As a matter of administration, the first-class inalienable forest falls into two divisions, viz.:—

The accessible and valuable, which will be organised and worked intensively at once, and

The inaccessible, on which expenditure at present would not be remunerative.

Thus in the case of a large first-class forest reserve, the accessible portion would have a forest station and nursery with a resident Forester in charge, and be completely protected from fire, and worked. The inaccessible portion would have such a measure of protection and working as circumstances warranted. The complete fire-protection of the more valuable part will help fire-protection in the inaccessible part, and the presence of a resident Forester, at no great distance, and his inspection visits, will afford a further protection against timber stealing and cattle trespassers, and illicit fire-setting.

6.—*Demarcation promotes Settlement.*

It has been often thought that there is antagonism between settlement and forest demarcation. There is really no more antagonism between them than between two banking accounts in the same bank. If the bank is so badly conducted as not to keep these two accounts clear, the depositors cannot be blamed for taking each what he best can in the general confusion! But that is a poor bank in which to place one's confidence. Such a bank represents the country with no forest demarcation. All through Australia I have seen failure amongst forest settlers, dumped down without discrimination on ground which should have formed part of the national forest estates of the country, while what Australia is going to lose in the confusion we can get a glimpse of in the estimate of £588,000,000 as the loss through bad Forestry during the next 30 years (p. 176).

The settler suffers in two ways: (1) he has the expense, very often a serious one, of destroying the timber: (2) he loses the helpful Government expenditure and work which should be going on near him if the Government, instead of alienating its forests, were organising and putting them into order.

It seems scarcely reasonable to draft settlers into great forest districts like the Northern Rivers in New South Wales, the Otway in Victoria, or the Karri

forest of Western Australia, without giving them facilities for earning a livelihood out of the forest. Had the area reservable for State forest been previously demarcated out they would have had assistance from the Government expenditure required in putting the new forest estates in order: expenditure on roads, buildings, and fire-paths; and, in the case of the forest worked, more intensively on nurseries and plantations. The timber, instead of being partially worked and the major portion burnt, would have been utilised in a much larger proportion under the expert advice of the Forest Department. A settler from Great Britain knows little or nothing of wood craft because that is not a forest country. A settler from Australia may know no more, or at most only one phase of Forestry, viz., timber-working. There is no forest education in Australia. Settlement *versus* Forestry is discussed fully under "Rural Employment" (p. 206) in the case of Scotland and Canada.

7.—Financial loss to States through non-demarcation necessitating resumption.

The want of forest demarcation in Australia has caused a loss to the country which will never be calculated. There is a loss in two ways: (1) The loss of the suitable *accessible land* required for the planting of softwoods and forming suburban forests (this will now have to be bought back); (2) The loss of the valuable accessible hardwood forests. This will probably never be quite remedied (see under "Suburban Forests"). The most valuable part of the national forest estates are gone, and for practically no consideration; the plums have been picked out of the cake, and the cake then burnt!

What national forest estates mean to a country can be seen in the case of Germany, which has a net revenue from its State forests of £16,000,000. This, at 4 per cent. represents a capital of £400,000,000. To this national asset, bringing in a gross revenue of some £21,000,000 and a net revenue of some £16,000,000, is partly due the fact that Germany had before the war a national debt of only £270,000,000 against France £1,300,000,000 and England £600,000,000. France has lost a large part of its best State Forests and now has a forest revenue of only £500,000.

No countries have greater need of some substantial set-off against their national debts than the Australian States. I have quoted Germany here because the statistics are the best known. Every European State, except England, is building up similar State Forests.

The "Valuable forests" of the geographical text-books should figure among the public assets of Australia. There is a danger that instead of this entry will appear the statement: "The original small area of good forest in Australia has been lost through mismanagement. It has been calculated that between 1915 and 1945 this management will cause a loss to the country of £588,000,000 (p. 176), allowing only a nominal sum for indirect losses."

8.—Pernicious political influence on Forestry as a rural industry.

Not only has the want of demarcation injured the national forest estates, but it has hampered the rural, as against the town, development of the country. State Forestry is the great national rural industry of a well-organised State. And in Australia, the loss of this hits the rural immigrant at once. The rural immigrant generally wants money; a Government expenditure to him is very precious. Work in the forest with comrades is a pleasant and healthful social relaxation! A quite small Government expenditure in a country place, I know from experience, means a great deal to the little country place.

With the loss of the national forests, the natural Government expenditure in putting the State forests in order has gone from the country to the overgrown towns. Population has had to follow it. With population has come political influence and votes; and thus the evil has tended to aggravate itself, since with the preponderance of voting power in the towns has come a preponderant town expenditure. Thus expenditure under political pressure has often been unnecessary, or such as might be postponed. There is the sad spectacle, this moment, of the electrification of the suburban railways of Melbourne when the whole of the north-east of Victoria remains unpierced by railways, a comparatively undeveloped country. If Australia had demarcated the accessible forests and area suitable for planting softwoods 100 years ago, there would have been a different economic position in Australia to-day.

Since scientific forestry was initiated in India some 50 years ago, Australia has been several times visited by Indian Forest Officers, travelling for health or recreation, and with them it has been nearly always the same story, many times repeated in their official organ the *Indian Forester*: "Demarcate, demarcate." "Forest demarcation," said they, "is the great want in Australia." But all this fell on deaf ears. The *Indian Forester* was not read in Australia. There were no scientific-trained foresters in Australia, no public opinion on Forestry, to force on the Government's attention a matter which represented no votes, and no immediate call for attention.

CHAPTER II.

Present Australian Demarcations and those of some other Countries.

(A.) FOREST DEMARCATION IN THE VARIOUS AUSTRALIAN STATES.

Victoria.—Victoria, under its Forest Act, began demarcation on the 1st January, 1908, the red letter day of Australian Forestry, and the bulk of its demarcations were ended punctually on the 31st December, 1912, the period provided in the Forest Act. The Victorian forest demarcation provides for progressive reservation. There are four million acres of State forest, and a smaller area of timber reserves and two other classes of forest land, more or less closely reserved. The Victorian forest demarcation offers a model which other Australian States may well follow.

New South Wales.—The New South Wales Act of 1909 gave a shorter period, and when that period had expired only a small quantity of demarcation had been agreed upon between the Forest Department and the Lands Department. Finally, under pressure from outside, early in 1915, a reservation *en bloc* of five million acres was declared. The detailed demarcation of the forests of New South Wales remains to be made.

This reservation was made on the report of a "Committee of Timber Supply" consisting of officials representing the Railway, the Harbour Trust, the Public Works Department, and the Lands and Forestry Departments. The Committee found that there was an annual consumption of timber amounting to 500 million superficial feet (42 million cubic feet), and that the average stand of timber in the New South Wales forest was 5,000 super. feet (416 cubic feet). Taking these figures, they asked the Government to dedicate, absolutely for State purposes,

five million acres of forest land. This reservation may be looked on as enough for present purposes on a 50 years' rotation if the forest be conserved. The amount of timber worked in New South Wales is at present slightly less than Western Australia, but on an average, in the last few years, has been somewhat greater.

It must be remembered that this New South Wales reservation is not made on the only reliable basis—a calculation of the timber required for the future population of the State—but as the result of political pressure. The same vacillating opportunist policy which has governed Forestry throughout its history in New South Wales is seen again here.

South Australia.—In South Australia forest-land alienation continued as late as 1903 when the Conservator was directed to prepare a schedule of reserved forest lands, which was attached to the Crown Lands Act of 1903. South Australia, as mentioned in "Forestry in South Australia," has but a small area of demarcated forest, and a still smaller area of demarcated accessible forest. For the State to get a normal proportion of reserved forest, comparable to its future population, there will have to be a heavy expenditure on redemption and plantation. A special Redemption Act is in force and redemption is proceeding as rapidly as funds will allow. There is a heavy expenditure for imported timber, not only from abroad, but from other Australian States. The economic position of South Australia is thus similar to South Africa in 1883.

Queensland.—In no Australian State is forest demarcation more urgent than in Queensland. But in place of a vigorous demarcation forest policy to retrieve the shocking errors of the past, one sees still only a vacillating and opportunist policy, similar to New South Wales. No vigorous policy of demarcation can be said to have been yet arrived at. From time to time certain areas are applied for for settlement; and if this contains good forest there is too often a struggle between the Forest Department, supported by a few far-seeing men, and the local greed of the speculator and land jobber.

And this is not the worst part of the business; legitimate land settlement is either blocked or conducted on lines which are mischievous to the country. In the absence of a forest demarcation, a settler is given land which ought to be within the forest boundaries, and he is forced to enter upon a purposeless course of forest destruction in order to make a living. There is also delay in getting the settler on to the land. He may spend time and money selecting land, only to find that the Forest Department may want the land, and that it will be inspected *as soon as possible!*

It may happen that the whole time of a Government Department is wasted in reporting on applications for forest lands. (See "Forestry in Tasmania," p. 351). It is a matter of common experience in various new countries that, until the forest demarcations are completed, there is continual waste and friction between Government departments. In New South Wales this has become a public scandal, judging from the utterances of well-informed men at the meetings of the British Association; while in Queensland one does not hear of friction, because the part of the Government machinery, which should be at work on forest demarcation, is non-existent!

In "Forestry in Queensland" (see p. 299) I have made a rough estimate of the area of demarcated forest required for the State, most of the fertile well-watered country being tropical, and thus lying outside my general estimate of the area of reserved forest required for extra-tropical Australia.

Queensland has a trained Conservator of Forests who has rightly devoted the greater part of his energies to forest demarcation, but his staff is so small that he can do little.

Tasmania.—Tasmania is the only Australian State where no attempt at forest demarcation has been made. The result is described at "Forestry in Tasmania," p. 332.

Western Australia.—There is a nominal reservation of one million acres (yearly report, Western Australia, 1913). In the published returns there figures a Special Reserve for Western Australia of 11,148,487 acres.

> "Fifteen years ago," says the acting Inspector General, "I had numerous reserves set apart, along the Great Southern Railway, etc. . . . . and, with the exception of one or two, they have all been alienated in the interests of settlement. . . . . The timber is the most valuable crop that will ever grow on a large proportion of the land, particularly that within the Jarrah belt, and it is obviously the most absolute folly to allow country with a crop of timber on it worth £50 per acre to be alienated, under conditional purchase, for 20s. or 30s. per acre."

Actually, there are no permanent timber reserves in Western Australia, and, pending forest demarcation, each application for land is referred to the Forest Department for report. This can only be regarded as a temporary expedient, with serious disadvantages, as mentioned above. It implies a diversion of the forest officials from their legitimate duties, and the position is satisfactory from neither a forest nor a settlement point of view. The settler wastes time in inspecting and choosing land which he may never be able to get; and it will depend on circumstances how the forest official is able to inspect the forest and how the report will fare in the official routine. The forest officials wish to do their duty by the forest and the settler; the settlement officials by the settler and the forest. There is a conflict of aims, friction, waste of time and, consequently, public money. Everyone is in a false position.

There have been nominal reservations *en bloc*, the so-called "timber reserves," for many years, but I understand that real demarcation began in 1912, parties of surveyors going out with the forest ranger and classifying the Karri and Jarrah forests. This is as it should be. The more detailed and carefully worked out a boundary, the more it is likely to stand, within the limits, of course, of a good boundary for the forest. One of the measures recommended in the 14th and final report of the Victorian Royal Commission on Forestry, 1901, was: "The demarcation, *on the ground*, of all reserved forests which have hitherto not been surveyed."

Naturally a tortuous boundary to the forest has to be avoided. It may be necessary to fence it some day. And all enclosures must receive very careful consideration or the cost of fire-protection may be greatly increased.

There are two classes of reserves: Class (A) and Class (B). Class (A) is not alienable except by Act of Parliament, which would, in most cases, mean the wish of the Ministry of the day, or the Minister in charge of Forests. This, therefore, is poor tenure. Worse than this, however, I understood at my visit that the greater portion of the forest reserves has not yet been brought under Class (A), but are in Class (B), and only under temporary reservation. It is stated that Jarrah forest, carrying four loads, or 200 cubic feet to the acre, is placed in Class (B); but the estimation of the stand of timber may be made by surveyors who have no knowledge of timber. I have heard of forests carrying up to 12 or 14 loads, say 650 cubic feet of timber, being estimated to contain not over 200 cubic feet, and thus alienated.

With a knowledge of what has happened in the Eastern Australian forests, it seems impossible that Western Australia can continue to run counter to its best interests by allowing further weakness, or mal-administration, in the matter of forest demarcation. As is truly observed by the Acting Conservator (locally, Inspector General) :—

"The timber is the most valuable crop that will ever grow on a large proportion of the land within the Jarrah belt, and it is obviously the most absolute folly to allow country with a crop of timber on it to be alienated under conditional purchase for 20s. or 30s. an acre."

Karri is, in some respects, more valuable than Ironbark (p. 226, Julius' tests). This has an important bearing on the demarcation of the Karri forests.

Demarcation is, I understand, proceeding steadily, if slowly. The yearly Forest Reports are criticised in that they show no record of its progress. Naturally this does seem an extraordinary omission: Demarcation, Fire-protection, and the introduction of self-spreading Pines being the three cardinal points of Forestry at present in Western Australia. Neither fire-protection nor the introduction of pines can be attempted with much chance of success till the forests are organised (p. 65); and they cannot be organised until they are demarcated.

The National Park and Pinjarra Reserve.—The fauna and flora reserve (160,000 acres) east of Pinjarra should, of course, go to the Forest Department for fire-protection, care, and economic working. The National Park, near Mt. Barker, I have referred to under forest fires, p. 20 and p. 337.

These are now yielding little or nothing from the forest, and as a result of the increasing forest fires, are, I was told, deteriorating rather than improving.

Area of Demarcated Forest required for Western Australia.—The total area of timber of all classes in Western Australia is usually stated at 98 million acres; and, very curiously, this is almost exactly the same figure arrived at as the area required for the national forests of Australia on my estimate of the supplies of timber required for the future population of Australia.

It is shown below—"Percentage of Reserved Forest required for Extra-tropical Australia" (p. 12)—that on a 20 per cent. standard 98½ million acres will be required, and on a 15 per cent. standard 74 million acres. It is unlikely that Australia will be able to secure a total reservation of more than 74 million acres, and comparing the rise in value of the forests under scientific Forestry, and the probable growth of the Australian population, it seems probable that 74 or 75 million acres will satisfy all wants. Fifteen per cent. is, of course, much below the European proportion of forest, but, so also is the growth of European timber with the production of timber in the extra-tropics.

Considering the value of Western Australian timbers, and the reputation that has been made for Western Australian hardwoods in Europe, Africa, and India, it would seem desirable that Western Australia should secure not less than one-third of the total "national forest" area of Australia, as computed above, say *25 million acres*. This figure refers to extra-tropical Western Australia only.

(B.) FOREST DEMARCATION IN SOME OTHER COUNTRIES.

India.—Forest demarcation began in India over half a century ago. As regards land, the situation was similar to Australia when the white man landed. All the land was Government land, and excepting, partially, in one province, has remained Government land ever since. Thus, when Forestry was started, the Government had a free hand; and forest demarcation was carried out in the most complete

and thorough manner. A special "Demarcation and Survey Branch" of the Forest Department was formed; but this was soon found not to be expeditious enough, and so demarcation was entrusted to the various Forest Departments right through India. As mentioned (p. 69, Working-plans), when the demarcations were finished, there was a special Working-plans division of the Forest Department, which has remained to this day, and, as in most countries, will continue to be required.

Japan.—The demarcation and survey of the Japanese forests began in 1890, and in a few years some 10 million acres had been surveyed and demarcated.

East African Highlands.—In the two important recently-formed Colonies of British East Africa and German East Africa, forest demarcation began with the advent of the white man. On the highlands of Equatorial Africa, where the climate is temperate, where it may freeze every night throughout the year, is the last region of the temperate climates of the globe remaining open to white settlement. This plateau country culminates in the snowy peaks of Mount Kenia and Mount Kilimanjaro, both well over 17,000 feet in elevation. In this winterless and summerless climate the glaciers and the eternal snow remain at about the same level throughout the year. This land of equatorial highlands has been colonised during the last twelve years by Englishmen and Germans.

British East Africa and German East Africa are probably the last examples of white colonisation, in the strict sense of the word, that will take place on this globe, for no more "White man's country" remains. In both these countries there has been a new departure in the settlement of the land. In place of the waste and forest destruction which occurred when the Spaniards colonised Mexico and South America, the Anglo-Saxon, North America, and, more recently, the British, Australia, forest demarcation both in German East Africa and British East Africa was the first step taken in the settlement of the country.

When I went to British East Africa in 1906 I found that forest demarcation had taken place in British East Africa, but it had been loosely done. Large areas were set aside on paper for the formation of the forest reserves. Then came the rush of white settlers to British East Africa from South Africa, and from England, and it was soon seen that the loose demarcation could not stand. A more detailed demarcation, and one laid out on the ground, was necessary. This I then did, the procedure being as follows:—

As had been done in India many years before, a survey branch of the Forest Department was formed, whose work it was to go over the country surveying and beaconing off the land best suited to form the future State Forests of the country. At the same time there was a larger staff of surveyors employed in laying out the farms required for the settlers. Gradually, as the work proceeded, the two met, and there is now little land left, either for farms or forest.

South Africa.—When scientific Forestry was started in South Africa in 1883 demarcation and forest surveys were at once put in hand. In the old settled parts of the South-West (colonised 300 years ago), the situation was, simply, taking over all that was left of the indigenous forest and making up the deficiency by planting.

In the eastern part of the Cape, where the Kaffirs advancing from the east and the white men from the west had met recently, and the Kaffirs were barely subjugated, forest demarcation was a more difficult matter. On arriving from India this work fell to me. The Kaffirs and Fingoes had been recently put into their locations and were burning the forest wholesale. The native magistrates said they had a right to do so, since in the forest was their best watered cultivable

ground. I took a different view, and set to work demarcating out all the best forest. There was no time for surveying. I pitched my tent, put in demarcation beacons, and showed these on plane-table sketches. The native magistrates appealed to Cape Town. A strong demarcation Forest Commission was then appointed representing the Forest Department, the native magistrates, with a high official from Cape Town to act as final arbiter on the spot. They went, from beacon to beacon, with the plane-table forest maps in their hands. In five weeks the demarcation was settled once for all. The natives wanted to shoot me, and a colony of Germans, whose forest I had also demarcated, proved a worse hornet's nest; they had votes and political influence at Cape Town. I was transferred to another part of South Africa. But the demarcation has remained to this day!

C'est vous qui a sauvé les forêts de pays-ci (It is you who have saved the forests of the country) said my chief, the French Count who at that time was at the head of the Cape Forest Department, when he went over the demarcation beacons afterwards, and from a hill-top Forest Station surveyed the fair scene; for British Kaffraria is a beautiful country of hill and dale, in climate similar to the mountains of Victoria.

CHAPTER III.

Total Extent of Demarcated Forest Necessary for Australia.

9.—*The three Rainfall Divisions of Australia which govern Forest growths.*

In the Official Year-book of the Commonwealth of Australia (No. 7, 1914, at page 64) is given the areas in Australia occupied by various average rainfalls.

Dry Australia.—Out of a total of 2,974,581 square miles, the area under 10 inches is represented by 1,077,245 square miles, the bulk of this area being in Extra-tropical Australia; so that only a little more than one-third the total area of Australia is really dry country, generally unsuited to all cultivation and only useful for thin (though indeed often valuable) grazing. This dry country will rarely carry timber of much value (exceptionally it does on the goldfields of Western Australia), and more rarely still, a permanent dense population. I therefore omit dry Australia from this calculation. It need only be considered as supplementary to the timber required for the heavier rainfall areas, which will carry a dense population. That leaves practically 2,000,000 square miles to be considered.

Dryish Australia.—In this 2,000,000 square miles there is an area of 957,716 square miles with a rainfall of between 10 inches and 20 inches, and the map at page 78 (Knibbs), together with the larger maps of the Meteorological Department, show that about half this is within the tropics, leaving some 500,000 square miles of extra-tropical dry country, but with sufficient rainfall for wheat, oats, and some other crops such as millet, and thus able to carry a fair population. For the purposes of this calculation, as regards possible density of population, we may rate this, at three-fifths, a good rainfall area, say 300,000 square miles = 192,000,000 acres.

Fertile Australia.—The weather maps show where the area representing fertile Australia is situated. It comprises practically the whole of Tasmania (the small area, 937 square miles, with a rainfall below 20 inches, is easily irrigable). It

comprises in Western Australia, south of the tropic, the South-West corner, taken in a liberal sense; the South-East and Mt. Lofty Range in South Australia; nearly three-fifths of the area of Victoria, and slightly over one-half of New South Wales. Queensland, tropical and extra-tropical, has about one-half its area in the zone above 20-inch rainfall, but 20-inch rainfall in the tropics is barely worth 10 inches in Tasmania. At page 390 I have given a separate estimate of the area required for forest reserves for the whole of Queensland, tropical and extra-tropical.

Considering the whole area of fertile Australia, with a rainfall above 20 inches, it will be seen from the charts that it has its larger half in the tropics; but, if we allow for areas that are tropical in latitude but, from their altitude, extra-tropical in temperature, it seems right to say that about half of fertile Australia is tropical and about half extra-tropical, bearing in mind the fact, with a summer rainfall and tropical latitudes a considerably higher rainfall is required to constitute a fertile climate.

The figures for the rainfall area of Australia above 20 inches, taken from the table at page 64 of the Year-book, give a total of 936,590 square miles, or 599,417,600 acres.

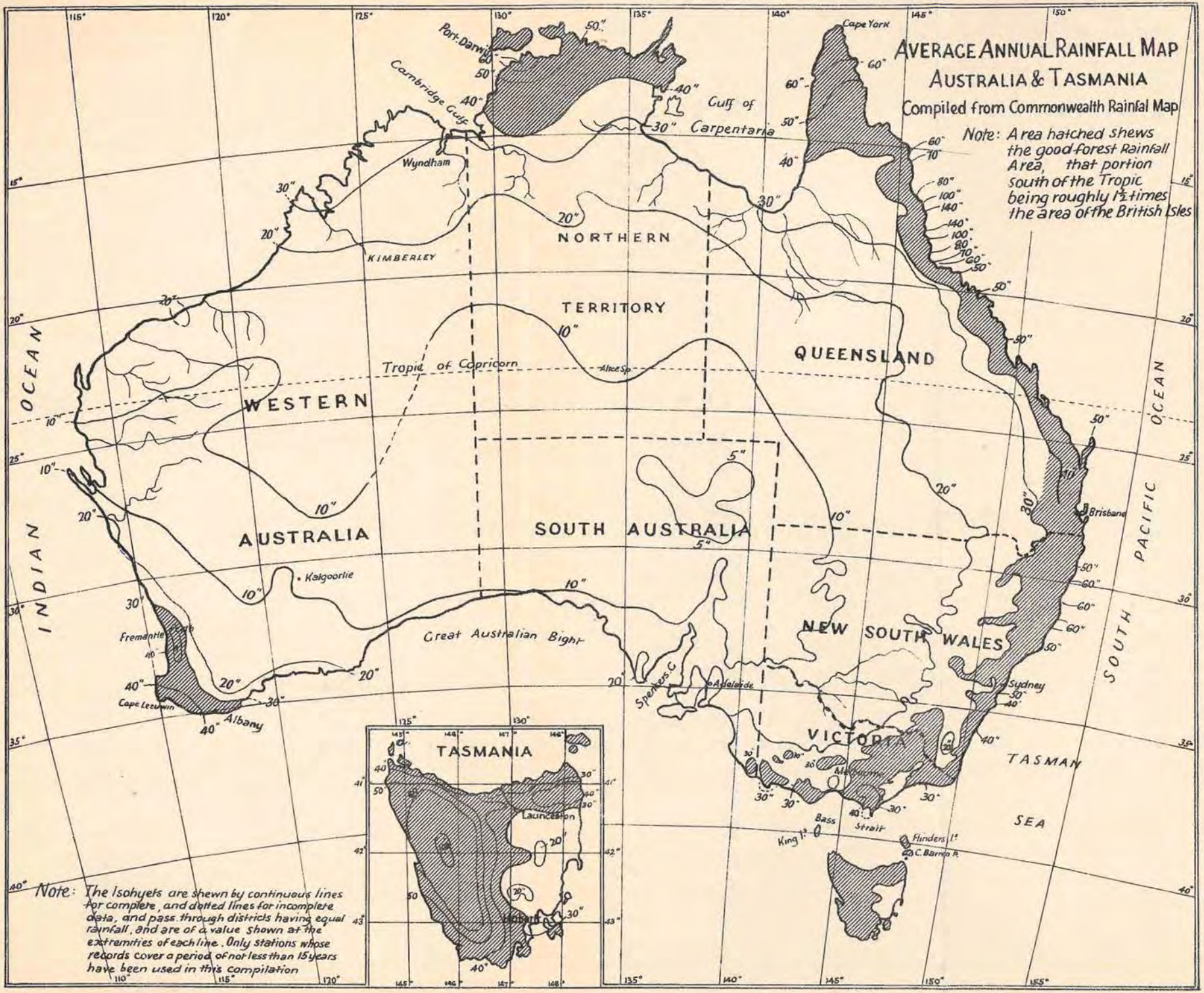
There is undoubtedly a considerable area in Australia which has thus a cool climate, and is likely to carry largish populations, although the latitude is tropical. We may thus divide this area of 599,417,600 acres by 2 (= 299,708,800) in order to represent the area of fertile extra-tropical Australia fitted to carry a dense population.

	Acres.
Dryish extra-tropical area, 10in. to 20in. rainfall, taken at 300,000 square miles	192,000,000
The fertile area of extra-tropical Australia with rainfall above 20 inches (Com. Year-book, No. 7, p. 64) ..	299,708,800
Total	491,708,800
Forest area at the 20 per cent. standard	98,341,760

This is a large figure; it is, in fact, one-twentieth of the total area of Australia, and is most of the present well-timbered forest area of 102 million acres (Commonwealth Year-book, No. 7, of 1914). The actual forest area of Australia is much larger; Western Australia alone is credited with 98 million acres.

It may be instructive to compare this figure with the area under crops in Australia, for some of the more highly cultivated forests of Europe yield as much per acre net as some land under agricultural crops—the Black Forest £5 per acre for instance. The total area of ground under crops in Australia in 1912-13 was 13 million acres (Com. Year-book, No. 7, of 1914, pp. 310 and 332). The total fertile area of Australia with a rainfall over 20 inches is some 598 million acres, so that there is ample room for all the Agriculture and all the Forestry required to make Australia a self-contained and self-supporting country. The extra-tropical area of over 30 inches average yearly rainfall is about 100 million acres (see yearly average rainfall maps of the Meteorological Department).

It is usual in the text-books of Forest Economy to take 25 per cent. as a normal area for a country to have under forest; and at page 387 of the *Com. Year-book*, No. 7, of 1914, is given a list of the forest percentages in various countries, from which it will be seen that Germany has 26 per cent., Austria (with Hungary) 30 per cent., and France 18 per cent., Russia 43 per cent. France lost



H J Pecher, Government Lithographer, Perth, W.A.

its best forests with the loss of Alsace-Lorraine. In fact, most European countries either have the 25 per cent. or are planting up their waste lands to get it. India has 25 per cent. of its area under forest. The *Com. Year-book* figure is incorrect.

The United States of America, in spite of the forest anarchy that reigned for over a century, has now retrieved the position so far that one-fifth the total forest area of the country is now in the forest reserves, and organised State forests are now being rapidly formed.

In the extra-tropics, however, we look for a decidedly higher yield of timber, provided the rainfall is good, say over 40 inches. In extra-tropical Australia there is an area of about 61,000,000 acres, with a rainfall of over 40 inches; but, pending demarcation, it is impossible to say how much of this 61,000,000 acres would get into the Reserved Forest area.

And further, into the 40in. rainfall area of extra-tropical Australia comes a good deal of quite cold country—as on the highlands of Victoria and Tasmania—where the growth would be as slow as that in mid-Europe. Making due allowance for these facts, for areas in the demarcated reserves on bad soil, or too dry, or too cold for the best growth, it seems hardly safe to take a percentage much below the common 25 per cent. standard. But, if a 15 per cent. standard were to be taken, that would mean an area of 74,000,000 acres of forest reserve.

In the above calculation I have excluded the forests of tropical Australia, partly because I have no knowledge of them, and partly because no one can say under what conditions tropical Australia will become thickly populated.

It will be remembered that in Europe the 25 per cent. of forest is far from being all Government forest; but there are few who, in a national sense, would not be glad to see all the forests definitely secured as State forests, as in almost every case the private forests have a lower yield, and give an inferior class of timber to that in the Government forests. And further, it must be remembered that in Australia there will be no good forest without fire-protection, which, to be economical, requires to be conducted on a large scale, and with the resources and organisation which can rarely be commanded except by Government.

10.—*Minimum Forest demarcation for industrial populations.*

With regard to the 15 per cent. and 20 per cent. standards, it must be remembered that nothing lower than these can be adopted for a country carrying a large population, of which a considerable portion is industrial; for, the larger the industrial population, the larger is the demand for timber. The 20 per cent. standard, with 98 million acres, is probably the lowest that can be taken to fully supply the home wants of a fully peopled extra-tropical Australia in timber, tan-bark, pulp-wood (for paper), and other forest products; and, at the same time, preserve all mountain forest for water supplies. But in so much as this area is only partly stocked at present, and cannot be fully stocked with the right sort of timber for a century or more, it would be very advisable, on this account, and also on account of having a margin for export timber, that the forest reserves of Australia should aim at, as high, and as early, a reservation as possible.

11.—*Limitations of Artificial Exotic Plantations.*

It will be understood that if plantations of exotics were made use of, (1) using the choicest timber trees suited to the climate that could be found in the world, (2) placing the plantations on good soil, (3) rainfall not less than 40 inches, a very much smaller area than 98 million acres would provide for all the requirements of Australia, both for home use and export (see pages 372 and 370). But

the idea of supplying the forest wants of the country to any large extent from plantations seems impracticable for three reasons:—

1. Good soil in a climate of over 40 inches rainfall is generally wanted for settlement, and there is usually no great area of land which is good for trees and not good for cultivation or grassing. Good forest land must be deep, moist, and well drained; and to be unsuitable for agriculture must be steep or stony. This is the ideal soil to demarcate into the forest reserves; but there may not be much of it. Inferior, shallow soils may be good enough to keep under forest, but the expense of planting them is prohibitive.
2. The expense of meeting the forest requirements of Australia from artificial plantations would be enormous. Working on a large scale in South Africa, where labour is cheaper than in Australia, and eliminating all items of unnecessary expenditure, as has been done in the recent plantations made for the Railways, the net cost of forest plantations on a large scale has worked out to £8 per acre. In New Zealand, where large forest plantations have been made, the cost has been considerably above this, and is unlikely ever to be brought down lower than the South African figure. Eight pounds per acre, with a crop maturing in 40 years, would, at 4 per cent., mean a cost of £38 8s. per acre, or say £40, allowing for accidents and supposing that value of thinnings will pay costs of maintenance. It is true that low-grade timber, such as packing-case, could be got sooner than 40 years, but, on the other hand, good timber would take longer. We may take 40 years as a mean period. This is far below the maturing time for European timbers.
3. Even with the utmost care to fit climate to climate, there is an element of uncertainty in the planting of exotic forest trees. This element of uncertainty undoubtedly exists, though the planting be done under the advice of a skilful arboriculturist, with the trees and climates of the world at his finger ends. The risk has been taken in South Africa (there was no choice in the matter) and, so far, with generally the best results. But it would be idle to attempt to ignore the risk. South Africa was not, like Australia, endowed with the finest hardwood forest in the world's extra-tropics; and to sacrifice these for plantations of exotics would be as unjustifiable as it would be to maintain that exotics need not be planted to supply softwood.

From this it results that, although the timber wants of Australia can be met to a certain extent from artificial plantations, the country must rely chiefly for its timber in the reservation and gradual improvement by scientific working of its present forests.

And there is this further important consideration, the natural forests of Australia, especially those in mountain areas, have a climatic influence of some importance, and a water-conserving influence of the utmost importance; so that, in a broad sense, there seems little doubt that the future welfare of Australia demands the adoption of the 20 per cent. standard.

12.—*Federal Finance necessary to re-afforest Tasmania.*

When one considers the placing of the 98 million acres of forest reserves, it becomes at once apparent that it is necessary, here also, to take a large view; to look on the forest requirements of Australia as a whole. Perhaps the most striking instance of this is the development of the central highlands of Tasmania. It

is the only part of Australia which is exactly suited in climate to the production of some species of timber which are now being imported to Australia, and there is an area of some 9,000,000 acres there available. Indeed half the area of Tasmania has a rainfall over 40 inches. But the forest development of this area, its fire-protection, and partial planting, are quite beyond the resources of Tasmania. It has lain idle and undeveloped for 100 years. A Federal loan to develop this area, conserving and improving its forests, would actually be a sinking fund to the £6,000,000 a year which I estimate as the probable average yearly cost of imported timber during the next 30 years.

There are those who consider that economy and efficiency would be promoted in Tasmania by the union of that State with Victoria; and the success of union in South Africa may be held as justifying this view. But that can hardly be said to be yet within the region of practical politics. In the meantime, it is urgent that steps should be taken to meet the foreign timber bill of Australia, and one of the most practicable of such steps would be a Federal loan to the Tasmanian Government of £4,000,000 to £6,000,000 to develop the central western forest area of Tasmania, requiring of course, as a condition of such loan, that the work be done either by the Commonwealth or to the satisfaction of a Commonwealth Forestry expert. A preferable course would be the nine million acres to be taken over by the Commonwealth and demarcated, fire-protected, and administered by the Federal Government. There is precedent for this in the United States of America, where, for many years, Federal and State Forestry have existed side by side.

13.—*Tropical Australia—Absence of data—Meteorology unreliable.*

The total proportion of all areas, fertile and arid, of Australia north of the tropic of Capricorn is five-thirteenths, or 0.386; but this proportion is practically largely reduced by highland areas within the tropical latitudes. Of this latter, no estimate is given in the Official Year-book (No. 7, of 1914). while the statement regarding the isotherm of 70° Fah. is very misleading. On account of the plateau character of South Africa, the isotherm of 70° extends to the Equator; while in America, along the great Andean plateaux and Cordilleras, it goes also to the equator! No practical purpose is served by quoting the theoretical isotherms so often shown on meteorological maps, or the temperatures of narrow coastal belts. Those who have been to southern Spain know that the small area within isotherm 70° is a local accident and has no general significance.

Allowing for highlands, Queensland seems about half-tropical, Western Australia, presuming no highlands, is about one-third tropical. Neglecting desert country, the Northern Territory is all tropical.

It is unfortunate that so little information is available on a point so vital to the future of these parts of Australia. In tropical America, as is well known, altitude has been the controlling feature of White colonisation, as it will be in Australia.

As regards extra-tropical Australia, the estimate of a forest area of 98 million acres on a 20 per cent. forest standard is the least that can be taken, assuming the industrial and agricultural progress of Australia to continue on present lines. It is not much for the big areas on the Australian continent: for instance, three times the area overrun with Prickly-pear in Queensland.

CHAPTER IV.

Fixity of Tenure for Demarcated Forest, and the Re-Purchase of Freeholds.

14.—*Non-alienable tenures under trustees indispensable.*

When a good forest demarcation has been made, the forest must be secured to the State in some certain manner. How is this to be done? In South Africa, South Australia, and in Victoria, an Act of Parliament is required before any portion of the national forests can be alienated. This leaves the forests in a not altogether safe position, since a strong Government controls Parliament and can do as it likes. Happily in most cases a strong Government is a good Government which would not readily consent to robbing the National forest estates. A weak Government would probably be turned out of office if it attempted it. There has been no serious forest alienation in South Africa for many years. This position, however, is not quite secure, and when I went to British East Africa and had to demarcate the forest and frame a Forest Act, I succeeded in persuading the Legislature to have the first-class forest reserves placed under trustees.

Politics are blamed in Australia for a large part of the forest scandals. Not only has there been an absence of scientific Forestry in Australia, but large areas of forest have been alienated, not for *bona fide* settlement, but simply to get the timber at a cheap rate. To prevent the possibility of such abuses occurring in the future, and to make certain that the carefully demarcated national forest reserves are preserved finally and for all time to the nation, I am of opinion that they should be vested in trustees. This trust need not be for an indefinite time; I should prefer it to be made till such time, whenever that may be, that Forestry in Australia is taken over by the Federal Government. The conflict between local and public interests which is always dangerous in a small State and parochial politics, is less to be feared in the case of a large State. In Natal, "the garden of South Africa," the most English of the four States, Forestry has a bad record. The vacillating and wasteful forest policy of Natal came to a prompt end with Union. No one now (not even in Natal itself, I am assured) would wish to see it otherwise.

15.—*Trustees for Western Australian Forests an urgent necessity.*

I recommend, therefore, that in Western Australia, the boundaries of the first-class forest reserves should be determined with the least possible delay, and these reserves then secured to the nation by being placed in trust for it, in the hands of trustees. It is not necessary to incur expense in this procedure. The trustees might be two or three high-placed Government functionaries, dignitaries of such a position that their motives may be above suspicion (the Archbishop of Canterbury is one of the Lords of the Treasury in England), together with two or three eminent citizens whose wealth, position, and antecedents would place their integrity beyond question.

16.—*Alienation evils and redemption costs.*

The reckless alienation of public lands, carrying the timber required for the use of the people of the country, is already causing loss to both Australia and North America, the two countries where the evil genius of the Anglo-Saxon has brought such ruin to the forests. The Federal Government of the United States is redeeming forest land on the Apalachians and White Mountain at a cost of half-a-million pounds yearly. Canada has destroyed two-thirds of its original forest area and it may have been right to do so to provide the necessary area for settlement. But it went wrong in taking no thought of forest demarcation, and now finds itself (out of all its huge forest area) left with only 24 millions acres of good forest! And its export trade in timber has been worth to it 3½ million pounds yearly in timber export to England. There the penalty for reckless forest alienation will be heavier than in Australia.

It is perhaps unnecessary to say anything specially about forest alienation in Australia, after what has been said here incidentally. The evil is the growth of 100 years of reckless settlement, and is probably coming to a rapid end in the more advanced Australian States. But in a backward State, such as Tasmania, with no Forestry, the evil flourishes unchecked, though the retribution will be felt throughout the southern half of the Commonwealth.

The extent to which the different Australian States have suffered from forest alienation varies much. Of the softwoods so precious to Australia, and of which only Queensland and northern New South Wales had any supply, Queensland is commonly stated to have alienated one-half, and New South Wales some three-quarters. Tasmania has alienated or burnt practically the whole of its softwoods, but never had much of a supply. The stars which represent these three States on the Australian flag stand for ever disgraced. It is one of those incidents which seems to show the necessity of national Forestry. Queensland, for some years to come, has enough softwood for its own use, and when I was in Queensland, and further forest alienation was proposed, no one seemed in the least to care that Australia was now having to pay £10,000 a day for imported softwood!

South Australia is probably the worst sufferer from reckless alienation, since it has lost its one area of accessible forest; but New South Wales is responsible for the heaviest bulk of forest alienation. Tasmania is a bad sufferer, since its once splendid waterside forest, with stands of timber worth £500 to £600 per acre to the miller, are entirely destroyed. Tasmania and South Australia have alienated exactly the forest which every consideration of prudence demanded keeping as national forest. Victoria and Western Australia seem to be the States that, on the whole, have suffered least from forest alienation, though one hears most about it in Victoria.

17.—*Alienation evils exemplified in Victoria.*

The following is an extract from the *Argus* (Melbourne), of January 11th, describing the visit of the Governor-General of Australia to the Otway forests in Victoria. It will be remembered that no British statesman can speak on Forestry with the same authority as Sir Ronald Munro-Ferguson:—

> "Beautiful scenery of all kinds was encountered by the party, and splendid timber—the best being Mountain Ash, Blue-gum, and Blackwood—was seen in the forests. On the way through Beech Forest and Laver's Hill, and at certain other points along the route, they passed through long stretches of dead timber, gaunt skeletons of forests, whose sap had been beaten out by the settler's axe and the devastating bush fire. On most of this country the dead timber still re-

mained, great ghastly shells, which towered with scarred and leafless limbs to the blue sky. Much of the land was seemingly deserted, abandoned after a brief but fruitless effort to win it from the forest. The Governor-General, who is greatly interested in timber, and has been a large timber-miller in Scotland, declared that he had never witnessed such a scene of desolation in any other part of the world, not even in America, where so many valuable forest areas had been wantonly destroyed. The Conservator (Mr. Mackay), who has always fought hard for the protection of the timber resources of Victoria, confessed that much of this country should never have been opened up for selection, as it was far better suited for forest purposes than for settlement."

Said the Conservator of Victoria at the Melbourne Forest Conservators' Conference in 1912, speaking of the reckless alienation in this same Otway district:—

"In the short space of 38 years, the various Governments which have held office in Victoria have deliberately allowed some 300,000 acres of Blue-gum, Spotted-gum, Mountain-Ash, Messmate, and Blackwood to be destroyed in the Otway district by axe and fire, wasted in the course of what is falsely called successful settlement. The present-day value of this timber, if preserved, would be from £100 to £200 per acre! Taking the lowest estimate, this represents a loss to the State or community of about £32 million sterling.

"It is no reply to say that this immense timber crop has been greatly increased in value by the building of two short railways. These railways would, in any case, have been built to serve the timber trade, if not by the State, then by private companies; and an immense trade in the export of the timbers I have mentioned, which include our finest hardwoods, could easily have been established. If this forest had not been destroyed, it could have given continuous employment to some 5,000 men, which means the support of 15,000 to 20,000 people, at least, in the trade, for not less than three-fourths of the time necessary for the growth of a new timber crop. As against this, the State has several hundred struggling selectors, many of whose holdings are heavily mortgaged, a railway operated at considerable loss, no townships, or roads fit to travel over in winter, and no field of employment worth speaking of, while the cattle bred by the selectors for a livelihood are driven by road long distances to market.

This state of things has happily come to an end in Victoria, but it describes graphically what is still taking place in other Australian forests. The Northern Rivers and inland Cypress pine forests in New South Wales, and the coast Eucalypt belt north of Brisbane, are in worse case than the Otway forests, where a large part remains as demarcated forest to the State, and some of the destroyed forest is being gradually bought back from the unfortunate settlers."

Over the evil in the other States a discreet official veil is drawn. I have referred to it in speaking of the Forestry of each State and it is unnecessary to repeat it here.

The Commonwealth Year-books give interesting tables and quite striking diagrams showing the progress of settlement in each State; but no hint is given of this sinister feature that has so often accompanied it: a feature which is going to tax the community so heavily, and which has actually retarded settlement itself.

The evil is thus commented upon in the Melbourne *Age* of the 4th March, 1914:—

"The Conservator had no power. He was employed mostly like a subordinate clerk in the Lands Department, sorting out papers and taking them up

to the Minister for his initials. When the Minister of Lands was pressed to provide lands for settlement, he coolly revoked the temporary reservation of another slice of the forest, whether the soil was good, bad, or indifferent. The forest was "settled"—for all time—if not the land from which it was swept. Afterwards the Minister boasted of the vast area of lands on which he had hurried up the development of his country!"

18.—*Repurchase of alienated Forest lands in Europe and America.*

The corollary of reckless alienation is expenditure on redemption. Both Victoria and South Australia are provided with funds, to redeem areas of private forests which it is considered necessary in the public interest to buy back and add to the State forests of the country. There is little doubt that in the States where there has been the most reckless alienation—Queensland and New South Wales—a policy of redemption must be adopted at an early date. It is already a question which I heard debated in Queensland whether it would not be more advisable for the State now, instead of planting softwoods, to buy back the lost softwood forest, of which, as mentioned, about one-half has been alienated.

Tasmania is the black sheep amongst Australian States in Forestry, and it will be no easy matter to set its affairs in order. Redemption will not be so easy there because, on account of the severity of the fires, most of the accessible forests which should have been retained for the State have been burnt and destroyed.

In Western Australia redemption should probably take the form of redeeming what is known in European forest law as "forest servitudes." Many of the largest and now most valuable European forests were only got into workable condition by redeeming the servitudes with which they were burdened. It should be the policy of Western Australia to redeem, as far as possible, such portion of the rights granted in the forest concessions as encourages or allows forest destruction. And probably there will be no great difficulty in doing this if the grantees are approached in a liberal spirit, as it is to the interest of both parties that the forest should be preserved rather than destroyed.

In European countries, where there is such a considerable private ownership of forest, it is found necessary in the public interest to maintain a continued policy of redemption. There is usually an item "Redemption" figuring in the Forest Budgets; and, year by year, as suitable forest estates offer, they are bought in and added to the State forests of the country. It has been mentioned how, at the great Forest Conference, held at Paris, 1913, the French Minister in charge of Forests, in welcoming us, announced that henceforth there would appear as a perpetual item on the French Budget, a sum of one million francs for forest redemption.

CHAPTER V.

Forest Fires—Their Effects and their Prevention.

19.—*Protection from Fire can be completely secured.*

In the reply to the Forest League deputation at Perth, in July, 1914, the Minister is reported (no doubt, incorrectly) as saying that the "Government were carrying out experiments in making fire-breaks, etc." This is rather like saying "The Government were carrying out experiments in making a steam engine!" It was not very long after Watt's days that systematic fire-protection was begun on a large scale in India, and it has been carried out with *complete success* ever since. I mention this incident as an illustration of the undoubted fact that there are large numbers of otherwise intelligent persons who hold that the Australian forests cannot be protected from fire. In travelling through the Australian forests, I have met with quite a number of such persons.

As a fact, the fire-protection of an average Eucalypt forest is considerably easier than that of some forests situated in climates identical with an Australian climate, that have been successfully protected from fire for the last half century. In South Africa, blocks and strips of Eucalypt forest have for many years been planted *to protect* the more inflammable blocks of pine forest. And they have done it!

If there were no Forestry in Australia, beyond mere fire-prevention, the benefit to the country would be incalculable. This is almost a truism to anyone who has travelled far through the forests of Australia; but, on the other hand, few Australians will admit that the fire-protection of the forest is practicable. They have not travelled through the forests of countries with climates like Australia, and gone round with the forest officers of those countries to see how their fire-protection is managed. Eucalypts and Acacias are being planted in the four quarters of the world, and planted for profit. Is it to be supposed that people would go on planting them if they could not protect them from fire? Natal has planted 160,000 acres of Black Wattle, and is making some £300,000 a year out of it. Australia got its Black Wattle for nothing, wild in the forests, but it never took the trouble to protect it from fire, and is now losing, as will be shown in connection with the Tanning industry, some £250,000 a year from this cause. (*See* page 185.)

I am in a position to assert positively that the control of fire in Australian forests is solely a matter of organisation; and I have spent a lifetime doing fire-work in India, in South Africa, and in British East Africa; while my visits to Southern Europe have shown me how fire is successfully controlled in forests there.

20.—*Western Australian Fire Risks.*

Owing to the absence of the hot winds of Eastern Australia and the comparatively light nature of the undergrowth in the forests of Western Australia, fire-protection is easier there than in other fertile parts of the Australian continent. The Karri forest in its natural condition does not burn, nor does the drier inland forest. But the "worked" Karri forest requires protection from fire when regrowing, and the larger part of the Jarrah forest requires fire-protection at all ages. The appearance of the Red-gum (*E. calophylla*) shows that with the present irregular condition of the Karri forest, there are a good many partial fires.

21.—*Consequences of Forest Fires.*

Without fire-protection, the growth of timber is inferior for three reasons: (1) Soil deterioration (consequent on the burning); (2) the too open character of the forest; (3) the actual burning of the forest regrowth and timber.

22.—*Fire-proof Forests.*

A further important point is this. Apart from dry areas and impenetrable soils, it is the forest fires that are mainly responsible for the present sparse inflammable forest. A close *better class Eucalypt forest* is nearly fireproof during all its younger life. This is well seen in the small areas of close forest in South Africa, and in Southern Europe. In South Africa, as already mentioned, this close Eucalypt forest is actually used as fire-breaks for the more inflammable pine forests. This practice has been followed in South Africa for many years past.

For this nearly fire-proof condition, it is necessary that the forest be close and regular, such as one sees in patches in the wild forests of South Africa to-day. The main object of forest "working-plans" in Australia will be to increase and preserve this close Eucalypt forest till the forest generally, over the larger part of its area, becomes practically fire-proof. This desirable result can only be achieved by systematic treatment with carefully prepared "working-plans."

23.—*Forest Fires in India.*

My first practical work with forest fires was in the forest of Teak and Bamboo in Western India. Here the bamboo grows like a huge grass 20ft. or 30ft. high, and when once fire gets into a block of forest, that block or square of forest must be burnt. The fire advances in a wall of flame, the bamboo joints exploding the while like pistol shots. The firemen gather round the adjoining blocks of forest, and as fires from sparks start in them, beat them out. The whole forest is cut up by broad fire paths, into squares like a chess board, and when fire breaks out, it is usually possible to confine it to one, or perhaps two or three squares.

24.—*Occasional Forest Fires seldom cause Permanent Injury.*

It must be remembered that an occasional fire in the forest may, comparatively, not do much mischief. This is probably why the fires of the natives in the Australian forests in former days did not destroy the forest as a whole, as has often happened since with the more frequent fires of the Whites. Occasional fires will destroy the seedlings and saplings, and a proportion of the younger timber, but the older timber can generally resist fire. Many trees are naturally fire-resistant when they are grown up. Teak is one such, *Pinus canariensis* (one of the most valuable pines in the extra tropics) is another, and it has the valuable property of shooting up again, freely and strongly, after it has been burnt. The common Insignis pine, when grown up, resists fire fairly. There is a good example of this at the Jenolan Caves, in New South Wales. The last South African Forest Report mentions the case of a group of *Pinus longifolia* in which the trees have grown up now to fair timber size, and have withstood severe occasional fires for some 30 years. Fire does little mischief to the thick-barked Eucalypts.

25.—*Rapid new growth after Fires.*

After a forest fire there is, usually, a profuse natural regeneration from seed. The dormant seed in the ground, which has been falling from the forest trees for years, may then come up like grass. It is possible that here is a case of natural selection and survival of the fittest, because occasional fires have been the fate of

Australian forests far back into geological time. For, with the dense undergrowth in many forests, if the seed did not await the coming of fire, the fruits of its germination would be lost owing to the plant, after sprouting, being killed by the want of light under such undergrowth. Many hard seeds, such as the Acacias, will scarcely germinate until they are exposed to fire, or heat, hence the common practice of boiling or roasting Wattle seed before it is sown. I have known, in an extreme case, Wattle seed to be boiled for half an hour and still germinate. The liquor in this case reminded one of pea-soup, but yet there was a fair germination of the seed. It should be mentioned that the elevation was 3,000 feet, so that the temperature of boiling point was below 212° Fahr. Still, the experiment showed clearly the power possessed by the seed of certain forest trees in resisting prolonged high temperatures. The usual practice with Wattle seed is to pour on boiling water, but not to prolong the boiling. All those who are familiar with the Eucalypt forests of Australia know how readily there is at first a regrowth after a forest fire. I have observed this repeatedly in Australia. And in the south of France if fire gets accidently into the forest of *Pinus pinaster* there is a profuse natural regrowth of young pines. Thus an ocasional fire in the forest may do mischief, but it will not destroy the forests like repeated fires.

26.—*Forests only totally destroyed by repeated Fires.*

It is the repeated fires, at short intervals, that destroy the forests in South Africa and Australia. In South Africa, it generally takes three fires at short intervals to finally destroy the indigenous forests. It is the "frequently repeated" forest fires that have to be guarded against, and for that we have a sure safeguard in a proper organisation of the forest.

27.—*The Trinity of Fire protection.*

For *complete* fire-protection three measures are necessary:—

THE TRINITY OF FIRE PROTECTION.

1. Watch-towers and a good look-out.
2. Fire-paths.
3. Extra watchers during the fire season.

28.—*Watch-towers and the Hill-top Forester.*

Watch-towers.—It is possible to protect a forest without watch-towers, or the hill-top Forester; it is frequently done. But wherever the watch-tower system can be arranged, the efficiency of the fire-protection is so greatly increased that I am tempted to place this first on the list of fire measures. With forest fires, like other fires, the most important point is to be able to pounce on the fire and extinguish it before it becomes serious. And this is so easily done when the Forester sees it from his house, summons his men, and runs down hill on to it. I have known forests where, with a good system of fire-paths and fire-watchers, no satisfactory fire exclusion was obtained until the forest got a hill-top Forester with his perpetual outlook. Hill-top Foresters, with the look-out against fire, have long been in vogue in South Africa and in Southern Europe. They, and simple watch-towers, are now being extensively adopted in America; we read of 18 in the State Forests of Arkansas, of 15 in New Hampshire, etc.

29.—*A French example—The Esterelle Forest.*

On the Mediterranean, in the South of France, in a climate much like that of Victoria, there is a fine forest on the Esterelle Mountains. This is a French State forest which, after repeated fires, had come to be nearly done for. A good deal of private forests in the neighbourhood has been destroyed either by fire or ill-regulated grazing. When the French Government undertook the better protection of the Esterelle State forest, the attempt was thought to be nearly hopeless. Now the forest is in excellent condition, and there have been no fires of any consequence for many years. I visited it a few years ago, and made complete notes and photographs on the subject, so as to furnish any further particulars when required. The forest is mostly Maritime-pine (*Pinus pinaster*) with a little Aleppo-pine (*Pinus halepensis*). There is an excellent system of roads used for bringing out the timber, these, of course, acting as "fire-paths." Of actual fire-paths I was surprised not to see more. The main reliance there appears to be on the roads acting as fire-paths, watch-towers, and a very efficient system of watchers and watching. The watch-tower business is done from several points, but chiefly from one of the culminating points of the mountains, termed Mont Vinaigre—some 3,500 feet high. From there telephones radiate to every part of the forest, and fire no sooner breaks out than it is stopped.

I climbed to the top of Mont Vinaigre, from whence there is a fine look-out over the whole forest. Here, I saw at once, lay the secret of the successful restoration of the Esterelle forest. And this Esterelle forest is no easy one to protect. It is the centre of the "Cote d'or," the most popular tourist region in France. It is practically a suburban forest to one of the most frequented of the Riviera watering-places.

Other French forests in the extra-tropical climate of the Riviera are protected in a similar manner. The climate there closely resembles the South-West of Western Australia, or South Africa. There are the same purely winter rains, and the same long dry summers. But the hot dry winds of summer, perhaps, render the climate more like that of Victoria than South-West Australia. There is no summer wind in the South-West of Western Australia, like the mistral of France. An old French proverb runs:—

> "Le mistral, le Parlement et la Durance,
> Sont les trois fleaux de la Provence."

The Durance River used to flood and devastate the plains owing to the destruction of forest on the mountains. This is now remedied by replanting and engineering work to stop the rush of water.

30.—*A Portugal example—The Leiria Forest.*

Now, let me tell the story of equally successful fire-protection in the same climate, but in quite another class of forest—flat coast country.

Shortly before leaving for Australia, I visited the Portuguese State Forest of Leiria; this, also, is of Cluster-pine. The Leiria forest is the pride of Portuguese Foresters. It, and its fire-protection, are described in the paper which I read before the British Association. An eminent French Forester and well-known writer, Mons. Pardé, who visited the forest a few years before myself, describes the fire-protection in an article in the *Revue des Eaux et Forets* as one of the most successful instances of fire protection known in Europe. There is a complete system of fire-paths, while the forest officials and forest labourers are all organised for fire-protection. The watch-tower business is carried out from four watch-towers, built up like light-houses. The area being a flat one, near the coast, four watch-towers are

necessary. The system followed is that every point of the forest comes under view of at least two watch-towers. When a fire breaks out, the magnetic bearing of the fire is immediately telephoned to head quarters. Then, on a large scale forest map, the two bearings are ruled off, the points of intersection giving the exact locality of the fire. It is now 13 years since there was a bad fire in this forest.

Regulated grazing in the forest of Leiria is a considerable help to fire-protection. After a forest fire, the young pines come up like grass. So that with fire and grazing under control, the occasional out-break of fire is not of much consequence.

31.—*American Railways and Forest Fires.*

In America we read of the devastation caused by forest fires, and the more or less successful checking of them by fire-patrols, and having spark-arresters on the railway engines. But we are beginning now to hear of a more complete system for the more valuable forests, the Forester in charge living on an elevated point from whence he can see over a great part of the forest and be in touch by telephone with the other parts. Then, when a fire breaks out, he can take his measures. It is this central control that is necessary, as necessary, in fact, to the man in charge of the fire-work of the forest as to the general of an army in the field.

It is claimed that whereas there used to be a loss of some 10 million pounds a year from forest fires in the United States of America, the yearly loss now is reduced to some £25,000; the cost of this successful work ranging from 1d. to 2d. an acre.

32.—*Fires due to Pleasure Parties and Travellers.*

The tea-drinking habit, which, unfortunately for the race, has developed so strongly among English-speaking people in recent years, is, according to statistics, nowhere so pronounced as in Australia. And it has without doubt an important bearing on fire-protection in Australian forests. Few Australians can be in a forest for long without wanting a taste of the national drug, and "boiling the billy" lets the man on the watch know they are there. The habit has, no doubt, had much to do with forest fires in Australia. Probably, on the whole, the habit is a favourable one to fire-protection in the case of organised forests, with a resident Forester so placed as to have a good look-out. It is true that a certain number of fires will be caused by accident, and quasi-accidents in "boiling the billy"; but, on the other hand, the tea-fires will let the forester know exactly who is in the forest, and he can be on the look-out for accidents accordingly. The tea-drinking habit emphasises the importance of the watch-tower business in Australian forests, since if the look-out is well-placed, a large proportion of the tea fires will be seen from it, while, without such a look-out, a proportion of the tea fires will cause accidental fires in the forest.

CHAPTER VI.

Natural Preventives of Injury to Forests by Fire.

33.—*Fire-paths: Forsyth's Indian Practice.*

Fire-paths first came prominently under the notice of English foresters with the fine work of Captain Forsyth, some 60 years ago, in the Central Provinces of India. The forests here are very extensive, but at the same time, very poor; poorer indeed than the ordinary forest which is necessarily destroyed every day in Australia for purposes of settlement. The intensity of the hot weather in India is, of course, far beyond anything, even in the driest of extra-tropical countries. The forest had been burnt from time immemorial. "It must always burn," said the natives and the old school of forest officers; but Captain Forsyth succeeded in protecting the whole area of demarcated State forests, while the undemarcated forests blazed around, and he succeeded in doing this at a surprisingly small cost per acre. The work was very difficult and required the most effective fire-paths. These were formed by making a cut, or cleared path, on each side, and burning off the centre early in the season, during a quiet time of the day. Captain Forsyth's work has been extended and perfected, and now embraces the whole of the State forests of India, an area which it would convey no meaning to mention in figures, but it must be borne in mind that the total forest area under the administration of the Forest Department of India amounts to 25 per cent. of the whole area of India.

Something like the double fire-path and burnt central road might be useful in Australia. The hand-cut path would be too expensive for Australian labour, but a narrow path, cleared just enough to let a stump-jump plough get through, might be practicable. Then, in the area between the ploughed strips, a road 200 or 300 yards wide could be burnt off as often as might be necessary, the timber sold or ringbarked, and in some cases sold for firewood. This would eventually destroy the forest on the 200 or 300 yards strip, which could afterwards be planted with some fire-resistant useful timber tree, such as Canary or other rough-barked Pine, or Busaco Cedar; but, on the whole, I think the *grassed fire-path*, to be referred to later, will be the best for Australian forests.

34.—*Fire-paths in Western Europe and South Africa.*

The fire-paths in the pine forests of the Landes of France, and in Southern France, Spain, and Portugal are similar to those in South Africa. There, with cheap labour, where a fire-path cannot be ploughed owing to the nature of the ground, it is cleared by hand. In many localities in Europe the peasants will cut the grass and brushwood on the fire-paths for the value of the fodder, and for litter for their cattle. This is not done in South Africa, nor would it be in Australia. In both these countries, where labour is more expensive, it is advisable, wherever possible, to make permanent fire-lines.

35.—*Permanent Fire-breaks*—(1) *Grassed track;* (2) *Non-inflammable Trees.*

Permanent fire-paths are ordinarily of two kinds: (1) grassed lines, (2) dense-growing, fire-resistant trees. The first requires care to see that they are kept constantly grazed down, the second to see that there is not an accumulation of dry leaves under the trees that might let fire creep through. Of course any vegetation that entirely occupies the ground and is itself non-inflammable can be used. The

American Aloe (*Agave americana*) makes a perfect fire-break, and an impenetrable fence, but takes long to establish. I have used it with success in India, on a small scale. Sterilisation of the ground with chemicals has so far not proved practicable.

Pine plantations in the Cape of Good Hope peninsula are protected by permanent lines of closely planted Eucalypts. So long as these Eucalypts are growing vigorously and close they will kill out other vegetation. Even when they grow up and tend to open out with litter on the ground that has to be cleaned up or swept out, the belts of tall straight trees form excellent spark-arresters. Stringy-bark Eucalypts are not good against fire and they have been little planted in South Africa on account of their generally inferior timbering.

In Australia, where labour is even more costly than near Cape Town, broad grass fire-paths seem preferable to any other form of permanent fire-path, especially in the damper parts where grass grows strong. In the drier parts, where grass does not grow strongly, the grazing off of the ground herbage will often be practicable by sheep. In any case, considerable grazing has to be found for departmental cattle; in South Africa most of the ploughing is done departmentally, with Government cattle. Where contract ploughing is more economical it is generally necessary to find grazing in the forest for the contractor's animals, and also for those used in extracting the timber. Horses are now much used in Australia, cattle in other extra-tropical countries; but cattle, when good grazing can be found for them, are naturally more economical; thus, in this way, fire protection and economical timber-working go together.

Considering the dearness of labour in Australia, the hot winds, and the distance to which strips of burning bark can be carried, it seems highly probable that the most economical and effectual fire-paths will prove to be wide, cleared strips, grassed in the wetter country, and kept bare by grazing in the drier country. In speaking of Forestry in Victoria, New South Wales, and Queensland, I have specially referred to this. "Grassing" is as well understood in Australia as ploughing a field for wheat. In 1912-13 as much as 7,347 acres in Australia were occupied in growing grass seed, the average yield being eight sacks per acre. The good growth of Cocksfoot and other grasses in the colder parts, and of Paspalum and Rhode's grass in the warmer, are well-known. Paspalum seed is cheap and it seems altogether an ideal grass for forest fire-paths. One has only to see it growing on grassed forest ground in New South Wales and Queensland to appreciate this. For the present area of State forests in Australia—some 11 million acres—there might be required some half million acres of grassed fire-paths. It must be remembered that the fire-path area must be a good deal larger now than later, when the forests will be in better order.

The total grassed area in Australia, up to 1912, was three million acres (*Com. Year Book*, 1914), so that the addition of half a million acres along the forest fire-paths now, and another half million acres presently as Forestry progresses, would be a material help to the dairying industry. An equal, if not greater help, would be rendered from internal forest grazing, particularly if Spanish goats were kept. (See p. 60.)

Lastly, one must remember the precious resource that grazing in a fire-protected forest offers to farmers in times of drought. When the pinch of drought comes and stock are dropping off and dying by millions, it is always possible for the forest officers to arrange for extra grazing in the forests. Fellings can be anticipated in certain areas; other areas can be thrown open for grazing somewhat before their time, the loss to the forest so caused being as nothing to the value of the starving stock thus saved. There is also an accumulated store of fire-pro-

tected, coarse herbage, which cattle will not eat when better food is available in normal times, but which is a precious stand-by in times of drought; this now gets burnt with the forest. The large bulk of coarse, drought grass may, in fact, be looked on as a set-off against the good spring grass coming after forest fires in normal times. The fires are worse in times of drought, and with no stoppage of the forest fires, as at present, the stored-up fodder of the good years is swept off, while with no rain there is little young grass till the drought is over and it is less wanted; thus, the net result of fire-protecting the forest is an insurance against drought for farmers.

In India it has come to be a recognised famine measure—throwing open the forest reserves temporarily to starving stock. The gain in this way has been so great that it has been frequently declared that forestry and fire-protection in India had justified their existence, if only as a famine measure: the insurance of stock against the worst effects of drought!

36.—*Other Preventive Measures. Permanent Watchers a useless expense unless organised.*

Fire-watchers are usually the first and simplest expedient when the fire-protection of a forest is undertaken; but, by themselves, they are not of much use, and it is quite easy to waste a lot of money on fire-patrols. Under a good system of organisation, the payment for fire-watchers is reduced to a minimum. It is quite possible, for an inefficient system of fire-watchers and burning off of debris, here and there in the forest to be as costly as a complete system of fire-protection.

In the suburban forests of Paris and Cape Town extra watchers have to be put on for Sundays and holidays, and special extra watchers are naturally advisable in all cases of special risk. But, speaking generally, it is preferable to have as firemen men in regular forest employment at the forest station, who can be depended upon for assistance when a fire breaks out. The work is arduous, usually night work, when the hot winds die down, and the men called out should have a liberal scale of payment. There should also be generous rewards for those who may bring in the first report of a *bona fide* forest fire.

As soon as grazing is under proper regulation it becomes a useful adjunct to fire protection (*see* "Grazing," p. 60). Sheep, goats, and cattle not only destroy the ground herbage, but tread it under. No doubt a forest which is not grazed over has the soil in better condition, and in temperate countries the foresters like to keep grazing down to low limits, allowing the soil to be retained in an open condition, and sheltered by the growth of the underwood. In the extra-tropics, however, this open soil benefit is usually far overshadowed by the paramount necessity of doing everything for fire-protection. Goats may even have their use in the forest in this way: I saw large flocks doing very useful work in the forest of Leiria, where everything is subordinated to the production of the finest timber. There is at Leiria a dense shrubby undergrowth, which has to be cut by hand-labour in the case of young forest, but which, as soon as the forest is grown up, can be kept down by goats. The utility of the Spanish goat in other ways is further mentioned at p. 60.

All leased grazing land should be let with the special proviso that there are no fires, and grazing leases should be cancelled automatically if a fire occurs, leaving it to the Conservator to renew them just so far as he thinks advisable.

37.— *Impracticable Proposals.*

Since I have been in Australia I have seen letters in the daily Press and heard suggestions made regarding impractical proposals for extinguishing forest

fires. It has been thought that water should be used, and I have even heard of water-carts. As a matter of fact, water has very little to do with extinugishing forest fires. Occasionally when more handy than earth it may be used to extinguish a burning log. The ordinary fire is, of course, beaten out or met with fire-paths, and counter-firing. Water-carts (or, indeed, the use of water at all), gas extinguishers, or chemicals for killing vegetation on fire-paths, have so far been of no practical use, though there is, of course, always the chance of getting a waste chemical cheap and abundant enough for the purpose.

38.—*Erroneous Popular Notions concerning Forest-fires.*

The popular idea of a "fire-proof" forest is one in which all the dead, inflammable material has been collected and burnt. This is somewhat like the elderly lady's scheme for mopping up the ocean, or, as I have heard it expressed, "burning the carpets to save the house"! A forest with all its inflammable material burnt up would, I need scarcely mention, not be in such a healthy condition as a fire-protected forest. Its soil would be in process of deterioration, its nitrogen plant-food vanishing (*see* p. 39). Quite a large class of trees, which flourish in the damp rich forest soil perish or languish in the dry, poor soil of the open country; Australian Red Cedar is one such. The condition of the soil is a never-ending study to the forester; on it depends directly the growth of the timber. Prof. Henry, of Nancy, has shown that forest humus has the power, under suitable conditions, of fixing the free nitrogen of the air. This is something more than the transmutation of lead to gold. In many senses what is right in agriculture is wrong in forestry, since agriculture is ever exhausting the soil and forestry always improving it.

There are hardy trees which will flourish in clean, open, dry soil. There are extensive Stone-pine forests at Valladolid in Spain, which in parts are so well grazed as to be absolutely fire-proof; but this result has only been attained by considerable soil deterioration, and loss in the quality and size of the timber. As mentioned, forest grazing is an important adjunct to fire-protection, but it must be applied with discretion and by those who know their forest. The notion of getting the best forest growth on such a soil is a fallacy.

39.—*A Forest is not a "Park."*

The ideal of those who want to "clean-up," as it is termed, the Australian forest, is a beautiful park-like scene, as safe from fire as an English park; but this is not "forestry." The soil of the newspaper writers "chocked with undergrowth," is the proper condition of the forest till the undergrowth is killed down by the close growth of timber, which it is the forester's art to produce; and then the decaying ground herbage and undergrowth forms the open, rich vegetable soil. The close growth of trees will produce a clean forest soil in which there is little to burn.

Said Mr. F. E. Kanthack, Director of Irrigation for South Africa:—

> "If you go into any of the local forest plantations you will see the ground between the trees as bare as this table."

Mr. Kenthack's complaint was that the clean forest soil held up so little water. This condition of the forest in which there is nothing that will burn easily is brought about not by "making bon-fires in a poor open forest," but by the naturally close growth of the trees in rich, fully-stocked forests.

40.—*Forests of Beauty—The "Bosquets" of Versailles.*

When, for the sake of beauty, or on account of deficient moisture conditions, an "open" forest is sought, the ideal should not be the British park, but, as will

later be shown, the "bosquets" of Versailles, viz., a close growth of forest in groups. In these groups we have the dense forest more or less self-protective against fire, and nourished by the sub-soil moisture of the surrounding bare land.

41.—*Tree-top Fires in South Australia.*

In the dry northern forests of South Australia there is little ground herbage, and fire-protection is a comparatively easy matter; but in the damper climate of its south-east more care is necessary. There one tramps through a thick growth of fern on the soil, and even "crown fires" on the Stringy-bark trees are said to be quite common.

42.—*South Australian Fire-breaks.*

Fire-paths have been made in the better and more accessible forests; and resident hill-top foresters to do the fire look-out business are being established. Fire-lines at Mount Burr are half a chain (Gunter's) wide round every 10 acres. Outside lines are three chains wide, and these broad lines are, very properly, sown with oats so as to recoup the cost of ploughing, which is here, however, only 6s. per acre. I have referred to the fire-protection work of South Australia generally in speaking of its Forestry (*see* p. 288).

43.—*Victorian practice needlessly expensive.*

In Victoria the attempt has been made to cope with fire in large valuable timber forests, and there has been a considerable expenditure on forest fire-work; but, as I have pointed out in speaking of forestry in Victoria (p. 318), fire-protection in that State is difficult, and a complete fire-organisation is necessary. Possibly the accounts might show that as much has been spent on patrols, temporary fire-paths, and "cleaning-up" as would have sufficed to have completely organised the more accessible forests with broad grassed fire-paths and hill-top resident foresters. A country can have fewer more useful servants in its service than the hill-top forester, with 20,000 or 30,000 acres in his charge. Its fire-protection, as it were, is in the hollow of his hand. He can drop on to any ordinary fire in ten minutes or in the remotest part of his forest in little over half an hour. (See "Organisation," p. 46). Patrols may be good enough for the inaccessible forest, but for the more valuable accessible forest, where fires are more numerous, organisation and more certain methods are desirable, and the higher economic value of the accesible forest will pay for the cost of organisation.

I saw excellent fire-lines in the Government State forest at Creswick, Victoria. The fire-lines here are 1½ chains broad, with a clear path on each side, and the middle burnt off. I cannot remember to have seen better or more effective fire-lines since I left India. A man is kept on watch here during the fire season, although there is no regular watch-tower. The State forest here is 130,000 acres, Eucalypt forest of the ordinary class, *i.e.*, partly poor and stunted, and partly well-grown. The young pine forest—about 1,000 acres—is more inflammable, and requires closer fire-lines. I was given the area and total cost of fire-work at Creswick, and found that it worked out to 3d. per acre. A larger area would have cost less in proportion. I saw no sign of fire, and was informed that, as a fact, there had been no serious fire here for 12 years, since the present system was started.

The clearing of the fire-paths in the 900 acres of the Eucalypt and pine plantation costs £12 yearly; the work is let out on contract. The paths on each side of the fire-line are ploughed and the centre then burnt off.

The fire-protection here at Creswick was as good, as it was bad in upper Macedon, but in neither case was there a hill-top forester. The Macedon failure is ascribed to the folly of divided responsibilities. In other plantations, under the Victorian Forest Department, fire-protection seemed quite successful.

44.—*Australia's vast losses from Forest Fires.*

In none of the Australian States, except Victoria and South Australia, has any attempt been made to control the forest fires. The wealth of timber destroyed, and extent of the forest and soil deterioration, are incalculable. It is the main item of loss in the dark days of Australian Forestry, during the past 100 years. At page 167 a conservative estimate shows the probable cost to Australia of the past 100 years of bad Forestry will, during *the next* 30 *years, be* £588,500,000! This is a stupendous figure; and there is no reasonable doubt about it; if anything, it is under-estimated. A country cannot go on burning, for 100 years, a prime necessity of civilised existence without running up a huge bill. The railway gauge mistake is a bagatelle to it; and that, according to the Engineers' Conference of 1912, would cost now about £40,000,000 to rectify, on a 4ft. 8½in. basis. The £588,500,000 is a legacy of the bad forestry during the past 100 years. In dealing with this very serious position, all considerations of the errors of the past 100 years, of rectification necessary during the next 30 years, the question of forest fires must play the leading part.

CHAPTER VII.

The "Bush Fires" of Australia and Tasmania.

45.—*Victoria loses* £250,000 *worth of timber in two years.*

The fertility of the mountain climate of Victoria, while it promotes the growth of what are probably the tallest trees in the world, produces at the same time a rich undergrowth, and—under present circumstances—fierce forest fires. In 1912-13 the Forest Department estimated that 91,000 acres of forest was traversed by fire, causing damage to the extent of over £100,000; in 1913-14, some 220,000 acres were burnt over!

At the present day Victoria, with all its losses from forest fires, is spending only some £600 or £700 a year on fire-protection! According to statements in the public Press it has lost some £500,000 worth of timber during the last two years; while of all the States in the great timber-forest belt of Eastern Australia Victoria alone takes the least heed of its burnt timber. Grazing rights are a fertile cause of forest fires in every country, and they should naturally, therefore, be placed entirely and exclusively under a Forest Department; but in Australia it is only in South Australia and Victoria that the Forest Department has control of the grazing, and in Victoria the control is not yet complete. Not long ago it was reported that in one forest in Victoria, and in one season, there were as many as 23 grazing fires.

Last year (1914) Victoria had altogether some 50,000 acres of forest under fire-protection, with fire-paths and patrols; and this area is being extended. Particular attention is given to Wattle areas, which are very easily burnt. (*See* p. 38, Fire-protection of Wattle plantations in Natal.)

46.—*Bush-fires in Victoria in* 1914.

The story of last summer's forest fires is thus told by the Melbourne *Age* newspaper in its issue of 4th May, 1914:—

The recent exceptionally dry summer, and the inflammable state of herbage and under growth, caused serious outbreaks of fire in nearly every district in Victoria . . . . . Figures compiled by the Forest Department show that during last season 220,000 acres of forest and Crown lands were laid waste by fire. . . . . Of this large area, 85,000 acres, comprising chiefly useful or valuable forest were severely damaged, whilst light fires swept over about 70,000 acres in the remaining area of 135,000 acres. . . . .

The most extensive outbreaks occurred in East Gippsland, in the part of the country into which New South Wales proposes to build a railway from Monara for the supply of timber. There, 40,000 acres were swept, the undergrowth, it is stated, being wilfully ignited. Further eastward, to the north of Mallacotta Lakes, 15,000 acres were swept, this tract also being deliberately set on fire. Between the Tambo and the Snowy Rivers, chiefly near the Orbost railway, fires broke out over 10,000 acres, a part of the outbreak being due to the carelessness of the workmen employed in building the railway. In the North-Eastern district, near Beechworth and Chiltern, 12,000 acres were set on fire, part of the timber being greatly injured. In the Northern Grampians, including Fyan's Creek water-shed, and part of the Sierra Range, over 60,000 acres were damaged . . . . . Whilst a large portion of this area consisted of inferior timber and scrub, a fair average of good young timber, estimated at 15,000 acres, on the Sierra face was badly injured.

On a survey of the reports furnished by the Forest staff, it appears that fully three-fourths of these fires were preventible, and due to deliberate acts, either with the object of "getting a good burn" on neighbouring private land, or of burning forest and undergrowth in order to get a new growth of grass for cattle in autumn and winter. About one-fourth of the fires was due to carelessness or "unknown causes" . . . . . In several cases where considerable damage has been done by offenders, Magistrates have inflicted an absurdly low penalty, such as £5. Such a punishment is merely a travesty of justice.

The Forest Department has for several years past, surrendered an annual revenue of nearly £3,000 in order to keep mountain areas within the reserves free from occupation as cattle runs, but the unreserved areas of mountain forest, especially between Baw Baw and Omeo, and the Croajingalong, are still let by another Department annually for grazing purposes, in many cases at merely nominal rentals. . . . . A report just received by Mr. H. R. Mackay, the Conservator of Forests, from his officer at Marysville, adds to the disastrous record. The officer states that he has ridden for 30 miles along the Yarra track, and for a distance of 18 or 20 miles, along either side the bush has been swept by fire, The area is between Marysville, Rubicon, and Wood's Point. The damage is attributed largely to holders of grazing leases, and it is remarked that as long as the leasing system is continued, the same waste of timber will ensue.

In the protection of forest lands, the mounted police, in a number of districts, rendered valuable service. . . . . Owing to the necessity of constant vigilance, no leave is granted to the Forest Service during the hot season, and in addition to a special patrol of nearly 100 men on the staff, 12 fireguards were employed in the mountain districts."

If these figures are correctly stated, it is worth noting that the pay of 112 men on firework for six months is in excess of the cost of a staff of resident Foresters, plus extra assistance during the fire season. (See Forest Organisation, p. 45.)

47.—*Bush-fires in New South Wales,* 1915.

The mischief caused by forest fires in the most fertile districts of New South Wales is probably equal to that in Victoria, but the Forest Department does not furnish the same particulars of the losses. This is unfortunate, because such figures have a historic and scientific interest; and when the present abnormal conditions cease, and New South Wales is developed along the lines of other civilised countries, the fire-destruction figures will be pregnant with interest. The report of the tour of the Government Botanist in the Dorigo forest describes a fire there in 1894. The following newspaper extract gives some idea of what fire destruction in New South Wales means to-day, 1915:—

News of disastrous bush fires continue to come in from several country centres, and much damage has been wrought. There are some big fires on the mountains, and the whole country along the main western road towards Mount Victoria, and on the ranges to the west, is alight. · The historic marked-tree on the Bathurst road was badly damaged by flames. · At

Singleton a destructive fire started this morning, and the large premises of the Singleton Central Co-operative Dairy Co. were destroyed. The machinery and plant were valued at £3,443, and buildings at £200. Miles of country were burnt out, sheep and cattle being incinerated in large numbers. Serious conflagrations are reported from Jerry's Plains, Maeranne, Ravenworth, Goorangoola, Bridgeman, Warkworth, Glendon and Oban Vale.

A fire in the Maeranne Mountains was the biggest in the history of the settlement. At Oban Vale, about three miles from Singleton, residents had an exciting and trying experience. About noon a huge wall of flame was seen approaching from the *direction of the railway*, and it took the most strenuous efforts of the people to get stock out of the paddocks on to roads. As the flames endangered residences, women were conveyed by motor cars to Singleton. Homes were narrowly saved. and some of the fire-fighters had their clothing burnt, while there were remarkable escapes from falling trees. In the Gosford district the country is ablaze, but beyond the destruction of grass and fencing, nothing serious is reported. At Oakley, Mr. F. Jennings lost his cottage and its contents.

All the country between Prospect and Bankstown, about 10 miles out of Sydney, has suffered severely, and desolation and ruin have been caused.—*Age*, 16th March, 1915.

48.—*Bush-fires in Tasmania*, 1914-1915.

The fires of this summer (1914-15) have been equally severe in Tasmania. Tasmania is a fertile, well-watered land, like the best parts of Victoria, and of the fires in Tasmania I have had a personal experience. (See Tasmanian Forestry, p. 335.) Says the Melbourne *Age* newspaper of 19th February, 1915:—

The most devastating bush fires ever known in Tasmania have swept over the north-west coast and other districts. The extent of the devastation cannot be estimated. The whole country for miles is one sea of flame.

Many settlers had narrow escapes, and extensive damage was done to homesteads and property. *Hundreds of cattle and sheep were destroyed, and many beasts are roaming about half roasted, moaning pitifully.* Trees are falling in all directions, all roads are blocked and communication has been cut off.

Numerous strenuous battles for life are reported. Tom Williams, aged 55, is missing at Smithton, and the worst is feared. Nothing is known of several colonists who recently arrived from British Columbia, but as they are near the river, it is thought that they are safe.

A settler named Tom Ryan found his home empty, and on *searching for his family found his wife and two children near a large stump. Mrs. Ryan was dead, her clothing having been completely burnt off her body, and the boy and girl were lying together*, the boy protecting his sister from the flying sparks. Over 100 trees had to be cut down to enable a coffin to be brought to the scene for the body.

Thousands of acres of grass have been destroyed, and stock have thus been left without food.

A shocking tragedy occurred at Natone yesterday afternoon, when Michael Hoare, 36, a road contractor, met his death through the bush fires. *Hoare, who was a married man with, eight children, the eldest aged 14 years, had a road contract at Natone, and perished while endeavouring to escape from a ring of fires. The body, which was brought to Burnie by Trooper Boag, presented a shocking appearance.*

The whole of the country is enveloped in dense smoke, and it is impossible to see any distance in the streets of Launceston.

The fires in North-West Tasmania are thus described in the Hobart *Mercury* of the 20th February, 1915:—

The Natone fire was for fierceness, rapidity of advance, and great extent, quite the worst experienced by any of those unfortunate enough to be caught by it, for, when at its height, it covered a front of over twelve miles, and how anyone came out alive from such a flaming, fiery furnace, is incomprehensible. That there was but one fatality is little short of miraculous, for not only were hardy men in the thick of the flames and smoke, the latter so dense as to prevent one seeing more than a few yards in any direction, and then only dimly, but gentle women and tender babes were compelled to battle for life in the terrible inferno which raged around them on all sides. There was no way out, for the fire seemed to spring up everywhere at once, and it *literally travelled as fast, or faster, than a horse could gallop.* It seemed to jump for fully half a mile at a time, this being due to the flying embers blown from the tops of dead myrtles and other taller trees. There was thus an ever-increasing hail of fire, apart from that blown along through the undergrowth by the strong gale, and which roared and howled with apparent delight as it hurried on its devastating way.

Where there were *children, they were wrapped in wet blankets, and carried away and placed in hurriedly excavated holes in the cultivated paddocks*, there to remain until the fire had passed over them.

In some cases at one fell swoop everything was destroyed—houses, dairies, stables, fences, stocks, vehicles, implements, etc.

The agony of mind and body which, apparently, induced poor Mick Hoare to leave the comparative shelter of the pipe culvert under the road where he and Hayes had taken refuge, and stagger on through the heat and smoke, to meet his death in a small creek, where his body was found with all the clothes burnt off it, on Thursday, can be readily imagined by those who were sharers in a somewhat similar experience, for it is fearfully trying.

All of those engaged on rescue work suffered more or less from smoke blindness.

It is safe to say that within the comparatively small area of heavy coast forest in Australia, where alone the fires are severe, little of the michief here depicted would be possible *if the Government forests were demarcated, organised, and fire-protected.* Certainly, any *general* forest fire would then be impossible, while the more valuable accessible forests near the settled districts would be rigidly fire-protected; and thus be a safeguard, instead of a source of danger, to the settlers.

49.—*Government culpability for Forest Fires.*

The unfortunate victims of Government neglect, who lose their homes, their stock, and sometimes their lives in these fires, are not aware that their loss lies at the door of ignorant and antiquated Government methods! Why should the Government squander public funds in the overgrown capital cities and leave the country-side and the forests (the country's most valuable natural asset) in a state of anarchy and pitiable neglect? The forests, instead of being a fire-swept waste, should be the beautiful and well-ordered home of a thriving rural population, living on the £3,500,000 yearly which is now being sent out of the country to pay for timber and forest products. If the French Government, in exactly the same climate, can protect an inflammable Pine forest, and more than pay all costs out of the timber, an Australian Government can do the same with a less inflammable Eucalypt forest!

The Boer says that scab in sheep is the act of God, and that it is impious to fight against scab: that seems to be much the attitude of the victims in these fires. "Scab has always existed in our sheep," says the Boer, and "forest fires always will exist in the forest country," thinks the unfortunate settler!

But if, when Australia was colonised, they had appointed a Forest Officer and Foresters soon after the first Governor and police, there would have been no more forest fires in Australia to-day than there is scab in its sheep; and, as we now know, there was none too much good forest to demarcate and protect when the first white man landed in Australia. If Victoria had followed Ribbentrop's advice as late as 20 years ago, the present generation would only know of forest fires by hearsay, and by smoke on distant mountains! All the accessible forest would by now have been as safe from fire as an average town house. Ribbentrop was the Inspector General of Forests, India (the Forest magnate who visits the forest camp in Rudyard Kipling's "Jungle Stories"), and knew what he was talking about.

Enough has been said, I think, to show that what I have said about stopping forest fires is no mere expression of opinion. What foreigners can do in Southern Europe, or Englishmen can do in India and South Africa, Englishmen can do in Australia, if only the matter is put squarely to them!

Most of this, with greater detail, was said in the eloquent address of the New South Wales' representative at the Forest League Conference, presided over by the Governor General, held last November in Melbourne.

As is seen (Forest Statistics, p. 183), owing to mismanagement three-fourths of the forest revenue of Australia has been lost; and even out of the one-quarter that has been saved, three Australian States have robbed the forests badly; New South Wales to the extent of £500,000, while, in a fourth State (Tasmania) there is no pretence either of forest revenue or forest management; and there the forest fires are the worst.

Of course, forest fires have their useful side to the settler as well as to the forester: it is these uncontrolled forest fires, the result of Government neglect, that are so ruinous, alike to the forest and the settler.

50.—*Fire damage to Municipal Water-catchment areas in Australia due to their non-protection.*

The poor water-holding power of the burnt-out forest soil is sufficiently obvious. It is discussed under "climatic effect" (at p. 208), and more particularly with reference to the loss of water in the municipal water areas of Melbourne and Hobart (pages 324 and 335). I have not heard of a single fire-protected water-catchment area belonging to any large town in Australia, so that here in the aggregate is a public loss of very considerable magnitude. No doubt, as soon as the fire-protection of forest lands becomes general in Australia, the water-catchment areas will be fire-protected with the other forests. At page 325 I have given figures showing what the Melbourne water-catchment area is losing through the forest not being scientifically conserved and worked. In this loss, the want of fire-protection is the heaviest item.

At the same time, it must be remembered that the exclusion of fire from a Eucalypt forest on a water-catchment area will mean better forest and more drain on the subsoil moisture (p. 326), so that with fire-protection on water-catchment areas should go the planting of trees, making less demand on subsoil water. Fire-protecting a Eucalypt forest on a catchment area will undoubtedly bring two antagonistic influences into force; but it is worth noting that on Mount Wellington (Hobart) the forest is practically all Eucalypt, and the effect of burning this down has been, according to common testimony, to reduce the flow of water at the "Springs."

CHAPTER VIII.

Forest Fires in other Countries.

51.—*Fire-protection in South Africa—Present practice.*

In South Africa fire-protection has followed as the natural result of putting the forests under scientific management. There are numerous outbreaks of fire, but they rarely do much damage. The young pine forests are the most difficult to protect, and, naturally, the forests near Cape Town and other centres of population give the most trouble. A considerable measure of safety has been obtained by breaking up the young pine plantations with young Eucalypt plantings. The latter, as already mentioned, is less liable to burn, and if it does burn, generally shoots again, especially if cut back; while young pine (except Canary-pine), in its first generation and with no dormant seed in the ground, is destroyed by fire. But, on the whole, the losses of young pine plantations have been small. Such as occur are reported regularly in the yearly reports. Thus in 1912-13 there were altogether 59 slight fires, extending over 128 acres, and one larger but not serious fire believed to be incendiary. The total damage done was estimated at £341. The origin of the fires were: burning fire-belts, 6; outside fires getting over the fire-lines, 14; workmen's carelessness, 4; travellers, 1; sparks from railway train, 2; incendiary, 6; unknown, 26.

52.—*"Native" Forests Fire-resisting.*

In South Africa it has never been necessary to make fire-paths on so extensive a scale as India. The indigenous forest of South Africa in its original condition does not burn. It is usually of the dense evergreen class, and, like the Karri forest and the "brush" forests of the East Australian coast—in fact, like dense forest of this class in all parts of the world—it is fire resistant. Otherwise, the South African forest would not be there, with the veldt fires raging round it every year or two. Sometimes round the indigenous forest there is seen a ring of dense thorny bush—the "Fynebosh of Knysna"—that acts as a buffer between the fire-swept veldt and the timber forest. Sometimes the fire-protection of the forest is helped by burning off the veldt when the wind is favourable. And, similarly, when the forest gets too open, and thus liable to burn, regulated fires are set outside it.

53.—*Planted or Artificial Forests must be Fire-protected.*

In the planted forests the usual fire-path is a chain or less wide, usually a ploughed line. Permanent fire-paths, grassed or planted with fire-resistant trees, I shall refer to later. I have described, under Tasmania and Mt. Wellington, the forest-protection of the slopes of Table Mountain, above Cape Town. This mountain had been burnt over nearly every year for 300 years. All the forest, and the best part of the soil, had disappeared. With the advent of scientific forestry, the reforesting of the mountain slopes was commenced, and is now being pushed forward at the rate of some 50 acres a year. There have been no serious fires since the reforesting of the mountain began.

54.—*Recovery of the Cedarberg Forest in Cape Colony.*

It will be well, however, to cite a more typical South African case than the Table Mountain area.

A hundred miles north of Cape Town, in the dry country, is a rugged and lofty range of mountains (running up to about the height of Australia's Mt.

Kosciusko), and called the Cedarberg. It is some 40 miles long, and gets its name from a peculiarly valuable tree, the Cedar (*Callitris arborea*), which grows throughout the range, and nowhere else in the world. This tree dies when planted away from the peculiar climatic conditions of this mountain range—intensely dry summers, fairly wet winters. The Cedarberg range has been fire-swept ever since the first Dutch colonists came there, some 250 years ago; and no doubt previously by the fires of the Hottentots, the wildest of the South African natives, who lived by hunting and shell-fishing in much the same condition as the Blacks of Australia.

By our day, all that remained of this valuable Cedar timber were various beams and fittings in old farm-houses, the wood being almost imperishable; and on the Cedarberg Mountains a few scattered living trees, in rocky spots too bare of vegetation for the fires to reach them. I had long wished to fire-protect the Cedarberg Mountain range, but the difficult nature of the country, and the few trees left —averaging barely one to the acre—naturally caused hesitation in undertaking the work. However, in 1903, after the Boer War, I succeeded in getting funds for the purpose, and got the work in hand, with fire-lines, inspection-paths, and a Forest Station inside the forest. The fire-lines consisted of broad, burnt paths; and, outside, the country was so wild that often there was no objection to putting in fire and burning off the veldt. The country was too difficult of access and too extensive to get any large view from the Forest Station, so sub-stations and fire look-outs had to be established. At the same time, sowings of Cedar seed were made in small patches of good ground in the valleys. A previous plantation had shown that there was no difficulty in raising Cedar trees artificially. A picked Forester was selected to be put in charge, and from 1903 to the present day the whole area has been practically free from fire. Says the last Yearly Forest Blue Book, there is now a profuse natural regeneration of the Cedar tree, and a curious bye-product has been got which has already repaid the whole cost of the operations.

55.—*A Valuable By-product due to Fire-protection.*

On the Cedarberg range grows a peculiar scented herb, called Buchu (*Barosma betulina*). (Specimens of this plant and of some of the other species of Barosma can be seen in the Botanic Gardens, Melbourne.) With fire-protection, came an increased growth of Buchu, and with the increased supply an increased demand in Europe. Buchu leaves have now realised up to 6s. 6d. a pound in London, and in 1912 there was a total export of 221,338 lbs., worth £38,264, with an average value of 3s. 5d. a pound, the Government royalty on this in the Cedarberg Mountains being 2s. 6d. per pound. It may here be mentioned that, years ago, Baron von Mueller recommended the planting of Buchu in Australia; but it should be noted that a plantation, made on the Cedarberg, was a failure equally with cuttings, seeds, and transplants. But the area on which it grows *naturally* on the Cedarberg is so large that, with fire-protection, and the present close season for three years, the supply from the mountain-side may be sufficient to meet the demand.

56.—*Wattle Fires and Forest Fires in Natal.*

It must not be supposed that the fire-protection of forests in South Africa is accomplished without care and perpetual watchfulness. From time to time serious disasters are recorded, though, happily, there have been none of these in recent times in the forests under the Forest Department. As has frequently been mentioned, in the fight against fire the important points are system and organisation, and these cannot always be secured outside the more regular management of Gov-

ernment forests. Thus, during the dry year of 1911, when the hot winds were unusually severe in Natal, the papers contained accounts of severe forest fires in the Wattle plantations, as much as £10,000 worth of Wattle being destroyed in one fire on one farm near Richmond, Natal.

Again, when during its chequered forestry history, before the Union of South Africa, Natal had temporarily abolished its Forest Department in 1909, the Government forest plantation at Cedara was completely swept by fire, and between 400 and 500 acres of forest plantation burnt. The newspapers estimated the loss to the Government at from £15,000 to £16,000. The burnt forest was mostly young pine 10 to 12 years old.

57.—*American Forest-fire obtuseness reflected in Australia: the cause and its misapplication.*

Possibly the unchecked fires in America have had to do with the condition of affairs in Australia; it being overlooked that, whereas there was a great excess of forest in North America requiring its clearance in great part for settlement, Australia never—as long as there were drought, Blacks, and fires in the land—had more than a strip of good coastal forest on the eastern side, and a corner of good timber forest in the south-west. In America it was not till quite recent times, when increased working caused increased fires, that the rapidly dwindling forest area was really any cause for alarm, and then the anarchy in forestry matters that had so long prevailed rendered it difficult to stop the mischief. It is interesting to contrast forest matters in North America with the orderly utilisation of the equally vast forests of Russia, which I have referred to under Forest Management (p. 271).

The havoc wrought by recent fires in the United States is well known. The official text-book of the subject may be taken as being "Forest Circular, No. 82," of 1910, by Graves.

58.—*Canadian original forests now two-thirds burnt off.*

In Canada, even more than in the States, it was not until lately that the great excess of forest was worth preserving from fire, though of course there was always the underlying mistake of not demarcating out the best forest, and letting the rest go. It is computed that two-thirds of the original forest has been burnt. There were very severe fires in Canada in the dry year of 1911. The forest fires caused a species of tornado, which knocked over the tall pines as they stood. Curious photos illustrative of this are given in the "Quarterly Journal of Forestry," in an article by Sir Hugh Beaver, an ex-President of the English Arboricultural Society.

59.—*United States' losses of forest timber from Railway engine sparks in* 1910.

In 1910, it was estimated that 17 million cubic feet of timber were burnt in the United States, most of the forest fires being caused by railway locomotives.

Most of the American locomotives running through forest country have now spark-arresters, but it is considered that only internal combustion engines will afford complete protection to the forest. Be this as it may, a forest railway runs into the heart of the Knysna forest in South Africa; the engines have good spark-arresters, and *there has not been a single forest fire during the* 11 *years that the railway has been running.* The ordinary railway engines in South Africa cause a good deal of mischief in veldt fires; and recently the Minister for Railways stated that it was intended next session to bring in a Bill dealing with the subject; a Bill that would be fair both to the Railway Administration and to the farmers.

Except in one or two short private lines, I have not seen spark-arresters anywhere on Australian Government Railways, but I have counted along one mile of railway seven fires recently lit from railway sparks. Luckily this was in dense Eucalypt forest, so the fires had not spread.

60.—*Remarkable growth of Australian Eucalypts in other countries, and their low average timber yield in Australian forests.*

The Forester who sees the Australian Eucalypt forests for the first time, is struck by the fact that the greater part of the forest which he sees is very poorly stocked, and making but little growth (*see* p. 102). This is an astonishing fact, because these same trees, when planted in South Africa or Southern Europe, have growths which beat all records in Forestry. Blue-gums in South Africa and California, when planted under favourable conditions, run up to averages per acre, per year, of 600 cubic feet; or 18 tons of dry wood. The phenomenal yield on the Nilgiris, Southern India, has a maximum of 700 cubic feet or 21 tons. In Portugal the growth of Eucalypts is nearly the same. Last year, when on a forest tour there, I saw Blue-gums which, at 25 years of age, were nearly 200 feet high. These are maximum figures on specially good soil, but if we divide them by two (or even three) for a general average, the growth remains far above that of the Eucalypt forests of Australia.

In discussing Forest management (p. 102), I have given the opinions of the Australian Conservators regarding the low average yield of Australian forests. It becomes an important question, therefore, to enquire what is the reason for the low yields of Eucalypt trees in Australia, while in other extra-tropical countries, the same trees give higher yields and frequently phenomenally high yields.

61.—*Low yields due to direct injury to trees.*

One cause is insect and fungoid pests, but the chief cause is undoubtedly fire, which acts both directly and indirectly in injuring the Australian forests. Direct injury is two-fold:—(1) By burning up the natural regrowth of the forest and leaving the future forest with too few trees per acre, consisting, in fact, of only such patches of seedlings and such individual trees as have escaped the ground fires in their youth. In reducing the number of stems per acre to a few survivors from the fires, the forest is entirely altered in character. The trees stand too far apart, and present all the evils of the sparse forest, stems tending to be short, tapering and branched, instead of long and clean. The waste on cutting up such trees is enormous. Frequently the utilisable portion of the bole is not one-eighth or one-tenth of the whole and the average is barely one-half. (2) By scorching the bark, and thus reducing the activity of growth. It is the cambium layer which is the seat of growth, and this lies easily exposed to external injury between the bark and the outermost layer of wood. Every forest fire destroys or injures the cambium layer. It is a stab at the tree's vitals. If the cambium is destroyed the growth of the tree ceases straight away at that point. If it is injured, as when scorched in the forest fires, the growth will be reduced.

The most striking instance of direct injury to Australian forests is the burning of the Wattle-bark trees. Black Wattle is particularly easily destroyed by fire. As has been mentioned (Statistics, p. 185), Australia has burnt the greater part of its Black Wattle, and is now losing a quarter of a million pounds yearly on account of such action. South Africa (Natal) has planted Black Wattle, of course protecting it from fire, and is now annually making one-third of a million pounds out of its bark.

62.—*Low yields due to burnt soil.*

Indirectly the fires injure the forest perhaps just as seriously. The fires which sweep through the forest every two or three years burn up the humus and decaying vegetation which is the chief source of enrichment to the forest soil. I have seen forests in Europe, where there were old-established rights to remove the humus and litter (used by the farmers for putting under animals and making stable manure), where the growth of the trees steadily declined as the litter was removed, and finally, to preserve the forest, the litter rights had to be restricted. This is what is now going on in the Eucalypt forests of Australia, only, *instead of anyone getting the benefit of the forest litter, it is burnt and lost.* The forest soil, in its normal condition, is the seat of complex chemical actions, and beneficent fungoid activity. As already mentioned, Professor Henry, of the Nancy Forest School, France, in a long series of researches, showed that one of the results of this complex action was the fixation of free nitrogen. He devoted years to this study, and published a volume which is well worth perusal, and which would, no doubt, be better known than it is, if it had been published with a German advertisement!

Then there is the Mycorhiza at the roots of the trees. A great many trees die straight away if the soil is burnt. The trees can only exist if the fungoid activity of the forest soil is uninterrupted. Nearly every species of pine tree is known to have a Mycorhiza at the root.

63.—*Low yields due to "Soil Sickness."*

Soil sickness is a well-known feature in agriculture, but it is commonly discredited in forestry. When, however, we have one class of trees growing for ages under the adverse conditions of fires and soil deterioration, it seems likely that the low productive power of their forests may be partially due to what is called "soil sickness," viz., the plant food required for any particular crop becoming exhausted. Fire-protection will gradually improve the soil. A normal forest is continually drawing mineral plant-food from the sub-soil and depositing it with the forest litter at the surface. In fire-swept forests this mineral plant-food (plus the fixed Nitrogen) is constantly being scattered to the four winds in ashes. But, in order to utilise the soil as it is, and at the same time add largely to the value of the forest, the remedy is to introduce a new crop, either slowly and expensively by replanting, or naturally by finding a new species which, in a new soil and a virgin forest, may spread like a weed. The selection of such trees must not be left to chance, or to persons unskilled in extra-tropical arboriculture, or incalculable injury to the forest may result. Here is one of the chief uses of forest arboretums (p. 153).

64.—*Filling up the Forest, and affording Fire-protection restores the quality of the soil.*

Thus, to resume, the two measures required to restore the quality of the soil and thus greatly to enhance the productiveness of Australian forests are:—

1. Fire protection.
2. The introduction of carefully selected timber trees to fill up the skeleton forest wherever the rainfall is enough to carry heavy forest (*see* p. 78, "Working-plans.").

The evidence for this lies in (1) the remarkable growth of Eucalypts in new soils, and (2) the remarkable growth of some of the trees that have already been introduced to Australia. The growth of Insignis-pine is discussed at pages 81, 82. I may refer also to the good growth of Canary-pine in South Australia, to *Quercus*

virginiana in New South Wales, and to the Camphor trees in Queensland; while, in Western Australia, the whole range of Mediterranean trees, which are often disappointing in the Eastern States, show the same fine growth in Western Australia that they do in South Africa. The reason for this is climatic. I may mention particularly the Cluster-pine (*Pinus pinaster*), Stone-pine (*Pinus pinea*), and Mediterranean Cypress trees (*Cupressus sempervirens*), planted at Perth and Albany.

CHAPTER IX.

Debit and Credit Sides to Forest Fires, and Forest Regeneration.

65.—*Eucalypt and Acacia Forest in Australia regenerate naturally after a Forest Fire.*

The other side of this dark picture, the use of fire in aiding the natural regeneration of the forest, is mentioned under "Forest Management and Working-plans," page 108.

Fire has been a bad enemy to Australian forests, but observation of the facts seems to show that, properly handled, it has its uses. Probably in no forest is there a better reproduction after fire than with the Eucalypt and Acacia trees in Australian forests.

I have seen Cluster-pine forest, self-sown, come up again, like grass after a fire, on a big scale in Southern France, and in Portugal; over small areas in South Africa, and at Creswick, in Victoria, and similarly with Wattles and Eucalypts in South Africa. But in few parts of the world is the natural regeneration of forest after fire better seen than in Australia. As a rule, the Eucalypt forest re-growth comes up well after a first fire, fairly after a second fire, and it is only after the third or fourth fire that the forest really begins to fail. That is the opinion I have had from those who have spent their lives in Australian Eucalypt forests. It is fully justified by what I have seen.

It is doubtless this strong natural reproduction of the forest after fire which has saved it in the past from destruction after the fires lit by the wandering blacks. I gather from the accounts of the aborigines that forest fires were numerous before the arrival of the whites. The irregular appearance of the virgin forest indicates this; and accounts of the habits of the blacks state that they were in the habit of lighting fires in order to drive and provide feeding grounds for the game; it was natural for them to do so.

In the right use of fire, there is a great aid to the systematic regeneration of the Eucalypt and Acacia forests. I have discussed this point with all the Chief Forest Officers in Australia, and with a number of mill-owners and bush-workers. I rode 30 miles through the fine forest on the Manning River, New South Wales. The part that had been milled, and once burnt, had all the appearance of a carefully worked European forest, so good was the natural regeneration after the one fire. I saw a similar fine regrowth of Eucalypts in the Otway forest of Victoria and in various forests in Tasmania. In Western Australia the Karri forest comes up even more densely and persistently. It is not easy to destroy it.

66.—*Procedure when utilising the fire-method for the regeneration of forests.*

Briefly, the procedure for the regeneration of the Eucalypt and Acacia forests by fire appears to be this: After the matured timber in the forest has been worked out, choose a favourable day, and get as good a general burn as possible. It is not necessary to go to any particular expense over this. The "cleaning-up" of the forest, so popular with some of the writers on Forestry in Australia, is an unnecessary expense. But the more general and complete the burn, the better for the regeneration of the forest. No doubt the cut-over forest will regenerate itself without burning, as does the different class of forest in Europe and in South Africa; but, in that case, the regrowth will be less regular, and less strong. If from any cause, such, for instance, as previous fires or cuttings, there are good patches of forest in the pole stage, or mast stage, already unregenerated, these, of course, should not be burnt. For burning under favourable conditions, as when the Forester burns, slight fire-paths will suffice to keep the fire out of such patches.

After the burn, as soon as the ashes are cool, planting the blanks and future fire-protection has to be thought of. Then, or with the first rains, is the time for sowing up glades and introducing seed and plants of more valuable species. The money to be put into this work must be a subject of careful forethought and study. If the forest is accessible, and under intensive working, there should be an expenditure at that time to the utmost limit of available funds. That is the time when planting can be done cheaply. If planting to any considerable extent there is advisable, a temporary nursery should previously have been laid down on the nearest spot where there is water. A nursery must have a supply of summer water to produce a transplant with fibrous superficial roots, such as is required for successful planting.

Sowing should only be attempted where seed is cheap, and there is a reasonable chance of the sown trees holding their own against the indigenous vegetation which will spring up so strongly after a fire. When the forest is accessible, and under intensive working, the whole area cut over and under regeneration will be planted or sown wherever it seems to want it. In a remote forest the planting or sowing will be limited to the introduction of such species as may be likely afterwards to spread of their own accord, and improve the forest.

Whether or not there has been any sowing or planting, after a burn comes the important matter of future fire-protection. In the accessible and valuable forest, this is the main consideration for many years to come; but the utility of fire-protection is greatest and the difficulty is also greatest for the first year or two after the first burn; till the forest has grown up dense, and the ground herbage rotted down under the dense shade. Then the forest becomes to a great extent self-protective. Karri soon gets into this state.

67.—*Bush fires habitually caused by the Blacks when pursuing game.*

The general use of fire by the Australian mainland blacks has, I believe, never been questioned. It has been asserted, however, that the Tasmanian natives had no knowledge of fire. But there is ample evidence to the contrary.

Captain Furneaux, during Cook's second voyage, got separated from Cook, and landed on the east coast of Tasmania, where it is noted that he found bark huts made by the natives, and extensive bush fires which they had started. This was in 1773.

The Tasmanian blacks lived largely on shell-fish, which the women dived for. In La Billadiere's account of the women diving for the fish, it was related that between the dives:—

> They stayed a little time to warm themselves, with their faces towards the fire on which the fish were roasting, and other little fires burning behind them, so that they might be warmed on all sides at once.
>
> The Tasmanian blacks knew how to obtain fire by twisting a pointed stick in a hollowed-out piece of wood, some dry tinder being placed in the hollow; and the use of fire was habitual to them for clearing the forests, in order to entice kangaroo and other game to feed in the clearings so made; for cooking their food, and cremating their dead. The Tasmanians always burnt their corpses, and generally built over the ashes a kind of tomb, formed of strips of Eucalypt bark and interwoven reeds. . . . . .
>
> In many areas open grass plains appear to represent the natural condition of the country, but it must be remembered that the aborigines, from time immemorial had been in the habit of burning out the scrub in order to make large feeding grounds for the kangaroos, and other grass-feeding game on which they subsisted.—("Naturalist in Tasmania," by G. Smith.)

There is evidence that since the blacks have disappeared from North-West Tasmania and before the advent of the "settlement" fires of the whites, the forest has become denser in some parts and spread over open glades in other parts.

68.—*Trees 400ft. in height in an organised forest producable in a single life-time if protected from fire.*

Fire protection, either complete in the more valuable and accessible forests, or partial in the inaccessible forest, must be undertaken, as a general scheme, throughout the forests now burnt over.

Fire-protect, and in four generations of man, one may look for trees 400 feet high anywhere among the tall Eucalypts of Australia, *i.e.*, in locations on the Victorian mountains, in the Karri forest of Western Australia, along the Northern Rivers of New South Wales, and in those parts of Tasmania, which have more than the 50 inch rainfall area. That seems the natural consequence of what I have seen.

For a tree to reach and maintain the height of 400 feet, one must have a close group of supporting trees and fire-protection. These great trees are unusually sensitive to fire at the heart. Fire creeps in, burns up, and then the fierce draught with these tall shafts of timber acting as chimneys, renders the inside of the great logs an inferno; and soon the tree is a wreck. The giant trees we now see are those that have escaped fire by a lucky chance in their long lives of two centuries or so; but the fall of their supporting associates makes their fall, or the loss of their top from wind, inevitable. This I saw for certain among the big trees of Victoria and Tasmania.

69.—*Fire-protection must be part of a general scheme for dealing with virgin forests or burnt out areas.*

The fire-protection of the forests is a matter, not so much of cost, as of organisation and practical knowledge of the subject. It is essential that the Forest Department in each State be properly organised; and with a Chief Forest Officer, who has a practical acquaintance with fire-work, either from training or travel. And as regards the cost of forests completely organised against fire, it must be remembered that often the complete fire-protection of the outer forests most exposed to fire will ensure a sufficient measure of protection to the inner, less accessible, and less frequented forests, where no irresponsible persons should be allowed during the fire season.

70.—*Undivided Departmental control absolutely essential.*

General measures are all that can be applied to the less valuable inaccessible forests. In any case, *the Forest Department must have an undivided autocratic control over all the operations.* Half-measures, or a divided authority, are useless. The Forest Department, with their staff on the spot, should be able to get more out of the grazing than any other Government Department, and fire is not a thing to be played with by half measures.

71.—*Foresters to reside within their areas; extent of their charge.*

A complete measure of fire-protection demands that the accessible and more valuable forests be cut up into Forester's charges of from 20,000 to 30,000 acres or more; and a resident Forester placed in each; so placed, that from a hill-top or other convenient situation, he can get a good look-out and have the greater part of the forest continually under his eye, and easily accessible by paths. Then, with the first spark of fire by night, or with the first puff of smoke by day, the Forester is able to summon his men and run down on to the fire. Of course, the Forester is not always in his house, but if he is not, some one is. The Forester's house is the "Forest Station" (p. 44), the working and social centre of that forest. The Forest Station is in touch with everyone in the forest. The Forester is a weather observer. Usually he supplies observation to the Meteorological Department. He is on the look-out for a hot wind like a sailor for bad weather at sea, and is not likely to be far away when a hot wind starts. If he gets a bad fire he knows that there will be an inquiry. He is in the position of the captain who has lost his ship. A captain cannot lose many ships. A Forester cannot have many fires. If he does, he is an unfortunate man; some other employment is found for him. That is the unwritten law.

The whole forest is cut up, like a chess-board, with broad main fire-paths, and smaller intersecting paths. If a fire breaks out and is not seen and put out at once, not more than a square of forest is burnt. This safety limit is 10 acres in South Australia; the same limit has been also used in South Africa. It varies naturally with the danger, and the value of the forest crop to be protected. But of course, with forest fires, as with town fires, the important thing is to get to the fire and put it out without a moment's unnecessary delay. Here is where the resident hill-top Forester (*see* Forest Organisation, p. 44), has the advantage. Before many others in the forest know that there is a fire, he is on to it, putting it out; whereas the man who lives outside his forest may not hear of the fire till it has grown to the magnitude of an uncontrollable national disaster.

72.—*Anomalous staff arrangements obtaining throughout Australian Forestry.*

So far, I have not yet heard of a single Forester in Australia living inside his forest, and so placed, that when a fire occurs he is in a position to summon assistance, and run down on to the fire in a few minutes. That is one of the curiosities which will have to be recorded when the strange history of Forestry in Australia comes to be written. Up to 1912, there was not a trained professional man among the Conservators; and up to 1915 there was scarcely a resident Forester living in the forest, or any complete system of fire-protection.

Forest fires, which are such a curse in most of the wild forests of warm countries, give little trouble when once the forest becomes organised and cultivated. Fire-protection then becomes part of the routine of forest work; it is taken as a matter of course, and costs little to carry out.

73.—*Excess yields of Eucalypts in foreign countries due entirely to fire protection.*

There is an astonishing difference in the timber yield between the wild Eucalypt forests of Australia and the cultivated Eucalypt forests of other countries. The main cause of this difference is the forest fires in the Australian wild forests. They not only destroy the trees of all ages, rendering the forest sparse and poor, but they deteriorate the soil and render it unfit to carry a heavy stand of timber. When rainfalls get above 40 or 45 inches the dampness of the climate, and dense growth of the forest, renders it naturally self-protective against fire; and here we see the towering smooth-barked Eucalypts, the tallest trees in the world, Mountain Ash and Karri (*Euc. regnans* and *Euc. diversicolor*). When fire does get at Mountain Ash trees, their thin, smooth bark renders them an easy prey, and when fire gets inside them, their height converts them into a chimney, with a draught that soon burns them to a shell.

In the Eucalypt forests of Australia, fire-protection gives a double gain (1) unburnt trees, denser forest, and far superior timber; (2) a soil more fertile and open, growing better forest, and conserving more water.

74.—*National Parks and "Native Reserves" may become dangerous fire risks.*

At page 143 it is shown how in the absence from the Public Service of an efficient Forest Department, there are no means of keeping fires out of the National Parks and Native Reserves, which may thus become burnt as soon as they are established and become public resorts.

CHAPTER X.

Forest Organisation—The Forest Station.

The forest having been divided up into convenient administrative units, it remains to organise each unit of forest with (1) the forest station; (2) roads, inspection-paths, and fire-paths; (3) the forest nursery and arboretum.

74A.—*Note on the founding of the Forest Station in Cyprus.*

The following note on the selection and formation of Forest Stations it may perhaps be useful to reproduce from my report to the British Colonial Office on Forestry in Cyprus:—

The selection of the Forest Stations requires careful consideration and either an intimate knowledge of the locality, or a careful examination of the forest. Three points have to be considered—(1.) Fire, (2.) Nurseries, (3.) Police.

1. Fire.—This is perhaps the most important point in the selection of a "Forest Station." The "Forest Station" should be so situated that it commands a good view of the forest; when a forest fire breaks out the Forester should be the first man to see the first puff of smoke, so that he may swoop down on the fire with his men from the nursery and other forest labourers whom it is convenient to locate at the Forest Station.

2. Nursery.—Within a convenient distance of the "Forest Station" and centrally situated should be the forest nursery, with one or two acres of good flat ground and an unfailing supply of water. If possible, the nursery should be provided with water from a running stream or spring, and preferably at pressure, enabling watering to be done with a hose. This is a considerable economy in the working of all but very small forest nurseries.

3. Police.—With a Forester residing in the forest, the Police of the forest becomes to a large extent automatic. The mere presence of the forester and his workmen always in the forest acts as a deterrent to the stealer of wood, the illicit grazer, or the fire-raiser.

Each station to have (1) a forest nursery, (2) a kitchen garden and land for the forester, (3) a house for the resident forester, and rooms for inspecting officials, together with stabling and outhouses.

At no distance from the "Forest Station" there should be ground where the forest workmen can be located. Here, where there is water and good ground for the workmen's cottages and gardens, there should gradually be formed a small forest hamlet.

At or near the "Forest Station" there should be also ground allotted to the forester for his own use, as grazing and cultivation ground. The usual arrangement is that the forester is encouraged to keep domestic animals and cultivate enough ground for his own use, but is not allowed to sell any of his produce. The object is to provide the forester with a profitable and comfortable home, in order that he may live happily with his family, and be contented with a small salary, economy being ever the first consideration for forest work, where the expenditure must, in most cases, accumulate to a high figure at compound interest before a return is realised.

Forest Stations have since been established in Cyprus on these lines.

75.—*Selection of the Central Station—An African example.*

To me fell the task of organising the forests in a large part of South Africa; and more recently the similar forest on the temperate highlands of Equatorial Africa. The last four years of my African service were as Chief Conservator of Forests in British East Africa. I should perhaps explain that, though under the equator, these highland forests are situated at an altitude of from 6,000 to 10,000 feet above sea-level, and the forest is practically the same there, under the equator, that it is at sea-level in the southern part of Cape Colony (the latitude of Sydney and Adelaide). In British East Africa there was a large area of forest, and the task of organising it effectually, with the funds at command, was a difficult one. It was necessary to place the Forest Stations far apart, sometimes 20 or 30 miles, but as soon as the Forest Stations were established it was apparent that the beneficial effect was being felt over a wide zone.

76.—*Size of the Forester's area.*

The area of a Forester's charge will, as above, depend on circumstances: 1,000 acres is not too small where much planting is going forward; 20,000 acres (31 square miles) or 30,000 acres would form a fair charge where there was fire-protection, with a little planting and timber-working over one yearly Section. This would mean a distance of little over two and a half miles or three miles from a central Forest Station to the border of the forest, or an average of one and a quarter miles for mid-distance, to run downhill to an outbreak of fire—say 20 minutes to an active man. And only active men are wanted as Foresters! A staff of eight foresters could thus look after a quarter of a million acres, or say 10 foresters, allowing for men on leave and some smaller charges, according as the forest boundaries happened to run. The Forest Station should naturally be located as near as possible to the centre of the forest.

Commonly, near the organised accessible forest there are inaccessible forests where there is little, if any, working, and where the fire-protection is thus easier. It is often convenient to put these inaccessible forests in charge of the nearest Forester living in an accessible forest.

The Cedarberg forest in South Africa, of which the fire-protection has been described (see p. 35), has, if I remember correctly, an area of some 120,000 acres. It is one Forester's charge.

77.—*Foresters an armed force with special status.*

All Foresters should be armed and be soldiers of the State. This is very important against fire-setters and marauders. For all dangerous patrols, or where evidence is required, the Forester must go with the neighbouring Forester, with

whom he should be in touch by heliograph or telephone. Foresters in France, Switzerland, and Germany form a *"corps d'elite"* as guides and pioneers. It is easy to see what an important part such a corps would form in the defence scheme of Australia. The military value of Foresters and their forest stations would possibly come somewhere near their whole cost to the State, leaving their forest duties out of the question! In South Africa Foresters are given arms and uniforms.

78.—*The "Resident Forester" a life appointment for a special man.*

I attach great importance to the resident Forester. He gets to know his forest better than any other man. He knows every dangerous spot for fire, the run of every path. He makes new paths where his 20 minutes run down to a fire is likely to be exceeded, or where there is a danger spot. He knows paths that even the fire-setters may be ignorant of. It is the old story of the strange dog and the dog at home!

The resident Forester gets to know the forest as a visiting Ranger cannot do. The forest becomes part of his life. And his children grow up with that knowledge of the trees that may stand them in good stead afterwards. A Forester's son is usually a Forester. It is the best of all careers in the long run, though never a lucrative one.

The forest incendiary hesitates to start a fire if he knows the Forester has an eye on him, even though that eye may be at a distance; and it is the same with cattle-trespassers and timber-stealers.

79.—*Absentee Foresters the rule throughout Australia.*

A Forester not living in his forest is a costly and more or less ineffective arrangement, which should not be allowed to continue after the forests are organised. In the present unorganised state of the Australian forests, absentee Foresters are the rule. An absentee Forester is worse than an absentee farmer or estate-agent, since his forest may be burnt down while he is away.

To place the Forester in charge outside the forest, often in an adjoining village, is both costly and ineffectual. The Forester's usefulness is limited to the ground that he can cover. If he is placed on one side of his forest, he covers half the ground; if outside the forest, less.

Selection of the Forest Station.—The Forest Station is the centre of all forest work—the centre of the fire-organisation, of the surveillance, and of all planting operations. It is the beginning of work in the wild forest, the first step towards its conversion to a more valuable forest estate.

Other advantages follow the establishment of the Forest Station. It establishes a Government Post in remote localities, often useful for general administrative work; possibly, at some time, also useful for defence. The working of wireless apparatus is becoming simplified: it may be possible later to instal them at Forest Stations. A remote Forest Station may be the last outpost of civilisation, and help to open up the country. When President Roosevelt made his historical ascent of Mount Kenia, a snowy mountain under the equator, it was from a Forest Station ("West Kenia") that he started—a Forest Station that I had selected and established only a few years previously. The inspection quarters at all Forest Stations are a great convenience, and save the cost of camping and tents.

It is useful for the Forest Stations to be in touch with one another, especially in cases of outbreaks of fire. This may be done either by telephone or signalling. I have heliographed for 20 miles across the mountains of South Africa. Helio-

graphing in its simpler forms is quite inexpensive. Signalling is easier; a smoke signal by day, or a fire signal by night can be seen for many miles, provided, of course, that there is a clear view. Hence the utility of the Forest Station, if placed in the highest part of the forest.

To carry this out necessarily means organisation. A road has to be got to the mountain top. Speaking generally, roads are the first essential of forest organisation. A few central roads have to be made in every forest, leaving the network to be made afterwards, as the timber of the various parts of the forest comes under working. (*See* "Roads," p. 53.)

The erection of a good "Forester's House" on mountain tops has proved generally easier than was expected. On nearly every mountain top a supply of stone is available. It is advisable, for various reasons, that the Forester's house should be constructed of rough, but strong, materials. A tank usually stores the drinking water: there is rarely any long period without rain on a forest-clad mountain top.

The utility of placing the Forest Stations on the mountain tops and using them as watch-towers has been proved by many long years' experience in South Africa. I began the system in 1884, in the eastern mountain forests of the Cape. The system was extended to the Knysna forest country in 1887: Knysna is the chief forest district in South Africa, the only locality in South Africa where there is any large area of indigenous forest in one block. The outlook Forester's cottage has been followed consistently in South Africa ever since; and when, within the last few years, I was asked by the English Colonial Office to organise the forests in British East Africa, the selections of sites for the Forest Stations was, with forest demarcation, the matter that first claimed attention.

In the development of the forests of a new country, where fire and cattle are the first consideration, the selection of the best eminence for the Forest Station may require very careful study. Two forest officers spent some weeks in exploration before the site of the "West Kenia" Forest Station, just referred to, was finally decided upon.

80.—*Meteorological Observatory in the Forest.*

The weather observations are a feature of nearly all the stations in South Africa, the Meteorological Department finding at these Forest Stations some of their most useful observers.

The advantages of a Forest Station Observatory are three:—(1) The Forest Station is usually in an elevated position, and thus the observations are freer from local sources of error. (2) The Forest Stations are usually in out-lying districts where the Meteorological Department cannot get other observers; and a Government official, who takes observations as part of his duties, is usually more to be depended upon than voluntary observers. It is understood that the Conservator has a knowledge of meteorology and checks the observations. (3) The Foresters become skilled in weather lore, and are able to tell from their observations when hot winds are likely to set in, and to govern their own movements accordingly.

81.—*The choice of a Nursery Site.*

Along with the best view of the forest for fire-protection comes the choice of the best locality for the Forest Nursery. As far as possible the Forest Nursery should be near the Forest Station; but, of course, the site of the Nursery must offer good soil and a supply of water, preferably at pressure. Thus, where there

are only two good outlooks against fire, the one nearest to a good nursery site would naturally be selected. Near the nursery site should be located the quarters for the labour employed in the nursery and in other forest work. The location of the labour within easy reach of the Forester's house is an essential part of forest organisation, for, naturally, on the outbreak of fire every hand has to be mustered.

82.—*Village for forest labourers.*

It is important that provision should be made at, or near, the Forest Station for the forest labourers, and that they should be encouraged to live and make their homes in the forests with their families; especially as they have to be depended upon in case of fires, and that forest fires are especially likely to occur on Sundays.

83.—*Education of the Workmen's Families.*

Schooling is an important consideration. In South Africa the provision for rural schools is liberal. Whenever two or three families can combine together, the Educational Department provides a teacher. The minimum, if I remember correctly, is 10 pupils. It is thus usually easy to obtain a rural school for the Forest Station.

At, or near, the Forest Station should be a forest hamlet, representing the social life of the forest, and with so much of the conveniences of civilisation as the work and size of the forest can support. Thus, in an important forest having a considerable Government expenditure there will be a general shop, a club-house and meeting room, a nurse, a school, a post office, a visiting clergyman, a dispensary for simple drugs, and a doctor within call on the telephone. This form of permanent settlement is seen at forest centres in Europe, and more or less in South Africa. At quite small Forest Stations there will be a Government post office, and perhaps a small shop kept by the Forester's wife. As already mentioned, there are always "inspection quarters" at the Forester's house for the inspecting forest officers; or for other Government officials or visitors, who get permission from the Conservator to stay there. The catering is done by the Forester's wife at a fixed tariff.

CHAPTER XI.

Cost of Forest Organisation.

84.—*The present total area of Australian intensive Forestry.*

It has been shown on p. 12 that on a 20 per cent. standard, Australia requires 98½ million acres, and on a 15 per cent. standard, 74 million acres of permanent forest. There is little chance now of Australia getting more than 74 million acres as its forest reserves; but considering the more rapid growth of timber in Australia, as compared to Europe, it is probable that 74 million acres will be enough for all possible requirements in timber. We may allow one-third of this area as being inaccessible or on bad soil, and to be not worth organising and working intensively for many years to come. This one-third in reserve would be more or less completely fire-protected, and the mature timber worked as far as might be, by pit-sawing, and selection felling (*see* p. 69). It would be like the old French quarter in reserve. The *"Code Forestiére"* and early "Forest Working-plans" contain frequent references to the *quart en reserve.* It was held as an insurance reserve in the early days of French "working-plans," before the exact yields of the forests were known.

85.—*Total yearly forestry wages for Australia including the permanent Forestry officers.*

Thus, deducting the one-third in reserve, and leaving, say, 50 million acres to be organised and worked intensively at 2,000 acres per man (*see* p. 200), there would be employment, when the State forests are fully organised, for some 25,000 men (50,000,000 ÷ 2,000 = 25,000 men); and these 50 million acres would cost the Commonwealth in labour wages something like 3½ millions yearly (p. 200).

As regards the permanent staff, deducting as above the one-third in reserve, there is left 50 million acres, and with Foresters' charges at 30,000 acres, there would be required 50,000,000 ÷ 30,000 = 1,666 Foresters, costing at an average of £200 each, £333,200. To take the case of Victoria, eight Foresters, with an average of 30,000 acres each, would look after, say, one-quarter million acres of organised accessible forest, or 32 Foresters per million acres. Thus, with four million acres of State forest, and one-third in reserve, Victoria would want for 2½ million acres 80 Foresters, costing £200 each, or £16,000 yearly.

86.—*A complete Australian organisation will cost* £4,000,000 *yearly, and bring in* £16,000,000 *yearly.*

Thus, 50 million acres, with a full staff of Foresters, but less labour than in European forests, would cost the Commonwealth some 3½ + one-third million, or, say, four million pounds yearly. This would be paid for out of the 3½ million pounds now annually going out of the country for imported timber (probably five million pounds before the forests are completely organised), together with the value of home-grown timber (p. 213), and the value of timber exported. Taking that export at four million pounds, as I have done (*see* p. 167), we get a total of 16 million pounds:—

	£
Value of home forest-production, now 5½ million pounds (*see* p. 213), say, by the time the forests are fully organised	7,000,000
Imported timber, probable amount when forests fully organised	5,000,000
Export timber, as above	4,000,000
Total	£16,000,000

Thus, to work the full complement of properly organised State Forests, we should have an expenditure of four million pounds yearly; and against this expenditure some 16 million pounds' worth of timber yearly for home use and export, in fact, as much timber as Australia is ever likely to want, even with a continued rapid industrial development like that of the last few years, viz., timber not only for home use, but for an export of four million pounds' worth, against the present one million pounds' worth.

87.—*The costliness of the present ill-organised system.*

We must remember that the present timber working is costly and ill-organised, and, as I show elsewhere, there is, with better methods, every prospect of the present export of one million pounds yearly being increased to four million pounds. It is simply a question of readily getting Australian hardwoods on to the European market. England (U.K.) is now paying four million pounds yearly for imported hardwood, and Germany about half that; while the hardwoods in existing European forests are continually being replaced by the more profitable softwoods. Farther

in the future, when extra tropical Australia has a population on the same scale as Europe, the forests would be organised for a higher production and the costs of the working forests would rise in proportion.

The essence of successful forest administration is a contented and efficient staff of Foresters living in the forest: and men cannot be expected to work well and be happy in the isolated and necessarily somewhat unpopular life of a forester, unless they are given the means of making a happy home for themselves and their families. In South Africa the preference has always been given to married men as Foresters, and they are given suitable quarters for a married man. It is usual also to add an extra room to the Forester's cottage, where the inspecting forest officer can be accommodated on his travels. This plan has been adopted in South Australia. It has obvious advantages. Till forest stations are formed it may happen that not even the inspecting forest officer can see the forest properly without the expense and delay of camping out.

88.—*The Forester's Cottage—its location and functions.*

The ideal forest station, as mentioned, is situated on top of a mountain or other vantage point from whence a view of the forest can be obtained against fire; and often to some extent against cattle trespassers, for trespassing cattle will come out into the glades and open places where, with good field-glasses, they can be seen from a well-placed forest station. The Forester must be most of his time on foot or in the saddle, but it is a dog's life if he is never at home; and cattle trespassers and fire-setters will generally know where he is. Hence the importance of seeing something even from his home.

89.—*A Cape Town example of a Forester's Cottage.*

When the visitor approaches Cape Town, either by sea or land, with the first view of Table Mountain there comes also into sight the old block-house above Rondebosch, at an elevation of about 1,600ft. on the mountain side. This is the forest station from whence has proceeded the reforesting of the slopes of Table Mountain. I found the old block-house a crumbling ruin, restored it and turned it into a forest station. A staff of some 30 or 40 convicts are maintained here. The road leading from Cape Town up to the forest station is the most striking feature on the mountain-side. Fire protection here (as mentioned, p. 338) was most difficult, the South-easters, which blow during summer, ranging up to a velocity of 65 miles per hour, which is some 10 miles an hour greater than the usual velocity of the hot winds in Australia. Every point of the mountain-side is accessible, and under view, from the forest station. It is some 20 years since reforesting was started here, and from the beginning there has never been a serious fire, though the picnic parties from Cape Town render fires unusually frequent. But fires do not spread; they are pounced upon and put out at once.

90.—*Building materials recommended to be used for the Forester's Cottage.*

Foresters should have good cottages to make them happy in their homes, but there can be no large expenditure on forest items which may have to run many years before there is a return. It it desirable that the Foresters' houses should be both solidly and economically constructed, because it is usually necessary to debit the cost of a special approach road to the cost of the cottage; and sometimes it is necessary, and good policy, to build rent-paying cottages for the labourers employed on the adjoining forest nursery, and who will be within call in case of a fire alarm.

Often the Forester's cottage is a stone-built house on a stoney-kopje; and where there is a well-placed stoney-kopje it requires only a rough mason to put up the stone walls of a thoroughly serviceable and substantial house. The walls should be made 1½ft. thick. This is the most economical thickness. If they are thinner there is a loss in stone-dressing; if thicker, a loss in material. The material of the wall is rough rubble in mud-mortar, or, as it is termed in South Africa, "daga." For this description of wall only roughly-squared stones on one face are necessary. It is possible to build, as I have sometimes seen done, with unskilled labour, and (as in fact the Romans did in some buildings) with unsquared stones.

Where stone is not available, there may be good clay for a kiln of bricks; and, failing this again, "daga" may be used for the whole wall, faced, when dry, with a special preparation for rendering it waterproof.

This preparation is a most useful recipe. It is not a paint, but soaks into the surface to which it is applied without discolouring the surface. It came originally from the Public Works Department, but has been in use by the Forest Department, in South Africa, for many years. It is a preparation of linseed oil, alum, and soft soap. It can be applied to a damp wall to keep the damp out, or, if applied to a wall of daga or unburnt brick, the surface to which it is applied will become water-tight and hard. It is thus extremely useful for rough buildings and local material. The effect is to render them as serviceable as would the use of the more expensive building materials usually employed in towns.

A rough stone building furnishes a comfortable, healthy, Forester's cottage, and this is the usual type of cottage in South Africa. The daga is well raked out, and pointed up with cement; the whole weather side, if damp, may be coated with the above preparation.

Bricks will sometimes prove the cheaper building material, but not usually in countries where labour is dear. Wood and tin have disadvantages. Wood is liable to be burnt, and however careful the fire-protection of a forest, the contingency of a fire has to be always remembered. The worst material, and one which should be absolutely barred, is corrugated iron. Corrugated iron in remote localities is naturally more expensive than local material, while tin houses in such localities are costly to maintain and unhealthy. A tin house will keep out actual rain, but it offers no protection against heat and cold, or damp; the damp is its worst feature if on a mountain top situation. A house built of substantial material has stored up warmth in its walls, and remains dry and wholesome during spells of wet and misty weather. As soon as a mountain top goes under clouds everything in a tin house begins to go damp within a few hours afterwards, unless constant fires are maintained in each room, and that is not possible.

The Forester's house, therefore, should be of substantial materials, and though it may be necessary to make the roof of corrugated iron, it is preferable to use shingles that have been previously steeped in a solution of sulphate of alumina, to render them, in a large measure, fire proof.

91.—*Cost of the Building.*

The cost of a six-roomed "Forester's cottage," with bedrooms economically placed in the attics, has varied from £300 to £400 in South Africa. The rent value of this at 5 per cent., = £15 to £20, is not a serious charge on the organisation of the forest. If the work were let out on contract it would cost more, but, perhaps happily, there are no building contractors on a mountain top in a forest, and the cottages are usually built under the supervision of the Forester, living in a temporary hut, and employing such labour as is necessary. Usually not much skilled labour is required.

92.—*Structural details of the Cottage.*

The Plan.—Where the walls are of daga, it is preferable to have a verandah running round the house, so as to keep off all rain. Where this is not convenient, as in a very exposed situation, it is necessary to coat all exposed surfaces and raw brick or daga with a damp-excluding preparation. One such as mentioned above has been in use for many years in South Africa. Where put on it renders raw brick or daga as good as burnt brick in resisting wet. One must remember that in many countries raw bricks are more commonly used than burnt bricks, and with certain precautions their use is quite successful. Daga is called "adobe" in Spanish America, and even cathedrals are built of it.

Bedrooms in the attics are the most economical and wholesome sleeping places; they are drier in damp weather and cooler and more secure in hot weather. This advantage is increased where there are trees, undergrowth, and mosquitoes. Attic bedrooms are not usual in Australia, but that is purely a local custom. Elsewhere they are common and well-known. In the sweetly pretty forest houses and foresters' cottages that one sees on the Continent of Europe, the upstairs bedroom is the all-prevailing feature.

Windows should, of course, be casement; this is more economical and in keeping with the rustic character of the cottage. The ugly sliding window (the guillotine window as the French term it) is out of place here. Doors may be imported, or local batten; the latter are the best.

93.—*The disuse of Paint on the woodwork.*

Little or no paint should be used anywhere. Both as regards artistic effect and economy, paint is inferior to carbolineum. "Carbo," as it is often termed, has largely replaced paint in South Africa. It is little used in Australia, and I should perhaps explain that "Carbo" is a wood-preservative liquid of an oily nature, which was first made in Germany, but is now easily obtained in England. Its cost is from one-half to one-third that of paint. It is put on quickly with a large brush, without skilled labour. The effect is greatly superior to paint, and it preserves woodwork better. It sinks into the wood, and being of an oily, tarry nature, entirely prevents decay. The effect is to turn deal or light-coloured wood into the semblance of oak, and as long as the "Carbo" is used the wood is more durable than oak. The "Carbo" will want renewing only about one-half or one-third as often as paint; it does not get shabby like paint, so that the final economy of "Carbo" is considerable. The only objection that can be urged against "Carbo" is that it takes somewhat longer to dry than paint, but the smell, instead of being unwholesome like that of paint, is antiseptic. Thus a house with the interior work finished in "Carbo" can be occupied without danger to health before the tarry smell has quite gone off. Carbolineum is sold under more than one trade name—Carbolineum, Solignum, etc. There is no difficulty in obtaining it through any hardware store. The artistic effect and economy by using "Carbo" is considerable. I have built some 25 or 30 foresters' cottages, and in all the more recent ones very little paint has been used. It has been remarked that there was not a pot of paint in them. As a matter of fact, paint was limited to the out-door surface of doors exposed to the weather, and of window sashes. Paint is required at such points to stop warping of the woodwork where there is driving rain or mist. The practice has been to put two coats of "Carbo" on the floor, thus making them like oak, and giving the tenant the chance of easily avoiding the unwholesome and dirty British carpet. For the ceiling one coat of "Carbo" is excellent; it does not show fly marks. Three coats of "Carbo" on the doors give them the dark colour of old oak, which is the best colour for tidiness where children are about.

94.—*Land for the Forester's Private Benefit.*

In pursuance of the policy of giving the Forester a good home in the forest, he should be given the use of sufficient ground round his house for cultivation and a good paddock. In South Africa, a Forester and his wife are encouraged to have a small home farm, with poultry, pigs, horses, and cows, the general rule made being that the forester may rear all he requires for his own requirements, but not sell farm produce. For a man with a family this is naturally a considerable help in living; and even better than this there are home pursuits and outdoor occupations for the wife and children, provided, of course, that the wife be a woman used to an outdoor life, and not a sickly, household drudge, or one accustomed only to town life and unable to make a loaf of bread.

95.—*The Forester's Wife.*

When recruiting foresters in England for the highlands of British East Africa, I made it a practice to interview the wives as well as the men. An active, healthy Forester's wife is an invaluable help. She has often saved the situation when a fire has broken out in the Forester's absence, and the comfort and cleanliness of the inspection quarters at the Forest station depend on her. She may, too, in a remote station have to keep a small shop and manage the post office; so, when recruiting Foresters, the Forester's wife has to be considered.

CHAPTER XII.

Forest Roads and Tramways.

96.—*Absence of Forest roads a cardinal defect in Australian Forest policy.*

Roads, fire-paths, buildings, and a nursery, are the four essentials in an organised forest.

I may here refer to one or two points in connection with forest roads. With the general absence of a definite forest policy in Australia, there has been no making of forest roads, as such. This has been a cardinal defect. It has left those who were working the forest to make expensive tramways to get the timber out; and to reimburse the cost of this it has been thought necessary to give away the timber at nominal, or very low rates, of royalty.

97.—*Main roads indispensable for economy.*

Though, of course, the expense on forest roads must be kept as low as possible, certain main roads should be made in every forest as soon as it comes under working. In nine cases out of ten these are called for in the interests of the general development of the country. The number of these main roads will naturally depend upon circumstances, such as the easy or difficult extraction of the timber, or the value and accessibility of the forest. In the mountain forests of Victoria, and Tasmania, expensive roads or tramways must be made before any timber can be got out. In a flatter country like Western Australia, roads are easier to make, and not so necessary. As mentioned in speaking of roads in Victoria, the "floating" which was once so largely practised in Europe, has now been mostly abandoned in favour of "metal" for roads.

98.—*The choice of metal roads and their construction.*

Metal roads should be the chief means of extracting timber in Australia, assisted only by tramways. To leave tramways to do all the work is an expensive procedure in the end.

It is not necessary here to distinguish between metal and gravel roads. The Forester is only too pleased to get the chance of connecting either with a forest road which may be only much used at intervals, and have its chief use as a fire-break.

Though necessarily expensive, it is generally better policy as soon as the forest is opened for timber working, to lay out the trunk roads, and metal or gravel a central strip of them where the nature of the ground requires it. In making metal roads, it has to be borne in mind that the present stock of timber in most of the Australian forests is far from being the *best* stock of timber that the forest will carry, and that it is better to make the roads cheaply at first, and gradually improve them as the quality of the timber in the forest improves with scientific working. In another 60 or 80 years the forest will be worth at least two or three times its present value. For roads which will at present only serve to get out the present relatively inferior timber, the expenditure must be kept down to as low a point as possible. Of course, if the metal road is also one which opens up the country beyond, the first expenditure may be on a more generous scale.

99.—*South African practice in laying out Forest roads.*

I have had some experience in road-making under these circumstances in South Africa, and with this experience offer the following suggestions:—In laying out a road in the forest three things have to be considered—(1) Extraction of timber; (2) Inspection purposes; (3) Fire work. For extraction of timber the grades have to be easy, but for inspection and fires-path purposes the grade is of less importance than straightness and directness. The best course in mountainous ground is generally to lay out an easy, well-graded road for the extraction of timber, and make this also useful for inspection purposes and fire-path work by cross cuts or cross roads.

100.—*Excessive width and cost of Australian roads; the retardation of Tasmania due to this cause.*

The visitor to Australia is at once struck by the fact that very little inconvenience would often be caused by metalling the roads half—or even one-third—their present width. It is quite easy, as traffic develops, to increase the breadth of the metalling. I must have travelled over hundreds of miles in Australia, where an ample allowance of width for the traffic would be less than one-half the present width. The general result of making the metal road between one-half and one-third its present width would be that double the length of road could be made for the same money. There are wide stretches of country in Australia where it is only the want of roads which delays the development of the country, either as regards forest or agriculture. Something like half the area of Tasmania is in this position. So is a large part of the fertile mountain country of Victoria; but in both these countries it is the fashion to make roads of excessive width.

It is the road making that has so severely strained the finances of Tasmania. It is the want of roads that is holding back the country, one-fourth of which is entirely undeveloped after more than a century's settlement; yet the main roads

are sometimes made on a wasteful scale. The new tourist road through the Blue Mountains of Tasmania is thus described in the *Mercury* of April 12th:—

> They have made a good road that will rival the main road from Hobart to Launceston The road is so wide that two large motor cars could pass with the greatest of ease in the dark without fear of collision.

And this too, be it remembered, is a mountain road where a narrow road costs little, end every extra yard increases the cost in geometrical proportion.

Only those who have had experience in making roads know the terrible cost of over-wide roads. One may surmise that the fashion for these wide and costly roads has risen as a reaction against the very narrow roads in some of the old countries of Europe, and the view is supported by the fact that the same excessively wide roads are seen in some of the new towns in South Africa. Bulawayo, for instance, presents the appearance of broad sandy wastes with a track, the actual road, meandering from side to side.

101.—*Excessive width of the roads in Australian cities.*

It would be out of place here to more than refer to the excessively wide roads in some of the Australian towns. A wide roadway is correct, but the space should be filled up with boulevards and avenues of trees; not left a dreary waste of asphalt or macadam, expensive to make, costly to maintain, and unpleasant to look at. King William Street, the chief street in Adelaide, is of this description. The St. Kilda road out of Melbourne is 70 yards broad, the side of an acre; and instead of having avenues of trees to fill up this great width, it has grotesque little strips of rock garden.

From the capital cities usually radiate broad thoroughfares showing the same defect of no roadside trees, and excessive width of metalling. These excessively wide metal roads stretch far into the country, and then often come to a sudden end with the failure of further funds. Yet in much older countries one sees roads which have been made for hundreds of years, and which really fill all the requirements of the traffic, with a 10 or 12 feet strip of hard road down the middle. In Flanders, paved roads were made long before macadam was invented, and the paved strip is there even narrower. When a cart turns off the solid road to let another pass it plunges into soft sand; but yet with the wealth which exists in Flanders, and the net-work of roads, railways, and canals all over the country, it has so far, not been thought necessary to increase the strip of hard road. Fashion has created the very wide and costly roads of Australia; custom has made the Flemings content with their very narrow roads. Forest roads, which only carry heavy traffic at intervals, if they are metalled or gravelled at all, should only have this as a strip down the middle.

102.—*Economical forest roads of grassed track.*

Apart from trunk roads, the usual forest road is a well-rounded and well-drained grass-road, with no bridges, but with graded approaches to good crossing places over streams—"drifts" they are termed in South Africa. Bridges have a short life at best in the damp forest atmosphere, and there is always the chance of destruction by fire. Such grass-roads are good enough for the extraction of timber in ordinary dry weather, provided that they are raised in the middle so as to give good drainage. When a well-drained grass-road becomes cut up with the heavy timber traffic going over it at intervals, it is better to pile up branches, and over this the cleanings from the ditches, than to make a corduroy road, and for this reason:—Where branches are laid thickly and covered with a thin layer of earth, the effect of the traffic upon the road is, when the road falls into disuse, to induce a strong

growth of grass. I have frequently seen this happen in South Africa, the result being that a year or two after the heavy traffic has come to an end, there is a fine grass road, well raised in the centre, and with a hard surface which will carry a good deal of traffic in the future. Whereas, when a corduroy road is abandoned, its last state is worse than its first. Tea-tree branches in Australia are credited with forming quite a durable road surface. In any case it is the branch-repaired and raised earth road that has to be looked to as the ordinary forest road; otherwise the cost of organising and fire-protecting the forest would be prohibitive. And a good binding-grass, such as "Fine quick" (*Cynadon dactylon*) in the warmer parts of Australia, is worth more to the Forester than a good bed of gravel.

Black, in his *Naturalised Flora of South Australia*, enumerates 36 introduced grasses which have run wild there. Their number is greater in some of the States which have more rainfall. Most of these enumerated in Black's list are also wild in South Africa, and many of them grow strong enough for forest paths and roadways.

103.—*The best grasses for binding forest roads.*

It is only by an experiment that the Forester is able to find the grasses best adapted to his purpose. In many of the forest arboretums in South Africa, I had small experimental plots of grass cultivated for the purpose of showing any which were useful for permanent fire-lines and forest tracks. Of the two common lawn grasses at Cape Town—"Fine quick" (*Cynodon dactylon*), and "Buffalo" (*Stenotaphrum americanum*)—only the first has a sufficiently strong and matted growth for use on forest roads and paths. It has been found that in Natal, after eight years' testing and experimenting with all the best grasses, only *Paspalum dilatatum* and *Phalaris commutata* will hold their own as *wild* grasses for more than two years. There is little danger of road grasses spreading into the forest and becoming pests, since the forest in its normal state is too dark and too close-growing to allow of a growth of these open-roadway grasses.

104.—*Long tramways in forests should be made by Government and a higher price charged for the timber.*

From what has been said, it will be seen that I consider it better policy, both from a purely forest point of view, and in the general interests of the country, that timber should be got out by road, rather than by tramway. Tramways have their use for short distances. In the model forest of Sihlwald in Switzerland is a complete system of tramways which has frequently been visited by Forest officers for purposes of study, and these show a profit against timber extraction by ordinary roads. But they are not very long, and the slopes are steep and mountainous. When tramways have to be run for long distances, as has occurred in Australia in many cases, they become branch railways, and instead of being constructed by the purchaser of the timber, should be made by Government in view of the general requirements of the country and of the forest, having regard of course, to the yield-capacity of the forest. I have seen timber companies in Australia which have been put to charges so heavy for tram and rail construction, that only the fact that they have timber at a nominal cost has enabled them to work at a profit, and with a reckless forest policy which allows the forest to become daily more inaccessible, and more ravaged by fire.

105.—*Tramway construction absorbs timber-companies dividends: Some Australian illustrations.*

The cost of tramways may eat up all the profits of the timber companies. It was stated recently at a saw-millers' deputation to a Minister in Melbourne that

an English Timber Co. in Tasmania, with a capital of a quarter of a million pounds has never paid a dividend. It gets its timber at little more than nominal rates, but has had to make railways which should have been made by the State.

The unfortunate saw-miller, handicapped by having to work a forest which is only partially stocked, and that with unsound timber, a forest too, entirely neglected by Government, instead of being given a subvention to make railways and tramways is frequently charged a fee for his tramways. In Tasmania this fee amounts to £1 or £2 per mile per year.

Many of the Australian timber lines are well equipped branch railways. Millar's Karri and Jarrah Co. of Western Australia, for instance, has constructed as much as 306 miles of railway (*Com. Year Book*, 1914). This at £1,000 per mile would represent an expenditure of about half a million pounds, and many of the mountain timber tramways I have been over in Queensland, New South Wales, Victoria, and Tasmania, with their heavy cuttings and earthworks, represent expenditures ranging up to £2,000 per mile.

CHAPTER XIII.

Forest Grazing.

106.—*Animal food raised in Europe from forest products.*

Forest grazing is discussed under "Working-plans" (p. 69) and under "Forest Fires" (p. 60); it remains only to notice certain points here.

European literature, especially that relating to former days when forests were more extensive, teems with reference to the value of forest grazing. In Charlemagne's time there was the curious spectacle of the Germans and Sclavs living side by side in central Europe, and the Germans getting the better grazing country; the Germans were in the Oak forests, the Sclavs were in the Pine forests. The German's love of pig-flesh and sausages goes back to a time when vast herds of pigs roamed the forest and subsisted on acorns and Beech-mast. At that time pigs and their forest grazing were to the Germans what goats and their grazing are to-day to the South European peoples, and might be to the Australian.

107.—*Grazing versus Forestry considered as rural and economic questions. British and Australian data.*

Grazing *versus* Forestry is an economic question which has been much studied in recent years in Scotland; particularly with regard to the great social question of rural depopulation (see p. 203). The Departmental Committee on Forestry in Scotland (December, 1911) reported:—

> Forests of the same size give ten times as much employment as sheep farms . . . . . without reckoning the population absorbed in attendant industries which, in many cases, trebles the ten-times ratio.

Two years before, the same question was considered by the Coast Erosion Royal Commission (p. 203), which finished its inquiry with a report on Forestry. The Coast Erosion Committee found that, putting Pasture against Forestry, the average figures work out to 15lbs. of mutton *versus* 50 cub. ft. of timber per acre per year. The live weight value of the mutton would be about 6s. 6d., and the value of the timber at 6d. a cubic foot, £1 5s., or discounted 40 years at 4 per cent., five shillings.

With the slow growth of timber in England it is thus rather less profitable to grow timber than mutton, but what decides the English farmer is that the mutton gives a return in two or three years, the timber only in 80 years. Thus the mutton is the farmers' business, the timber the State's business.

I have referred at p. 203 to the Australian estimate of employment of one man per 7,500 sheep, which in forest country might represent something like one man per 10,000 acres, while on the lowest scale of forest organisation there would be employment in the forest for one man per 2,000 acres on purely forest work, exclusive of timber, while if the forests were organised and cultivated as in Europe, there would be employment for one man per 800 acres. In Australia the average production of timber would be about 100 cubic feet per acre per year, while the average production of mutton per acre would be less; but the value of timber would be also less. It will depend on local circumstances whether sheep raising or timber growing is the more profitable; as regards employment, however, there is no comparison.

108.—*Bad effects of grazing in Australian forests is directly due to a Wrong System of Control.*

All through Australian forests I have remarked the absence of a sufficient proportion of young trees in the "pole" stage of growth. This, as mentioned in "Forest Management" (p. 71) is to be attributed to the common failing of a generally sparse and crooked growth. There is usually a good reproduction from seed, particularly after a forest fire. But other forest fires reduce this reproduction to a patchy condition. Then, if there is grazing in such forests before the trees are sufficiently grown up, further harm results. It is thus especially important that the regulation of grazing should be left entirely to the Forest Department, so that the grazing may be used to help the forest, instead of to destroy it. And, furthermore, there is the difficult and delicate matter of getting graziers who will abstain from burning the forest.

Very commonly, however, in Australia, the grazing is left at the disposal of the Lands Department. The result is a dual control, which does enormous mischief in more ways than one. In New South Wales I found this dual control had reached the proportions of a public scandal. It has mostly been got rid of in Victoria, but some still remains. Victoria has four classes of forest "reserves," but the grazing control, I understand, is only effective on the four million acres of State forest.

"The British Association Hand-book for Victoria" (p. 312) has the following paragraph from the pen of Mr. Mackay, the Conservator of Forests, Victoria:—

> The natural reafforestation (regeneration) of trees of slow growth, such as Grey-box and Yellow-box, and to a less extent of Red-gum, is greatly impeded by the maintenance of dual authority in connection with forest grazing. The control of grazing in many valuable unreserved forests is still retained by the Lands Department, and exercised in a manner which often greatly injures them. Sheep especially, greedily eat seedlings and stool shoots of many species, even when grass is abundant. They thus destroy all hope of obtaining regular hardy crops of natural growth. To this cause alone is due the absence of young pole timber in many valuable forests, where rabbits are scarcely ever seen. Every endeavour has been made, but generally without avail, to put a stop to this senseless practice of sacrificing young forest growth to what is at best a small grazing revenue, and, until the Conservator is given statutory power to regulate all grazing in forests, there is no likelihood of proper control in this respect being exercised.

109.—*Wattle Bark as illustrating losses due to improper grazing regulations.*

It is shown by statistics that when the war broke out Australia was losing (in imports plus lost exports) some £250,000 yearly on tan bark. Nearly all this loss was Wattle bark, *Acacia decurrens* and *Acacia pycnantha*, and the bulk of the

Wattle bark lost was in forest fires (*see* p. 20). But, with all the Acacias, grazing also plays an important part, much more so than in the case of Eucalypts. All the Acacias probably, and certainly nearly all the tan-bark-yielding Acacias, are greedily devoured by grazing animals. A well-fed milch cow, that will not touch coarse grazing, will graze off Acacias to such an extent as to taint the milk. The nitrogen-fixing nodules on the roots of Acacias have been held to account for the good grazing qualities of Acacia leaves, the nitrogen-fixing bacteria putting an unusual store of nitrogen into the foliage . Be this as it may, the fact remains that with certain exceptions, such as Black Wattle, at Swansea, the tan-bark Acacias are devoured by grazing animals, and that the regulation of grazing in the forests where tan Wattles grow is particularly urgent, as having an important bearing on the problem of restoring to Australia the £250,000 now being annually lost on tan-bark.

110.—*Conditions rendering light grazing permissible.*

In forests which are not sufficiently accessible or valuable to be worked intensively, it is generally found that light grazing is permissible, if not beneficial, provided of course that it is *bona fide,* and that no fires are set. In any forest where doubtful fires occur, that forest should be immediately closed against grazing. It is, of course, absolutely necessary to be firm on this point. If Forestry is of a make-shift character, as in New South Wales, it is mere waste of time to attempt anything till the Forest Department has full control of the grazing in the demarcated forests, and of all areas where trees still have a value.

111.—*Danger of ill-used tree areas reverting to worthless scrub; the disastrous experience of Queensland.*

A calamity which has occurred in several countries, and which is a distinct danger to be avoided, is that if a forest be recklessly destroyed it will not give even the partial return of good grazing. It will be liable to run into nearly worthless grazing fern, or a scrub which is useless for nearly every purpose. This is a danger which is brought home by the area that has run to waste with Prickly-pear in Queensland—some 30 million acres gone and one million a year going! In Africa, very large areas of destroyed forest have run to scrub with the destruction of the forest.

To avoid this danger in Australia there is but one course, viz., to follow the example of South Australia, and place not only the demarcated forests under the Forest Department, but also all doubtful tree-lands of which the ultimate fate has not yet been decided. It must be remembered that the area under forest reserves in Australia (even if we include as a good reserve area the recent declaration of five million acres in New South Wales) has, at present, only one-eighth of the required normal forest area on the 20 per cent. standard. On such doubtful lands, while the Forest Department can take measures to see that there is no purposeless destruction of forest, it should also, with its staff living on the spot, be in a better position to obtain revenue from the grazing than can the Lands Department.

112.—*Forest pastures a stock refuge in times of drought.*

The value of forest grazing when the forest is protected from fire as a refuge for starving stock in times of drought, has been mentioned under "Forest Fires" (p. 27). This resource has proved of incalculable value in India, and it should prove equally so in Australia, since danger from droughts will remain, while the area of unoccupied land will decrease. It seems of the first importance to have a certain area with a vast store of grazing, accumulated in the forests by fire-pro-

tection. It is true that this will be quite second-class grazing, but any grazing is precious in times of drought.

113.—*Forest grazing by Goats; its use and abuse. The Goat a "Forest-feeding Animal."*

A note regarding grazing in extra-tropical forests would be incomplete without a mention of the goat of Southern Europe. To ordinary travellers, the goat is the *bête noir* of extra-tropical Forestry, and this opinion is justified by the fact that it is doubtful whether in Southern Europe more mischief, on the whole, has been done to the forest by fire or by goats! But, like fire, goats may be a good friend as well as a bad enemy. This is soon perceived by the Forester who travels in Southern Europe.

Amongst the cultivated extra-tropical forests of the world, there are none where more minute and studied attention is given to the growth of timber than in the State Forest of Leiría, in Portugal, and there we find goats playing an important part—most useful to the forest and profitable to their owners. From the time when the young trees have got a good head, at a height above the reach of goats, it is found useful there to let them into the forest. Where sheep and cattle will nibble the herbage, and look for grass, goats will clear off the ground herbage without troubling about grass at all; and they will also clear off the lower branches from the trees. These branches are destined to fall, and the more rapidly they are got out of the way, the less the danger from fire. Commonly with valuable, well-cultivated trees, it is necessary to go to the expense, as a fire measure, of pruning them off. Here, therefore, the goat is doing a useful service to the forest in a double sense.

It is necessary to make this point quite clear. The natural food of the goat is not grass, but shrubs and young trees. As soon as the Forester has got his trees above harm's way from goats, they should be let in to clear off the ground herbage, and the effect of doing this is doubly beneficial to the forest: (1) It reduces the danger from fire. (2) In clearing off the ground herbage the drain on forest subsoil moisture is reduced.

In order to have good grazing in a forest for sheep, cattle, and horses, the forest must be sufficiently open, and the ground sufficiently clean to allow a growth of grass, or herbage of a like nature. I have elsewhere mentioned a forest of this class at Valladolid, in Spain, but that could not, in any sense, be described as a forest fit for the production of the best timber. It is a sparse forest of Stone-pine, yielding the valuable Stone-pine nuts, and over a large part of the forest the grazing is as good as a meadow. The forest conditions there, however, are not such as are the most conducive to the production of good timber, while at Leiría, the forest is of the highest type, solely devoted to the production of the best timber; and in such a forest the goat will clear off the dangerous forest undergrowth that other grazing animals, unless they are starving, will only nibble at!

114.—*Forests and Goats as factors in Dairy-farming.*

The goat being thus fitted to play this useful part in forest economy, it is necessary to add a word about goats generally.

The goat to an average Englishman does not signify much. Its mutton is inferior to sheep, and the ordinary farmer looks on the goat as fitted for little else than the production of inferior mutton. The "National Goat Society" of England, at agricultural shows and elsewhere, exhibits breeds of milch goats, but the keeping of goats in England seems to make practically no headway. In South Africa and in Australia the goat is looked on as the poor man's cow!

In good grass countries, such as middle, and particularly north-western Europe, the cow is a more profitable animal than the goat. England, whence most of the domestic animals of Australia come from, is the finest grass country in the world, but in Southern Europe this position is reversed. There one sees a poor and short-lived pasture of winter grass, and for the summer, the only green fodder is to be found in herbage and shrubs which get their roots deep into the subsoil moisture; and the animal that lives on this shrubby fodder is not the cow (certainly not the cow of English breeds), but the goat. Thus it comes about that in the extra-tropics of Europe, the goat has taken the place of the cow.

In our one South European possession of any size, the Island of Cyprus, till the English came there, it is said that there were only three milch cows on the island, and the number there now could be counted on one's fingers. But there are a quarter of a million goats; and a large proportion of these are milch goats.

At Malta it was the same story, and there, goat's milk was commonly drunk by the garrison until the connection was traced (as a result of a fine scientific investigation) between goat's milk and Maltese fever. This connection between goat's milk and Maltese fever seems to be a local accident; one hears nothing of it in other South European countries; but what one does hear of and see very prominently is the milch goat. It comes to one's door in the morning, and though not much bigger than a large dog, will give half as much milk as a small cow, and milk rather richer in quality than cow's milk. It spends the day picking up its food on the scrub-covered hills; if of the choicer breeds, and if in full milk, it will get some hand-feeding in addition.

Now, the point which it is necessary to urge here is that not only is the goat useful in a well-managed forest, but it means money to the dairying industry. Milch goats in these latitudes represent to the dairying farmer an untapped source of wealth. Those who have travelled in the Mediterranean know the place of the milch goat in the social economy of the people, and those who have travelled away from the hotels catering for English tastes, have drunk goat's milk and eaten goat's milk products. There is a whole range of goat's milk cheeses, many of them excellent, and some preferred by cheese connoisseurs to cow's milk cheeses.

With systematic Forestry in this climate, there will be rendered available large supplies of goat fodder. One can foresee supplies so large that, as in Southern Europe, the dairy products from goat's milk may come near rivalling the dairy products from cow's milk. If one considers that the present grassed area of Australia is 3½ million acres, that the present State Forest area is 11 million acres, and that this is only one-eighth of the normal forest area, it is easy to foresee what great extension of the dairying industry may take place in Australia by the use of the milch goat on the forest areas.

The breeding and care of milch goats in Southern Europe receive the same attention that is given to stud-bred dairy stock in England, and, in proportion, higher prices are given for choice milch goats in Spain than for choice milch cows in England. Foresters will not wish to see goats in Australia as long as Forestry is in its present state; but as soon as order takes the place of the present chaos in the forests, goat-keeping should not be the least of the benefits that Australia has to expect from good Forestry.

I have not mentioned Angora goats here; they are an increasingly valuable industry in South Africa, and the small number of them in Australia is astonishing; they have often been tried in Australia; they thrive well enough, but no one seems to keep them for long. The failure is put down to rough, inferior fencing, and perhaps also the reluctance to give children a healthy out-door employment. Of goats of all kinds, the returns show a total of a little over one-quarter of a million

in Australia; about the same number as in the little island of Cyprus! The small number of goats in Australia is almost as great a puzzle as the total of only 7,000 mules and donkeys in Australia.

115.—*Trees have converted certain barren lands into pastures.*

It is noticeable how, with planting, barren land may frequently be turned into good pasture lands. This happens when Larch is planted on moorland in Scotland. It happens, to some extent, in sparse Cluster-pine forests in Gascony. The effect of the planting is to produce a better soil at the surface, through trees' roots bringing up plant food from below, and the fall of the leaf depositing this at the surface.

116.—*Forest demarcation must include pastures for the cattle which will be employed in the forest.*

Under demarcation it has been pointed out that the demarcating officer has to provide, not only for the best timber growth in the forest, but for the needs in grazing of the grazing animals that work the forest. (See also Timber-working, p. 115.)

117.—*Pig grazing on forest products in Europe and South Africa.*

Pig raising is not the most flourishing of Australian industries. In recent years the number of pigs raised yearly in Australia has fluctuated between one million and three-quarters of a million. Says the *Com. Year Book,* 1914: "Pigs exhibit more fluctuation than that of any of the other classes of live stock." The number of pigs raised in 1912 was practically the same as that raised as far back as the year 1880. Arboriculture and forest grazing should have a steadying effect on the pig-raising industry, arboriculture especially; for then, as will be later shown, a farmer has it properly brought home to him that he is losing wealth through not planting acorn-producing oaks. (*See* pp. 264 and 267.)

The average Australian diet is not quite the best. Like that of the South African Boer the proportion of meat is too large; but in bacon the Australian consumption has not averaged above 10 or 11lbs. per head in recent years. Even with this small consumption, Australia does little more than find its own bacon. In 1912 the net export of bacon, ham, and frozen pork was only £70,000 worth for the Commonwealth. (*Com. Year Book,* 1914.) These figures show how greatly the Australian pig-industry needs developing with forest grazing like that of Portugal. The climate of Portugal is identical with the coast climate of Australia, and the same trees grow equally well in both countries. Twenty years ago, in one of the Cape forest plantations, a grove of Oaks was planted. Only some three or four acres were put in, as the Oak was the English Oak, and therefore not quite hardy there; but before long, pigs from a neighbouring farm found their way in, and for some years now a small semi-wild herd of pigs have established themselves there, living on the acorns and the grazing they pick up in the adjoining forest of Eucalypts, Wattles, and Pines. The increase of the herd is shot down at acorn-time and furnishes good pork.

Certain trees are worth planting for what may be termed their grazing value. The important economic positions of *Quercus ilex* and of *Q. suber* (the Ilex and Cork-oak of Spain and Portugal) mentioned under this head (at p. 263). One-third million pigs are raised yearly in Portugal, forest grazing helping to feed them, and all the fattening done with acorns. The point to remember is, that the same Oak which bears a few handfuls of acorns every two or three years in Northern Europe will give a sack or two every year in the warmer climate of South

Europe, South Africa, or Southern Australia; and the southern acorns are about double the size of the northern ones. I have heard a prosperous South African farmer, with broad acres under vineyards and crops, remark:—"If my father had planted Oaks when I was a boy, I could have made as much off the farm with *half the trouble and risk*"! With the artificial propagation and natural spreading of these trees in fire-protected forests, the same industry may be looked forward to in Australia as in South Africa and Portugal. What South Europeans have accomplished, Britons can do in the same climate and with the same trees.

118.—*Grazing is not a by-issue; it is an essential part of Forest Management and insusceptible of Divided Control.*

The general position is perfectly clear; unless the Forest Department has *absolute control* over the grazing, it is not in a position to manage the forests. Grazing, as we have seen, is an important consideration in fire-protection in more ways than one; and grazing, as has also been mentioned, may be useful at one age of the forest, and very harmful in another. And this is always to be remembered: that the more the forest is regularised into successive gradations of even-aged areas, the larger will be the area of grazing available, not only without harm, but, in these latitudes, with benefit to the forest.

Grazing may give but a poor return as compared to Forestry, but regulated forest grazing may be a valuable asset, especially as regards goats and pigs. Grazing has had much to do with the disappearance of Wattles and the quarter of a million pounds which is now being annually lost over tan bark.

Lastly, there is the drought insurance to farmers by providing a great store of second-class grazing in fire-protected forests. In India this has become one of the most important drought-relief measures.

CHAPTER XIV.

The Tourist Traffic and the Aesthetic Side of Forest Countries.

119.—*Tourists do not see Australian forests advantageously.*

With the organisation and opening up of the forests of Australia with roads, there will be brought into the range of the tourist the most beautiful part of Australia. This is almost a truism, but it is useful to reflect to what a considerable extent the cost of organisating and opening up the forests will be met by the increasing attractiveness of the country to tourists and the money they bring. Fire-protection, as practised in South Africa and in Europe, does not mean the closing of the forests to tourists, but appealing to their good sense to take precautions against fire, and having also at hand the means of putting out, or arresting, fires that may occur by accident. At present the usual result of a tour in Australia and New Zealand is the unfortunate verdict that New Zealand is the tourists' country and Australia is not. After coming to the country with the British Association and hearing the opinions of it expressed by the members, and after touring Australia for over a year afterwards, I may perhaps venture to express the opinion that this verdict is unjust, and that the reason of its being arrived at is that the tourist from the Northern Hemisphere is unable to visit the best parts of Australia, that is to say, the forests!

I hope some day to see the beauties of the National Park on the Stirling Range of Western Australia. In its present pathless state it is impossible for anyone to do so.

120.—*Organised Forests would attract tourists, as exemplified in other countries.*

The beauties of the forest country in every State of Australia are such that a description of them would easily fill a book. To one who has come as a "Forester" and is able to go into the forest country the beauties are seen; but to the ordinary tourist, all this best part of Australia is closed. Inside the forests there are few roads, and fewer places to stay at; and, except at a very few places, such as the Jenolan Caves, in New South Wales, there are no picturesque paths by which the tourist can wander about at will. But consider the contrast when the forest is organised and opened up with roads and inspection-paths (*see* p. 43). Every scrap of the forest, down to the units of 10 acres in the best forest, is rendered accessible by paths, and the forest is to be seen in its naturally beautiful state, instead of, as now, often presenting the appearance of a burnt cinder. Added to this is the colour that will be thrown into the rather sombre tints of Australian forests by the planting of the beautiful extra-tropical trees of the Northern Hemisphere—the graceful Cedars—the tapering Pines. Perhaps the most beautiful spot in South Australia is a mountain lake at Mt. Gambier, which the Conservator has surrounded with a Pine forest.

There arises the question where to stay. Up to a certain point, the quarters at the Forest Stations can be rendered available for occasional summer visitors. But it is quite certain that, as soon as the forests are opened out and organised, the most beautiful spots will be pounced upon by hotel and boardinghouse-keepers; and, where this is not done, it is easy for Government to continue the practice which was happily begun at the Jenolan caves and elsewhere, and provide Government accommodation. These are details which it is not necessary to more than mention here. The important point is the fire-protection and opening up of the forests of Australia to tourists, as has been done in the forest resorts on the Continent of Europe.

121.—*The Tourist Club of France and its help in the National Forestry. The contrast with Australian Tourist Bureaus.*

Tourism (to borrow a French word) is a living force in France and other European nations. It was under the auspices of the "Tourist Club of France" that the recent International Forest Conference in Paris was held. The Tourist Club of France is a powerful organisation, its head-quarters a mansion in the best part of Paris. It does a great and a good work in getting Frenchmen to travel and know their beautiful country. It does more. It has in France gone hand in hand with Forestry for many years. The Tourist Club recognises hotels where there is a certain standard of comfort, cleanliness, and healthiness. It puts up guide posts in the forest as do Australia Tourist Associations; and it *assists in the fire-protection of the forests.* In the beautiful suburban forests of Paris, one meets the warning notices of the Tourists' Association against fire almost at every turn in the forest. But, in Australia, I have not noticed this sympathetic attitude towards the forest. Tasmania, the first in the field with the Tourist Bureau, is at the bottom of the States in Forestry. Sydney, with its grandiose Tourist Office, is in much the same position. What is the result? The tourist comes to Australia. He is sent to admire the scenery in that picture of desolution, *a burnt forest*, and he comes to Australia no more.

Switzerland, according to statistics, gets £8,000,000 a year out of the tourist traffic, while the capital sunk in the tourist industry is some £33,000,000 (*Daily Mail* Year Book, 1910).

Egypt and Scotland are not for behind Switzerland in the millions that are made out of tourist traffic. According to Lord Cromer tourists spend an average of some £1,025,000 yearly in Egypt. Nearly all the "Spas" in Germany are forest resorts. The Black Forest is packed full of Spas. The dweller in mid-Europe goes to a forest resort where the Englishman goes to the seaside; and the forest "Watering-place" is generally the most pleasant of the two in climates where there is glare, and heat, in summer.

122.—*Choice scenery forest areas not yet utilised in Australia.*

I trust that the "National Park" on the Stirling Range, Western Australia, will be declared a State Forest at once, and handed over to the Forest Department for timber-working, fire-protection, and opening up with roads. Nothing could be much more unfortunate than that the choicest spot in Western Australia should be unutilised and unknown; an idle capital bringing in nothing to the State. It was described to me as the most beautiful part of Western Australia, but with its natural beauties already getting deteriorated by the fires. A more striking case of undeveloped forest scenery is that of the mountains of Victoria; this is discussed at page 318. Tasmania has a most useful Tourists' Office, but the beautiful mountain and lake scenery of the country remains nearly a closed book, and, what is worse, badly ravaged by fires. (*See* page 338.)

CHAPTER XV.

Forest Game and its Importance.

123.—*Game development in Australia awaiting Organised Forestry.*

Game, both native and introduced, has naturally received, amongst Englishmen in Australia, the consideration which its importance merits; but forest game, without Forestry and an efficient Forest Department, is somewhat like a ship without a rudder. In some cases game has been introduced and allowed to be shot down before it has spread over the country. This has been the case with deer in parts of Tasmania, while in New Zealand the deer has increased to such an extent that it is injuring the reproduction of the forest. In many directions one can see where game might be introduced under conditions which prevail only in certain parts, or again, if certain trees were introduced that would provide food for game.

The practical side of game in Australia, as far as I can learn, awaits the systematic development of Forestry. When the forests are organised, with a hill-top Forester in the centre of each forest, he will be in a position to protect and develop the game in that forest in the same way that he will protect the forest from fire, timber-stealers, fire-raisers, or illicit grazers.

The Victorian Forest Commission (14th and Final Report) makes the following amongst its many useful recommendations:—

In addition to the control of the forest reserves, the Forest Department should be intrusted with the administration of the Game Act and the Fisheries of the Colony. The reserves are now the only refuges for large game such as Kangaroo and Emu, and though protected by law, the former are still shot for the sake of their skins wherever opportunity offers; while duck, native-pigeons, and insectivorous birds are destroyed in many districts where it is safe to do so without regard to close seasons or any legal restriction. We consider it of the first importance that all forest officers should have full power to protect the game and fish of Crown areas.

124.—*Present Australian practice is "Game Laws without Game-keepers," and "Nature Reserves" without Fire-protection.*

The unique native game Fauna of Australia has become so rare that now-a-days, in order to see it, the visitor can do little more than visit it in the Zoological Gardens. Those interested in the matter have hoped that it would be preserved by game laws and nature reserves. But game laws without gamekeepers and nature reserves without fire-protection are of little avail.

There is no reason why, with the coming of Forestry to Australia, game should not be of the same importance in Australia that it is in other countries. At present, coming from Africa, or indeed from most other countries, the visitor is filled with astonishment at the almost complete absence of game in the forest. One travels day after day in the forests without seeing anything, and finishes by wondering which is the greatest puzzle, the neglect of game or the neglect of Forestry in Australia.

125.—*Game Departments in Europe and Africa are administered by the Forestry Departments.*

This would be changed, almost automatically, and without expense, with the organisation of the forests. All that will be required will be to hand over the care of the game and the administration of the game laws in the forest country to the Forest Department. This was done in South Africa many years ago, and the time is not far distant when, in any country that once teemed with game, there will be little game left, but what is to be found in the forests.

In British East Africa (the only temperate climate country left in the world where there is at present a great stock of native game, the Government mainatins a special "Game Department," but it is intended presently to hand the game over to the charge of the Forest Department.

In European countries the charge of the game and fisheries within the forests falls naturally to the Forest Department. The Forest officials are allowed certain game privileges which are highly prized. The official title of the French Forest Department is "Departement des Eaux et Forêts," and both there and in Spain the inland waters, and the fish hatcheries which keep them supplied with firsh, are in charge of the Forest Department.

126.—*Australia's need of more introduced Game.*

I understand that the introduction of the game likely to spread in Australia is far from complete. Guinea-fowl, jungle-fowl, pea-fowl have all been experimented with in South Africa with varying success. The trouble there is that there are so many large and fierce carnivorous animals; these the Australian forest is free from. So large and powerful a bird as the English swan, a bird that is credited with being able to break a man's leg with a blow of its wing, cannot exist

in the wild state in South Africa. It is taken by an otter. The Australian black swan has naturally less chance still against the otter.

One of the most interesting extra-tropical game animals is the Mouflon or Wild-sheep of Southern Europe, now nearly extinct. One herd of it in Cyprus is very carefully preserved by the Forest Department, but it shows no appreciable increase. There are more poachers than Mouflon in Cyprus; but in some of the other Mediterranean Islands Mouflon are more abundant. When in Cyprus, I had the good fortune to see the one Mouflon herd there. I am informed that the Mouflon has not been introduced to Australia.

The introduction of valuable game animals and birds to Australia naturally demands care and organisation, and, within my experience, particularly the care of the Forester living in the forest. He alone is able properly to look after them, allowing them gradually to run wild where conditions are favourable, and to keep a hand on them afterwards against poachers and natural enemies until they are strong enough to hold their own. Game in Australian forests, like fire-protection, seems to demand a resident Forester. With him the work goes forward automatically; without him it seems an expensive and doubtful business.

127.—*Game under a large organisation produces large revenue.*

In European Continental forests the revenue from game is considerable. There are forests in which it exceeds the revenue from timber, and in nearly every forest it is an important part of the forest revenue. There is no general game preservation as in England, and often the only game in the country is in the forests. And game preservation has this feature: on a small area it is difficult and costly; on a large area easy. In this respect it resembles fire-protection, which must be worked on a large scale and be general in its nature to be economical. From a Government forest point of view the game protection costs nothing, and is a very valuable source of forest revenue.

Game resembles fire-protection again in the fact that it is the cultivated forest, intersected by broad grassed fire-paths and fire-lines generally, which favours the production and shooting of game. The damage done by deer in New Zealand would probably be less if the animals had as their grazing grounds the broad lines of the organised forest. In France it is along these broad lines that the real hunting of deer and the shooting of pheasants and partridges takes place. In England such lines are made solely for pheasant "drives." It will certainly happen in Australia that the organisation of the forest with roads and broad grassed fire-paths will prove favourable to the feeding and shooting of game.

Sportsmen tell me that bush-fires have had most to do with the failure of partridge, pheasants and other game in Australian forests; more, in fact, than vermin.

It is noticed (p. 94) in connection with Tourism, how the beauty of the Australian forest is marred by fires, and undeveloped by the want of softwood and pine planting and paths. To this must be added game. No European scene is complete without the herd of deer. No forest, as one understands it in Europe, is complete without the life of the forest, the beauty and joy of game to men, and even many women. It is common knowledge that in countries where game abounds men devote their lives to the study and pursuit of game. One must live as a country gentleman in England to appreciate this. These, the monied and leisure class, are the people whom Australia is trying to attract as tourists. The first question that at least half of these ask in England when a tour is projected to a new country is this:—"What is there to shoot"? A man is not going to come to Australia to shoot rabbits; but tell him there are deer, wild boar, and Mouflon, with facilities for living

in and getting about in the forests, a South European climate, and no language trouble, he will overhaul his rifles and write to T. Cook & Son. I was advised to sell my guns before coming to Australia, and am glad I did so.

128.—*Organised Forestry restricts or destroys rabbits and vermin.*

One reason why rabbits have obtained their rapid advance in Australia, even in suburban districts, is that they offer so little sport. Sportsmen soon tire of shooting rabbits alone. But with other game in view, the man with a gun wanders farther afield, and with a gun in his hand rabbits and other vermin that come in his way are shot. Thus a Europeon game bag usually counts so much game with the addition of so many rabbits. And the rabbits will often go far to repay the cost of the game.

In this connection one may recall the trouble that is taken over game preservation in England. I know a fair-sized forest estate in Oxfordshire, the remains of one of the State forests of England, where £60,000 is said to be spent yearly on game preservation, mostly pheasant breeding. The general expensiveness of game-preservation in England is well expressed in the common gamekeeper's tag:—"Up gets a sovereign, bang goes a penny, down comes half-a-crown"; meaning, that the average cost of rearing pheasants works out at about a sovereign, a cartridge costs about a penny, and the value of the bird when sent to the poulterers is half-a-crown.

It will be said that all this has long been known and practised in Australia. That is very true, but the means of carrying game preservation to a successful conclusion has been wanting with the absence of forest organisation. With forest organisation there will be some chance of game becoming as plentiful in Australian forests as vermin of all sorts is at present. There is no reasonable doubt that with the Forester walking about on most days of the year with the gun which every Forester loves to carry as a matter of duty and privilege, vermin will be got rid of from Australian forests, as it is got rid of in England; and with the control of vermin and forest fires, game introduction will at last become a success in Australian forests.

In the forest of Dean, England's one good State forest, rabbits have been entirely got rid of.

Division II.

PRACTICAL FORESTRY.

CHAPTER I.

Forest Working and Management.

129.—*"Working Plans" essential to secure continuity of system and to avoid repetition of errors.*

As soon as forests came to be worked systematically in Europe, it was seen that a "Working-plan," or scheme of management for a term of years was necessary in order to secure continuity of management. With the development of scientific forestry "Working-plans" became more minute in detail, and in some of the older forests of Europe they have become so detailed and elaborated that it may be doubted whether they are always quite worth the cost and expense involved in framing them, or of working minutely to them. Some of the German "Working plans" require a knowledge of the higher mathematics to follow them! It may be questioned whether the super-structure has not over-grown the foundation! But a "Working-plan" of some sort is necessary for every forest that is systematically managed. The history part, for instance, is the only guarantee against a repetition of errors in management. One must remember that the life of a man is as nothing compared to the life of a forest.

It should be recognised that the making of Working-plans is the most important part of early forest management. Every Forest Department in Australia should have a "Working-plan" Branch, for this purpose. For new countries, the Working-plans are of a simple nature, their chief part at first being writing up the historical chapter. Foresters owe it as a sacred duty to their successors, to leave a record of what has happened in each separate forest unit. Here photos. are useful. There should be photography as well as map-drawing in every Working-plans office. Be this as it may, a "Working-plan," more or less detailed, is an essential feature in every economically worked forest.

Mr. Mackay, the Victorian Conservator, has remarked very truly:—

> In the utilisation of our principal reserves, it would obviously be a mistake to introduce elaborate " Working plans " according to the methods in vogue in older countries like France and Germany.—(Royal Commission on Forestry, Victoria.)

It is certain that in India the first Working-plans prepared were unnecessarily complex. They were very soon replaced by much simpler plans, more suited

to the generally poor quality of the forest and the backward state of the country. The United States of America, Russia, and Japan have large areas of wild forest which are gradually, by means of Working-plans, being got into the position of more productive cultivated forests.

130.—*Contrast between Russian and Australian Working Plans.*

Russia, like Australia, has a large area of wild forest to deal with; it will be useful, therefore, to see how Russia takes this situation. The area of Russian forests in Europe and Asia is about two million square miles, that is to say, about the area of all Australia, less Western Australia. Russia derives £9,500,000 revenue from its forests, and this revenue is rising largely as the forests are being opened up, and those previously inaccessible rendered workable. Russia exports 26 million pounds worth of timber, of which nearly one-half goes to England. Let us see now how Russia manages the part of this huge forest area that is accessible and being worked.

The Russian Forest Department has 32,000 subordinates, 1,400 superior officers, and 3,022 officers of intermediate grade. *Of these* 1,400 *superior officers, more than half, that is to say* 800, *are engaged on making or revising "Working-plans"*!

This may be contrasted with Australia, where with only a small fraction of the Russian forest area, and one comparatively quite easily dealt with, it is only in Victoria and South Australia that any attempt at making regular Working-plans has been made. Victoria has Working-plans regulating the yield. This, in Australia, is usually not the first point calling for attention.

131.—*Official Working Plans for private forests in the United States.*

In the United States, almost as soon as the Federal Forest Department began, there was established a Working-plan Branch, and Working-plans were made for private, as well as for Government forests. Some of these American Working-plans form most interesting studies. I may mention one as a particularly useful study for Australian Foresters, viz., a Working-plan for a forest on the dry side (Texas) of the habitat of the best of the Pitch-pines (*Pinus palustris synaustralis*).

132.—*Japan has* 5,000 *Working-plans for* 5,000 *square miles of forest.*

The Japanese who, as a progressive civilised State, started long after the founding of Australia, though they have comparatively a larger forest area than Australia, started modern Forestry as soon as they became a powerful modern nation. They sent a Forest Commission abroad to study the World's Forestry, and promptly started getting their own wild forests into order. Forest demarcation, surveys, and Working-plans began in 1890. By 1912 they had some 5,000 Working-plans completed, covering some three million acres, or an average of about one separate Working-plan for each square mile of forest! Japan has, from Formosa to Saghalien, a greater range of climates than Australia and much more varied forests, thus requiring more diverse and detailed Forest Working-plans.

133.—*Character of Working Plan required for Australia.*

For some of the Eastern States of Australia, particularly Victoria, simple preliminary Working-plans have already been made. For Australian forests generally, it will be necessary in the first instance to prepare only short, simple Working-plans for each class of forest, with details varying for each individual forest,

or homogeneous forest unit. Certain features of these Working-plans may be mentioned here.

The general aim will be to clear off the matured timber and *regularize* the forests by graduated cutting of the marketable timber. A regular even-aged forest is more valuable than an irregular forest, because the timber being of the same age has a more regular growth, and because there is then one age class of timber for one locality. In a regular forest a miller will find more timber to work in one place, the working will be more economical, and the profits to Government and the miller larger. With the regularisation of the forest there comes necessarily a gradation of ages. Thus, in one area of forest the timber will all be of an age to be worked through, say, in 10 years. During this 10 years, this portion of the forest will be cut over, and at the same time, regenerated. If a fire is wanted to bring up the undergrowth, a fire, under control, will be put in. When the regeneration of the forest has been secured, the regrowth will be protected from fire and from grazing. If, in any part of the area the natural reproduction is insufficient, it will be supplemented by planting, or sowing seed. If there is any valuable exotic to be introduced here then is the time when it should be sown or planted. It is in this part of the forest that are concentrated both the work of the forester and the work of the miller, that renders them both more effective than if they were spread over a wide area as is the case, more or less, in the virgin forest. In short, each portion of the forest is opened and closed successively; opened for the working and regeneration of the forests, closed for the up-growth of the timber.

The closing of the forest for a period of rest is usually the first step that is taken in any scheme of forest *conservation*. Commonly, this is quite well done in Australia; a mill is put in, the mature timber cleared off, and the forest closed for regrowth.

134.—*Catastrophe to Forest Management: The "Settler's" invasion.*

The catastrophe comes when, for purposes of settlement, the forest is thrown open without the forest having been previously demarcated. This is the leap in the dark! This is the fatal mistake!! The selector is liable to get ground so heavily timbered that it will not pay to clear; or he may get forest to pick over and destroy under the pretext of settlement! In any case, the forest goes to the wall. The settler may be wrongly placed, but there he is. It is no blame to him if he makes the best of the situation, the blame rests entirely with those who, when the country was surveyed for settlement, failed to previously demarcate out the forest.

It should be remembered, therefore, that economically the position is quite sound up to the time when the mill, cutting under supervision, clears off the mature timber, and the Forest Department regulates fire and grazing so that the area is left with a good crop of self-sown seedlings.

135.—*Choice of the felling-system to be adopted.*

In an irregular forest the first workings of timber only above a certain girth, are known as "Selection" or "Jardinage" fellings. It is often advisable to avoid completely uncovering the ground, and to effect the regeneration of the forest, by these partial fellings. In cold countries foresters have to be very careful about uncovering the ground. And frequently in the extra-tropics forests of the dense evergreen class must be kept under selection fellings.

Generally, in the extra-tropics, and probably always in Eucalypt forests, a clean felling and a complete regeneration are to be preferred. This is the case with the chief forest species in Southern Portugal—the Cluster-pine. It is the case with the Eucalypt forests of Australia. I found that on this point my experience

of Eucalypt plantations in South Africa coincided with the views of forest officers in Australia, viz., the desirability of clean-felling. In such case the "Working-plan" of the Eucalypt forest becomes simplified. Either (1) the "Selection fellings" will be practised over a gradually extending period until the "rotation of conversion" comes to equal the "final rotation" of the forest; in other words, the close period in each portion of the forest will be gradually extended, until the close period (with the exception of thinnings) comes to equal the total period of the life of the trees to the best timber age. Or (2) the forest will be straight away clean-felled in sections.

136.—*Fixing the period of "Forest-rotation."*

It will be asked what should be the close period or "rotation" to begin with? In South Africa this was fixed by Count de Vasselot, the eminent French forester, at 40 years. There were practical disadvantages, however, in having the period so long at first, in that certain portions of the forest had to wait too long a time before they came under working, and during this time the mature timber represented an idle capital. I was, therefore, able to convince the Minister later that the period of 40 years should be shortened to 20 years, and this was done.

137.—*Thinning, in relation to Forest and to Forest Plantations.*

From what has been said elsewhere and here, it will be gathered that very little thinning, *per se*, is required in Australian forests. Speaking generally, the forest wants filling up with trees, not thinning. I only know of very restricted areas requiring thinning, such as certain strips of Eucalypt forests that have been burnt once, and escaped subsequent fires. There is also the case of thinning Cypress-pine where, if not thinned, the pine becomes stunted and shows little growth. The so-called improvement thinnings, or "cleaning-up" are discussed separately (*see* p. 317). It would be useless here to indicate any general rules for thinning; it is a matter which must be left to the forester's training, it is not one which can be learned from books.

In Australia, on account of the dearness of labour, a special feature is introduced in the plantation which has to be foreseen in forming them. Usually in a plantation or well stocked forest, there come one or two thinnings which are classed as unremunerative, the product of the thinnings not being enough to pay for the cost of thinning. With the high cost of labour in Australia these unremunerative thinnings may become a serious matter; so that in laying out a plantation one has to put in the trees wider than would be demanded by good forestry.

It therefore becomes necessary to adopt a medium course; planting sufficiently sparsely to avoid much expenditure in the early thinnings, but close enough to avoid having too knotty and coarse timber. There have been plantations in South Africa and in New Zealand planted closely according to the best rules of good forestry which have cost £10 an acre to thin, thus more than doubling the first cost of planting.

138.—*Sustaining the yield; White ants and "piped" trees.*

Perhaps the most important part of the average European Working-plan is the calculation of the yield and the measures taken to secure a sustained yield.

It is important for economical reasons to have a sustained yield. A quantity of timber thrown on the market, at one time, means a loss of value for even marketable timber, and it may easily become unmarketable. On the other hand, if the supply of timber fails, the factories and employment dependent on it are thrown out of work.

In newer countries, however, the sustained yield is not so important, since industries have not yet got into grooves; and, in virgin forests, there may be large stocks of over-mature timber which, if not turned into money, will go to decay and be worthless. This is the case to a considerable extent in the indigenous forests of South Africa. It is the case to a much greater extent in the larger virgin forests of Australia. Thus, in arranging the "Working-plans" of most Australian forests, the first consideration is not so much a sustained yield as the realisation of the huge stocks of over-mature timber going rapidly to decay. In Australia so far, little more than this timber has been worked. This thoroughly mature timber is of first-rate quality, but difficult and expensive to work, on account of its unsoundness, and the sparseness of its occurrence. In all the white-ant country it is almost always badly piped, and white-ants come further south in Australia than in Africa.

And there is such a huge gap between the present state of the forests and what the forest might be after fire-protection and regularisation, that provision for the sustained yield, though of course it cannot be omitted, comes to be considered only in a general sense, and as subsidiary to the more important consideration of turning to account the huge accumulation of over-mature timber in the virgin forest.

139.—*Laying out "Coupes" or Yearly Cutting Areas.*

General Scheme of Management.—While the details of the forest Working-plans will vary with the locality, the board lines on which they will be framed are well established.

Wherever arrangements can be made for working a forest, either by saw-millers, sleeper-hewers, splitters, pit-sawyers, or Government agency, the area should be marked off and yearly coupes or felling areas laid out; the marking, of course, being done by the Forest official, with his prismatic compass or plane-table. Expensive surveys are out of the question. Coupes, or cutting areas, will be arranged for one or two years in advance of requirements, and the "exploitable" or fellable timber in that coupe may have to be marked for felling, according to the class of timber that the buyer will take or according to the Working-plan of the forest.

The marking of the timber to be felled in those forests where there is not clean-cutting, is a matter of the first importance. *It is the man who marks the timber for felling who is at the foundation of all systematic forestry*, and on his judgment and industry a great deal depends. He has frequently to hold the balance between what is best for the future of the forest and the timber wanted for cutting. Happily, a coupe in a Eucalypt forest is usually a simpler matter. It is not like that in an evergreen forest, where it would be dangerous to uncover the ground. As with the Cluster-pine and other light demanding trees, the best treatment is a "clean-cutting," and if the saw-miller will engage to take all the trees that will be the best thing in two ways: (1) It will save the trouble and expense of having the fellable trees previously marked by the Forest Department; (2) It will obtain a regular regrowth for the forest at once. Where the saw-miller is willing to take the whole of the "Coupe" or "Section" of forest, he should be encouraged to do so, by a lower rate of royalty.

140.—*Burning-over "Coupes" after cutting.*

As soon as the saw-miller has his "Coupe" worked out thoroughly (and the more rapidly he does so the better), it should be burnt over, if that is necessary for regeneration, and then be very carefully fire-protected and closed against trespassers of all sorts. This special care will only be required for a few years. As

the forest grows up close it will kill down the undergrowth and protect itself from fire to a great extent; it will certainly get out of reach of harm by cattle. In the regular Eucalypt plantations of South Africa the forest becomes practically safe from fire as soon as it has "closed," and it remains so for 20 or 30 years longer. Cattle, after the forest has grown up dense and above reach of damage from grazing animals, will do no harm, and often much good in helping to brush off the side branches and keep the soil clean against forest fires.

A general sketch of systematic forest management is necessary in order to make quite clear my notes regarding certain points of forest management that have come under observation in the course of my tours through Australian forests.

141.—*Regularising the Irregular Forest.*

I have been frequently asked in Australia, "What is the use of Working-plans; what is gained practically by having them?" The question is natural to those who are only acquainted with the poor fire-swept forests of Australia. The actual answer to the question is to convert the forest from a poorly stocked, irregular forest (usually one-third or one-quarter stocked) to a much more valuable fully-stocked, regular forest. Why a regular forest? Because (1) the regular forest will produce a much larger quantity of timber; (2) timber of a better shape with less waste at the mill and easier to haul and work at the mill; (3) timber of better quality. Being more evenly grown it will be more regular in the grain and will season better, being grown in a dense forest, it will be straight and free from knots.

There need be little of the irregular forest in Australia. Shade-loving trees, like those of the indigenous forest of South Africa, or the Cedar and other "brush" timbers of East Australia are liable to die when isolated. They can only gradually be got into the condition of regular forest. Not so the Eucalypt forest. The way to get it regular is easy—clean felling, or nearly so. Irregular forest will have to subsist for a time (1) in forest too inaccessible to work except by splitters and pit-sawyers; (2) cluster forest on ridges or steep ground. Elsewhere irregular forest can easily be got rid of.

142.—*Systems of "Forest-regenerating."*

Regeneration in groups.—The treatment of the Black Forest of Germany (perhaps the best known cultivated forest in the world), is regeneration in groups. The treatment of the Australian forests will be regeneration in groups for many years, viz., the cuttings working gradually to a general regularisation in the better forest and, in the drier forest, working into groups of good, dense forest in a grazing area.

143.—*"Clear-cutting" and "Burning-over" advisable for Eucalypt Forest.*

My experience with small areas of Eucalypts in South Africa coincides with what appears to be the general opinion of forest officers in Australia, that for the Eucalypts the ideal system is "clear-cutting," and burning if necessary for a good stock of seedling regrowth. I shall refer to fire later. The difficulty with clear-cutting lies in getting it done. There was the same difficulty at first in the felling "Sections" of the indigenous forest of South Africa. The timber-workers had been used to roam over the forest and pick any tree they wanted. To get them to work out the marked sections completely special low rates were given. These difficulties gradually passed away.

144.—*"Selection-fellings" in Virgin Forest; a critical question.*

Mr. Dalrymple Hay, the New South Wales Conservator, and who was President of the first inter-State Conference on Forestry at Sydney, said:—

We are trying here to bring about clear-cutting. We think that is the most effective way to bring about regeneration, and the after-effect is an even-aged forest. Our aim is to bring that about if we possibly can. We open a "Section" or "Compartment" of a forest. First of all we try to get all the timber taken from it that is suitable for sawmill purposes; when the saw-miller has removed all the timber he requires, we allow the sleeper-getter to go into the section or compartment; then, after he has finished, we try to have the remaining timber worked-up for such minor purposes as spokes and fencing material. After that stage, the State steps in and improves the area for regeneration, and closes it from future operation.

When in New South Wales I was shown some interesting natural regeneration in the Eucalypt forest a few miles from Wyong. There have been fellings there, and in places where old trees have been left the Forest Department girdles them and afterwards burns them. The general result is that there are now five or six times the number of stems per acre (the forester's estimate is about 10), that there were in the virgin forest. There is certainly now an over-stocking since many of the re-shoots are visibly dominated. The whole work seems quite successful. It is unfortunate that it has not been applied generally in New South Wales. It is applied in certain forests in New South Wales and then goes by the misleading name of "reafforesting"; a clumsy word, which is generally used as the equivalent of re-foresting or *restoring* the forest, *where it once existed.* The work in New South Wales is nothing more than the forester's routine work—a regeneration cutting.

Mr. Mackay, the Conservator of Forests, Victoria, said at the Conference in Sydney, and used almost the same words in the British Association's Victorian Hand-book:—

The simplest and best forms of management for adaptation, but not adoption, in Australia, are, I think—(1) Clear-felling; (2) Modified selection; (3) For young forest coppice with standard, or a modification of the Shelter-wood compartment system; (4) Simple coppice, or the clear-felling of pole timber.

Again, he says:—

While close natural growth is essential with most Eucalypts, up to a point where they attain a fair standard length of bole, trees such as Ironbark and Box flourish best in open order, and should not at any stage be overcrowded. . . . . In the vicinity of large gold-mining centres, where the demand for props and engine fuel is very heavy, the rotation fixed for the coppice is from 18 to 25 years.

Here the original Eucalypt forest was cut for mining. The regrowth of Eucalypt copse is now worked in compartments, about 20 acres in extent. Mr. Mackay adds:—

Every tree to be felled is first marked by the Forester, except in the case of badly burnt or diseased areas, where he marks the trees to be reserved. The compartments are open for cutting during the winter months from the 1st of April to the 30th of September.

Where the miller will only take trees of a certain class or where it is only possible to obtain the working of one class of timber, such as hewn-sleepers, the clear-felled coupe becomes impossible and all that can be done is to regularise, as far as possible, the selection fellings. Thus, the gradual regularisation of the forest is brought about by the dividing up of the forest roughly into felling areas, and going over these in succession at intervals from 10 to 20 years. In a Eucalypt forest where there is no danger of uncovering the ground, the longer the rotation the better. In other forests or in Eucalypt forests where, for special reasons, it may not be desirable to have the ground much cleared at any time, the rotations must be chosen shorter, and, as a consequence, the felling areas larger.

145.—*Clear-fellings would be fatal to the Brush Forest of East Australia.*

In a forest such as the indigenous forest of South Africa, or in the "brush" forests of Australia, where the trees do not flourish away from the shade and shelter of the forest, the forester has to go to work very carefully with the fellings. The clear-fellings of the Eucalypt forest of Australia or of the Cluster-pine forests of South-West Europe would be a fatal error here. If too much is removed at one time and the forest is too much opened out, many evils are caused which it is not necessary now to enumerate. In such a forest and in each felling area, the trees to be removed must be carefully marked previously by the Forest Department. This is a long and tedious business under an African or Australian sun in summer; for the coupe is generally got ready in summer for the felling in winter. A good description of working of this class of forest is given in a work of great interest, which should be in the library of every forest office in Australia, the "Forest Flora of Cape Colony," by T. Simm. Mr. Simm's book is singularly complete, both as regards its Botany and Forestry; its author is one of the ablest men the Cape Forest service has produced during the last quarter of a century. This book would be particularly useful to forest officers such as those in New South Wales and Queensland who have the "brush" forest to manage, and even in Victoria and Tasmania there are patches of dense forest where the treatment required is that which has been followed in South Africa since 1883, and which I hope to see adopted generally in New Zealand.

CHAPTER II.

The Improvement of Western Australian Forests by Interplanting Exotic Trees.

JARRAH (*Eucalyptus marginata*).

146.—*The Jarrah Forest as viewed by a Forester.*

The following note of the general character of the Jarrah forest as it first strikes a visiting Forester, is perhaps of sufficient interest to be reproduced:—

The Jarrah forest is open, so much so as to be generally traversable in any direction, on foot, or on horseback, without paths. The only undergrowth is a sprinkling of young Eucalypts, with some shrubby little Acacias, Banksias, and "Blackboy" trees. They are said to be more species of Acacias than of Eucalypts in the forest. There is a thin coarse wire-like grass, long enough to burn once in three or four years. The trees average 40 to 60 feet high, with big Jarrah sprinkled through the forest, running up to 80 or 90 feet. In the better forest, nearer the coast, the trees are smaller, and there is more undergrowth. The biggest Jarrah tree known to Mr. Kelly, at the Kirupp mills, is eight feet in diameter at the butt, 95 feet bole, with some 50 feet of crown, say 145 feet total height. It is estimated to yield 1,900 cubic feet of merchantable timber. It is a well-known tree, standing uncut near the Mangerbrook mill, Yarloop.

Jarrah Virgin Forest: Collie District, W.A.

147.—*The Jarrah as a timber tree.*

Jarrah is the most important timber of Western Australia on account of its abundance, its fair-seasoning and working qualities, and its good durability. It is *the* sleeper-timber of Australia, and a very large part of the Jarrah forests will only yield sleepers. It is true that poles can be got from the Jarrah forest; but I have not seen nor heard of any part of the Jarrah forest where poles could be cut with due regard to the future of the forest. The Jarrah forest is almost always very much too sparse and open, the result of forest fires; and, in the accessible parts, the not sufficiently regulated fellings. The cutting of poles in the Jarrah forests in their present state should receive the fullest attention in the Working-plans.

Outside Australia, and by those in Australia who have a general knowledge of Australian timbers, Jarrah, as a general utility hardwood, is accorded the premier place. Among Eucalypts it is probably not quite as durable as Ironbark and Tallow-wood, or possibly Murray Red-gum. It is not, in my view, such a handsome furniture wood as "Tasmanian Oak." But it is undoubtedly a good furniture wood; it is sufficiently durable for nearly every purpose, and as an easy-working and good seasoning hardwood is unsurpassed as an Eucalypt. Its exact position as a timber is discussed at p. 227.

Jarrah, compared to Karri, offers a sharp contrast. The Jarrah forest, like most of the Eucalypt forests, is liable to be burnt every two or three years, and its regrowth is not nearly so abundant or strong or rapid as Karri. Karri is usually found on good soil, Jarrah on poor.

To a certain extent, the comparative soil requirements of Karri and Jarrah are indicated in their ash. Jarrah burns like a strip of newspaper, leaving little ash; Karri, on the other hand, yields large quantities of white ash which I refer to elsewhere.

148.—*Jarrah timber as Railway sleepers.*

The greater part of the Jarrah forest, especially that which one sees from the railway, is more suited to supply sleepers than any other timber product. The Jarrah sleeper is so good that it is not surprising we find it now in every part of the world; but particularly in the Southern Hemisphere. A million Jarrah sleepers went to South Africa in 1913. Says "Timbers of Western Australia, 1908":—

> Jarrah sleepers average only 4 per cent. renewals in 18 years, and 95 per cent. of these are not due to decay. This is 50 per cent. to 100 per cent. better than the ordinary hardwood sleepers of Tasmania. Cracks usually run in about 9in.; these do not matter, but the sleepers must be covered with ballast to stop the cracks extending. White ants eat Jarrah slightly only.

This also was the general experience with regard to Jarrah sleepers which I saw used in a dry part of the country in Equatorial Africa.

There is, indeed, a huge area of forest in Western Australia with ill-shapen Jarrah timber that is only useful for sleepers. I recommend that as a matter of economy, a proportion of these crooked sleepers should be brought into use for railway purposes at once. They may not look so well as a straight sawn or hewn sleeper, but they would really be equally serviceable. The useful Queensland sleepers are referred to at p. 292).

It is a misfortune that when there was so large an area of "Jam" country, the straight pieces of that very durable wood were not picked out for sleepers, instead of being burnt by the settlers.

149.—*The measures necessary for improving the Jarrah Forest.*

In the treatment of the Jarrah forest, the following four measures seem called for:—

1. The problem is to fill up the sparse Jarrah forest with the stock of timber that the rainfall fits it to carry; and so improve the yield, and straighten up the too often crooked Jarrah. Pines naturally suggest themselves for this purpose, and they are particularly wanted for there is no softwood in the forests of Western Australia. They make the least demand on subsoil moisture, they are naturally straight-growing trees, and straighten other trees growing with them. Pines and Eucalypts grow naturally well together (p. 82). Before going to the expense of plantations, pine-growing should be tried, with any kind of cheap pine seed available. In this climate in South Africa, a mixture of Cluster-pine and Canary-pine is used for pine-sowings. Here, in the Jarrah forest, strips might be sowed or raked in so as to test (1) the growth of the pines against the native weeds, and (2) the spread afterwards of the pines self-sown into the half-empty forest round. This would be followed by some small seedling planting, in broad strips, of Insignis, Muricata, Taeda, Australis, Mitis, Thunbergii, or other selected pines.

Should the native vegetation prove too strong for the young pine trees so produced, even with some help from hoeing, it would be necessary to proceed with planting in the ordinary way, using large strong nursery plants and weeding, but this would naturally be more expensive. Whatever happens, enough pine strips should be sown or planted, in each class of forest, to thoroughly test the growth of various pines under the conditions. This is really a sacred duty to posteri y!

2. Fire-protect as much forest as possible, but in any case protect these test forests. The results would be full of interest. There would be the growth of the pines in the virgin forest where they are so much wanted, and with fire-protection a denser growth of Jarrah.

3. Get large Forest demarcation parties into the field to demarcate all doubtful forest boundaries without delay.

4. In the fire-protected forest, on selected deep damp soil plant some experimental broad strips of the more valuable Conifers—*Cupressus lusitanica; Cup. macrocarpa; Deodar* (there is a fine young tree at Mr. Brockman's), *Sequoia sempervirens; Quercus lusitanica,* and some of the other Portuguese Oaks *Quercus lusitanica,* under the name of *Q. Hodgkinsoni,* is growing well in the Jarrah country in several places. Other trees suitable for this work are mentioned at page 379. This special planting would be specially protected, apart from the general fire-protection of the forest.

The "slipping" or hauling is now nearly all done with horses. They say it was formerly cattle, and that one is as good as the other. Grassed areas and good grazing for cattle should cheapen the working. I have referred elsewhere to the economical German cows we saw used in the Black Forest, but for the hardest work in hauling timber and the easiest animals to keep in condition, the tame buffaloes of Southern Europe should be imported (p. 116).

150.—*Demarcation urgently necessary, as replanting Jarrah Forest is impracticable.*

The general position with regard to the Jarrah forest may be summed up as *aut demarcation aut nullus,* for it will never be practicable to replant Jarrah. This is the experience in every part of the world where Jarrah planting has been tried, South Australia, South Africa, South America, and California. If Western Australia is to preserve its present production of about £1,000,000 worth of Jarrah

timber yearly and double this in the early future, from the improved Jarrah forests, it is only careful demarcation now that will do it. Planting is out of the question.

151.—*Jarrah timber the most valuable crop Jarrah Forest lands will ever produce.*

And what has to be clearly remembered is that the Jarrah forest, as Jarrah forest, is worth more to the country than anything else. The position is not to clear the forest for "population and progress," but to demarcate and improve the forest for "population and progress." Generally speaking, the Jarrah forest is on poor soil, nearly useless for agriculture, and certainly not worth clearing and grassing. I was shown forest of Jarrah, and of the Red-gum valleys intersecting it, that it would cost from £15 to £20 an acre to clear and grass. A selector gets 160 acres on which often he cannot live. A South European peasant could perhaps scarcely live on some of the poor Jarrah country, while as a good Jarrah forest, filled up with pine, the produce of timber on 160 acres would go far towards supporting, if it would not entirely support, one family, while goat-grazing (p. 60) and forest work would support another. If the Jarrah forest were filled up with Cluster-pine, as suggested below, the district would have one of the best rural populations in Australia, living on the turpentine industry.

The Red-gum valleys (*Euc. calophylla*) on good soil require very careful demarcation to separate out areas for settlement, and areas best suited for forest requirements, viz., grazing for the cattle employed in working the forest, permanent fire-breaks of densely-growing trees, soil for trees of special value which will only grow in such localities, cultivable areas for the forest nurseries, and cultivable areas for the forest workmen and their families.

Thus the Working-plans for the Jarrah forest will have as their object the conversion of a wild, irregular, and very poor natural forest, to one of great economic value, by regularisation, fire-protection, and filling up with introduced pine trees.

It must be remembered that the Jarrah forest, as at present existing, is only an indication of what it will be when regularised and fire-protected, and, far better still, filled up with pine. By the kindness of Millar's Company, when on my interesting tour with Mr. Brockman, I saw some first-rate Jarrah forest in the Kirupp district carrying from 600 to 3,500 cubic feet of merchantable timber per acre, but average Jarrah forest, taking it through, does not average more than 200 cubic feet per acre in two good marketable trees. This is a low stand, characteristic of the poorest class of forest (p. 102).

152.—*The Jarrah Forest wants filling up with conifers.*

I have treated elsewhere the general question of planting of Conifers (p. 106) It only remains to offer here, under Forest management, certain recommendations regarding the filling up of the Eucalypt and particularly the Jarrah forest.

First, as regards the question, is it worth doing? The Jarrah forest itself, with fire-protection, will be a greatly improved asset to the State by supporting a larger population. But if the Jarrah forest could be filled up with Cluster-pine it would support a very much denser population, in fact an industrial population of the best type, a population living on a rural industry.

153.—*The climate of the Jarrah Forest will suit the Cluster-pine.*

The facts regarding the Turpentine and Resin industry of the Cluster-pine* in Gascony are well known. What is not always appreciated at its full significance is that the forest that supports this industry is all artificial. There was a little

**Pinus pinaster* syn *maritima.*

Cluster-pine on the Landes in Roman times. That got destroyed in the dark ages. All we see now is pine planted or sown, and the traveller takes nearly a day's journey in a train to pass through it: From Bordeaux to Bayonne is nearly 100 miles. The farming industry, the timber industry, the resin and turpentine industry, the whole wealth of a now prosperous French province, is built up on Cluster-pine (p. 259). Huffel, the French forestry writer, has estimated the cost of planting and road-making since 1855 at upwards of £2,000,000, and the present value of the pine forests formed at £18,000,000. These forests, in timber, turpentine, and resin, yield over £500,000 yearly, or at the rate of seven shillings per acre.

To me came the fortunate accident of making a tour through the Cluster-pine forests of Gascony, and in a few months making a similar tour through the Jarrah forests of Western Australia. I was thus, at once, and without disturbing impressions, able to lay my views of the two side by side, and see what Cluster-pine might mean in the Jarrah forests of Western Australia. The climate in the Western Australian Jarrah forests is sufficiently similar to that of Southern France, but *more favourable to Cluster-pine.* It is, in fact, the exact climate of Leiria in Portugal, where I saw the Cluster-pine at its best! Like the Landes of Gascony, a large portion of the soil in the Jarrah forests of Western Australia is of a poor hungry type, closely resembling the poor sandy soils of Gascony, on whose poor hungry soils, where for centuries there was nothing but a thin population of shepherds tending sheep, there is now a dense industrial population supplying the world with the products of the Cluster-pine tree!

The world gets its turpentine and resin from two sources, the wild forest of the Gulf States of the United States of America, and the cultivated forest of Gascony. The Portuguese do little resin production, but produce a better timber. The Cluster-pine, north of Lisbon, is on the same poor soil as the Landes of Gascony. Both Gascons and Portuguese do an enormous pit-prop business with England.

154.—*The light in the Jarrah Forest is ample for Pine growth.*

But against the introduction of Cluster-pine to the Jarrah forests of Western Australia the forest expert will immediately bring forward the fact that to fill up the existing Jarrah forest, the ideal species should be a shade-bearer. Even in so open a forest as the Jarrah forest it would be preferable.

To this objection there is a fairly good answer. One hears a great deal of the light-demanding qualities of Cluster-pine in France. It is an axiom amongst French forest officers in Gascony that it is hardly possible to give the Cluster-pine too much light; and it must be remembered that the accounts, in English, regarding the strong light-demanding nature of the Cluster-pine, have been derived entirely from French accounts of its cultivation in Gascony, and from English foresters who have toured there.

When one gets to the more ample sun of Southern Portugal, in the same latitude as Western Australia, one hears a great deal less about the strong light-demanding constitution of the Cluster-pine! As I have mentioned elsewhere in this discussion, and more fully in my paper read before the British Association, "Extra-tropical Forestry in Portugal," the Portuguese forests at Leiria grow Cluster-pine practically as closely, and produce timber as clean and straight as one sees in the best pine forests of central Europe. The timber tree of the State forest of Leiria is like another tree when compared with the sparsely-grown branching tree in Gascony. I have already mentioned another point, and I may, on account of its importance refer again to it here; it is seed from the Portuguese forests that should be obtained, not seed from the comparatively stunted and crooked trees which occur on the Landes of Gascony. At the time of my visit the

Portuguese Forest Department professed its ability to supply Portuguese seed at prices no higher than the Landes seed, and I have the same assurance from business men in the Portuguese Cluster-pine country who are engaged in the timber and pit-prop trade with England.

155.—*The Cluster-pine recommended for interplanting with Jarrah*

I place Cluster-pine as the first species to plant in the Jarrah forests of Western Australia for these three reasons:—

(1.) Western Australia wants population. In the Landes of France and in the Leiria country, North of Lisbon, one sees large rural populations living on Cluster-pine. The Landes resin and turpentine industry is too well known to make it necessary to give any reproduction of the facts here. Australia, as I have mentioned in "Statistics," is now paying £60,000 per year for imported turpentine and resin. There is no part of Australia where Cluster-pine is more exactly fitted to its own climate and soil than it would be in the Jarrah forests of Western Australia. The same tree that supports about a million inhabitants in Gascony on the turpentine and resin industry, and some half million in Portugal on the Cluster-pine timber industry, will support similar large populations in Western Australia. It may be said that the same industry which would support two families in Southern France and Portugal would only support one in Western Australia on account of the higher wages and higher standard of living. That is true, but it must also be remembered that filling up the Jarrah forest with Cluster-pine is adding the lucrative Cluster-pine industry to the already lucrative Jarrah timber industry, and at the same time greatly improving the quantity and quality of the Jarrah timber!

(2.) The second reason for selecting Cluster-pine for filling up the Jarrah forest is that it is the only seed which can be obtained commercially in abundance at a cheap rate. South Africa has been importing it by tons for many years. There is plenty of South African seed naturally, but labour near Cape Town is higher than in Gascony, and the women and children in France are stronger and better workers than in South Africa. The price of French seed varies, but I have bought it at as low a rate as 2d. per lb. It is a regular article of commerce in France, and is exported in sacks like wheat. I know of no other Pine seed which can be bought at any price approaching this.

(3.) There is little risk in immediately starting away with Cluster-pine (Maritime-pine) planted on a large scale. In climate and soil the Jarrah country of Western Australia repeats the climate and soil of the South-West districts of the Cape Province of South Africa, where, indeed, Jarrah grows as well when planted as it does in Western Australian forests. In South Africa the Cluster pine has been flourishing without a check for the last 300 years. The old records of the Dutch East Africa Company show that some 300 years ago Cluster-pine flourished on the shores of Table Bay, as it does to-day on the sandy soils and poor ironstone and gravelly country of the South-West of the Cape Province. Thus, Cluster-pine can be introduced to the Jarrah forests of Western Australia with a minimum of the risk which attaches generally to the introduction of an exotic to any country. It is already growing well on sandy soil in the Albany park.

156.—*Advantages and disadvantages of Insignis-pine for interplanting with Jarrah.*

The general cultivation of Insignis-pine I have treated fully elsewhere (p. 257). It only remains here to say that, as compared to Cluster-pine, it has advantages and disadvantages. (1.) The seed is very much more costly than Cluster-pine, so

costly that it has never been used in South Africa for broadcast sowings. (2.) The Insignis-pine is a poor tree in its own country in California, where indeed it is nearly extinct as a species. Instead of supporting a great industrial population like Cluster-pine, the Californians think it scarcely worth cutting for timber. On the other hand, it has shown a phenomenally rapid rate of growth in Australia and South Africa and other countries when planted as an exotic on good soil, and it is undoubtedly the first pine for the more expensive work of regular planting in the Jarrah forest. (3.) As compared with Cluster-pine, Insignis-pine has not the same reproductive power, but is more shade-bearing. In the Mount Muirhead plantation of South Australia, now 35 years old, is to be seen an interesting study of the growth under wild conditions of pines and Eucalypts. Here I saw dense small thickets of Cluster and Aleppo Pine coming up under old Blue-gum (*Euc. globulus*) trees. There was not the same natural reproduction of Insignis-pine. (4.) In South Africa the Cluster-pine will grow on the poorest sands of the Cape flats, but the Insignis-pine requires the better soil of the lower mountain slopes. There is no soil in the Jarrah forests of Western Australia too poor for Cluster-pine. There may be for Insignis-pine. (5.) But on good soil and in the cooler damper parts of the Jarrah forest, Insignis-pine will grow from 30 per cent. to 60 per cent. faster than Cluster-pine. (6.) When isolated or in poor thin plantations, Insignis keeps its shape better than Cluster-pine.

157.—*The choice of Pines for filling the open forests of Western Australia.*

It is impossible to say beforehand which of the five common winter-rainfall pines may give the most useful results in filling up the open Eucalypt forest of Western Australia. Insignis-pine grows the quickest; Cluster has the cheapest seed and the prospect of a resin industry; Aleppo has the largest and earliest natural reproduction; Stone-pine has a valuable bye-product in its nuts; Canary-pine has the straightest growth and the most valuable timber, and it shoots again like a Gum when cut or burnt as a young tree—the only one of the five to do this. Stone-pine and Canary will be at home farther north than the others, which will begin to fall off in growth at that end of the Darling Range. Insignis is the least able to stand drought and heat; Canary and Aleppo the best, so that they will grow well further north and east than the others.

Further details regarding these five pines will be found (pp. 255 to 261) in the list of useful trees for planting in Western Australia. The most interesting present point is how far each, in its growth from seeds sown, will be able to get away from the weeds and vegetation of the forest floor. Usually pines keep the ground below them clean, and their own regrowth is little able to make headway on dirty ground. Probably none of these pines will succeed with simple broadcast sowing. Probably most will succeed in roughly sown lines allowing them to be mulched with the weeds which would otherwise kill them (p. 131). Stone-pine with the stored-up plant food in its kernel is generally the most rapid pine to get away from the weeds. Of course, once above the weeds and ground vegetation, the pines will have it all their own way.

Insignis-pine, as mentioned, is to some extent shade-bearing. Aleppo is more so, and Aleppo-pine seems to grow better in Western Australia than anywhere else in Australia. It is an Eastern Mediterranean pine of a quite dry summer. But, probably where the expense of planting has to be resorted to, Busaco Cedar (*Cupressus lusitanica*) surpasses all others, and next to this the *macrocarpa* Cypress. The former I saw a good deal of at Cintra, in Portugal, and it is about the most valuable of the quite successful Conifers planted in South Africa.

Cupressus macrocarpa has been planted in quite dense forest of Eucalypt, etc., at Tokai, near Cape Town, taking a good stem in dense stand.

158.—*The Rabbit Pest in the mixed forest.*

While Insignis-pine reproduction failed at Mount Muirhead, in South Australia, the colder climate of Macedon in Victoria, which is more favourable to Insignis-pine, I saw good natural reproduction everywhere. And the forester in charge told me that in an old Insignis plantation, after a bad fire, the cones opened and the young pines came up like grass! It was thought to utilise this abundant crop of young pines for planting purposes, but before they were old enough for lifting, rabbits cleared them all off in two months! Rabbits have, therefore, to be considered in any general measure for filling up the Jarrah forest with pines. As yet the Jarrah forest is free from them, and I have elsewhere (Appendix III.) suggested a measure tending to keep them down as pests in Australia generally. But looking at the present position, it seems impossible to hope that the rabbit fences will keep rabbits permanently out of the Jarrah forest, so that it is an important point to get up a good stock of pines before their possible arrival.

Once the forest is stocked with Cluster-pine the production of Cluster-pine seed is so heavy that in a clearing or after a burn, there would probably be enough seedlings and to spare for the rabbits. It was possibly rabbits that ate down the Insignis-pine seedlings, and left the Cluster and the Aleppo pines in the Mount Muirhead plantation.

159.—*Successful interplanting of Eucalypts and Pines in South Africa.*

In South Africa, where there has been the largest planting of Pines and Eucalypts in a climate like Australia, they have generally not been planted together. (1.) Because the forester could see what was before him more easily in having pure plantations of each. (2.) It was considered best, for fire-protective purposes, to put the Eucalypt planting in dense belts, where it acts as fire-breaks to the more inflammable Pines. (3.) The general practice has been to plant Eucalypts on the better soil and Pines on the poorer soil.

Exceptionally, however, Pines and Eucalypts have been planted together. I can recall a small plantation planted at first with Jarrah pure, in the Government forest at Tokai. The Jarrah was growing very slowly and producing crooked timber. To remedy this, I tried inter-planting with Cluster-pine. On one side of the plantation where the Jarrah was growing better, the Cluster-pine and Jarrah grew up well together, the Jarrah showing a rapid and straighter growth. On the other side of the plantation, where the Jarrah was not growing so well, it became dominated by the Cluster-pine, which thus took its place and produced timber where the Jarrah had failed. On the mountain slopes, at about 600 feet elevation at Tokai, is a sprinkling of good Jarrah trees, some of them, for their age, better than similar trees in Western Australia; these are growing mixed with Pine and other trees, and growing well.

160.—*Successful interplanting of Eucalypts and Pines in Australia.*

In Australia, during my recent tour I came across various instances of Pines and Eucalypts growing well toegther. Of these by far the most notable is the 700 acres of Insignis-pine (with a little Laricio-pine) growing with Stringy-bark (*Euc. obliqua*) at Creswick, in Victoria; these pines are on poorish soil, planted eight feet apart, among the Eucalypt copse; each pine cost about 1½d. to plant, 1d. for its pit, and ½d. planting.

Near the Wirrabara nursery in South Australia is a clump of tall pine trees (Insignis, Aleppo, and Canary) with their heads well above the native Eucalypt forest around. In the Wirrabara and in the Bundaleer plantations of South Australia, I saw Pines and Eucalypts growing well together in various locations.

At the Conservators' Forest Conference, held at Sydney in 1912, the question of under-planting Eucalypt forests with Pines came up for consideration. Mr. Jolly, the Conservator of Forests, Queensland, mentioned having seen at Marble Hill, in South Australia, Eucalypts and Conifers growing well together. Mr. Hay added:—"At Mittagong I have seen Insignis-pine growing in an open (Eucalypt) forest and doing well."

KARRI (*Eucalyptus diversicolor*).

161.—*The Karri Forest easy to manage.*

Karri is one of the easiest trees to manage. It presents none of the difficulties of some of the Gums. It matures in about 40 years, it is stated, and this statement is borne out by its growth in the considerable plantations of Karri in South Africa. Further, in the natural state it is safe from fire. The regrowth is rapid, dense, and abundant. It should always be able to yield a good return on the ground that it occupies, and as the demand for timber increases, and the yield of the forest improves, the demarcated Karri forest will support a considerable population.

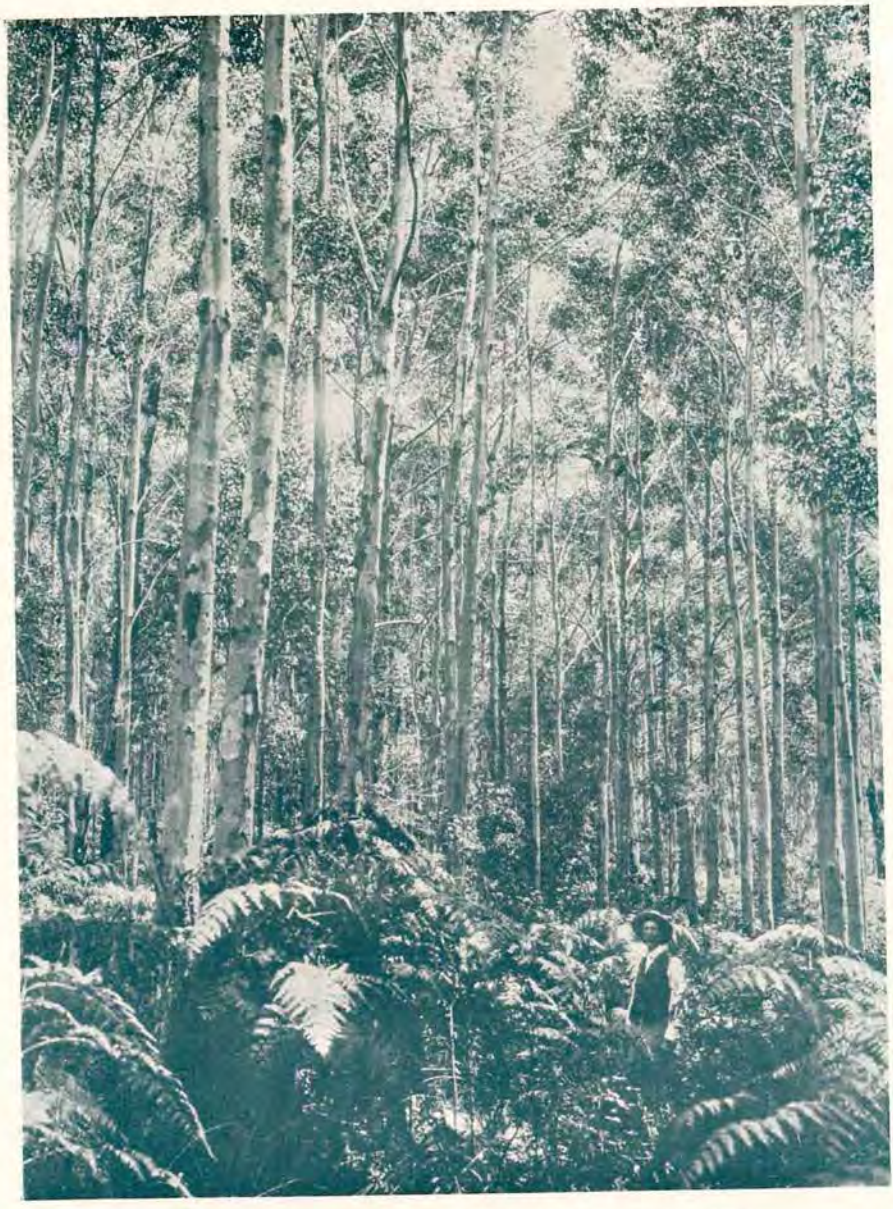
162.—*The rapid re-growth of Karri.*

The regrowth at Karridale in 30 years averages 18in. to 24in. diameter, although it appears to have been kept back for want of thinning. Karridale is on good soil. On a poor, dry, gravelly hill at Jarnadup I saw Karri regrowth averaging four feet high, the growth of 18 months after a forest fire. At Denmark the straightness and denseness of the Karri regrowth are equally remarkable; there must be little like it in all Australia. I saw good natural reproduction of Karri after a fire on Mr. Hortin's farm at Torbay, Millar's Company having cut the timber off from there some 19 years ago. This regrowth has much the appearance of Karri in one of the South African plantations except that it is not so regular, and being rather on the edge of the Karri areas where there is a lightish rainfall for Karri, the growth is rather low. Thus, at 19 years the regrowth now formed is of tall straight poles, averaging 5in. diameter and 50ft. total height, but I saw a dense stand with stems up to 9in. x 90ft. high. In South Africa (Tokai) the average at 18 years is 8in. diameter and 80ft. high. Mr. Horton was of opinion that this regrowth Karri, which has come up after cutting, ring-barking, and burning, is superior in the original primeval forest. In this opinion I agree. In a forest managed for the regrowth it would have been better still.

163.—*Karri trees probably the tallest in the world.*

In connection with Karri, there is a point which must appeal to the patriotism of every Australian. It and the *Euc. regnans* divide the honour of being the biggest trees in Australia, and probably the tallest trees in the world.

So far as at present known, the Victorian tree, *Euc. regnans* is the larger of the two. I refer further to this in speaking of Victorian forests. It will be sufficient to mention here, that while staying in the forest at the Government sawmills, at "Bigbrook," I measured, with an angular instrument, trees that were little under 300 feet in height, and made careful inquiries with reference to the height of the largest trees known. Mr. Brockman, whose opinion as a careful and ac-



Karri Regrowth, 30 years old : Karridale Concession, W.A.

curate local observer carries weight, told me that he was not acquainted with trees over 300 feet in height, but that it was possible such trees might exist in clumps of tall trees growing in low-lying soil, and drawn up to a level of the ordinary tall trees growing on higher ground. The biggest measured tree known to him was that measured by Governor Weld, which had 200 feet bole and 80 or 100 feet of crown. The tallest tree I measured was 284 feet to the topmost twigs where these had been broken off by the wind. Looking at the tree, I could not imagine it as being less than 300 feet high originally. I probably saw higher trees, but was not in a position to clear a sufficient opening for measuring them with an angular instrument. Mr. Kelly, Millar's manager at the Kirupp mills, told me of single trees of Karri yielding up to 25,000 superficial feet. The largest tree that had been logged in recent years yielded 3,750 cubic feet in eight logs.

In the District Surveyor's Office, at Albany, I saw photos. and discussed with Mr. Rose the height of the great Karri tree known as "King Karri." This tree had a girth of 40 feet at the base. In the photograph of this tree the actual diameter (apart from the base bulge) looks to be about 12 feet. It is stated that the height of the bole of this tree was 242 feet. Estimated from the photo. that would give to the tree a total height of 342 feet. As regards maximum thickness, I had good evidence of a tree growing in the heart of the best Karri forest, on the seaward side of "Bigbrook" and within seven miles of the sea, that was 17ft. diameter at the base and 15ft. at the centre of the bole.

164.—*Dimensions of Karri trees actually measured.*

The actually largest tree I measured, taking both thickness and height, and of which I have a set of photographs, was 11 feet in diameter and 270 feet high—the same diameter as the recorded largest tree in South Africa, known as "The Eastern Monarch." The largest trees I heard of were mentioned by the "Bush Boss," or officer in charge of the timber getters at the Government mills, Bigbrook. He is accustomed to estimate the height of trees, and was with me one afternoon when we measured some trees with an angular instrument. Comparing the trees that we measured with the biggest trees he knew, he estimated the latter at about 400 feet. At the last International Paris Exhibition there was exhibited the section of a big tree, certified by a surveyor to have been 434 feet total height. Mr. Donovan, now Forest Ranger, was in the employ of the Davis Company at that time, and remembers the cutting of this tree.

165.—*Desirable that the biggest trees be exactly located.*

I would suggest, as a point of historical and scientific interest, that the exact location of the biggest Karri trees should be ascertained, the forest surrounding these giant trees kept free of all cutting, and if necessary, protected from fire. If only for advertisement and tourist purposes, the preservation of those wonderful trees would repay the slight cost and trouble of doing so. At present it is only vaguely known where they are. And this, too, in such a comparatively small area as that occupied by the Karri forests!

166.—*How to distinguish Karri wood from Jarrah.*

Karri has been so frequently substituted for Jarrah, and the true value of Jarrah as a sleeper thus depreciated, that it may be worth while mentioning here the readiest means of distinguishing Karri from Jarrah. In practice I have used three:—(1) Jarrah burns blacker than Karri; (2) Jarrah cuts softer; (3) Jarrah is less porous.

(1.) The burning test is usually done with a chip, but this sometimes fails. If the chip is quite dry and in a current of air, a Jarrah chip will burn away freely like Karri; otherwise it will smoulder and turn black.

(2.) Jarrah with a sharp knife cuts softer, in fact some specimens cut like a hard Cedar, while Karri cuts more horny; but this test also may fail; it is only true with regard to average samples of both timbers.

(3.) If a clean cross-section be made with a razor or sharp knife, Jarrah will show only a few medium-sized pores! Karri, numerous large pores. This test may sometimes fail between two samples; but as a test between average samples it will not fail, and is, in my opinion, the most reliable of the three. In practice I have found it the one on which to place the greatest reliance. Some years back a quantity of Karri sleepers came to South Africa, substituted for Jarrah, and the fraud was not detected until too late. I have since had a good many samples to examine.

YATE (*Eucalyptus cornuta*).

167.—*The Yate as a cultivated forest tree.*

The Yate seems a tree of which the propagation should be encouraged in the natural forest, for two reasons:—(1) It has succeeded well on a small scale as a cultivated tree in South Africa and in Cyprus. (2) Julius' experiments (p. 235) have shown that it is a peculiarly strong timber, being thus specially valuable for constructional purposes.

The forester will note that it grows well as a planted tree, and it will probably be more abundant in the natural forests when these are fire-protected. It is not a forest tree of any importance in Western Australia at present. It seems to grow vigorously, but usually in sparse forests, and not to any size. When cut or burnt it does not come up again as freely as Jarrah, and that is perhaps why it has been pushed out of the Jarrah forest, occurring now only in patches on the seaward and landward side of the Jarrah belt. At Torbay, near Albany, I found small pure patches of it growing on poor sandy soil.

In plantations in South Africa it shows a good average growth, not so fast as Karri, or as *Euc. globulus,* or *Euc. saligna,* but distinctly one of the fast-growing Gums. In Australia the only certain figure of growth known to me is one near Torbay, on Mr. Hortin's farm; there a self-sown Yate has come up and grown alongside of *Pinus insignis* at much the same rate of growth. In most parts of the winter-rainfall area of Australia, Insignis-pine is reputed to be the fastest-growing tree. Ednie Brown, in "Forests of Western Australia, 1899," describes it as "fast-growing, a hardy species, readily adapting itself to rainfalls as low as 15in. to 20in. and well worthy of cultivation."

Yate is usually stated not to be durable in the ground, but on a wooden bridge near Torbay I saw posts that are stated to have been there for 19 years, and in South Africa I have notes of a largish log left lying exposed to rot in a damp situation for some years, and in this log I found the heart-wood quite durable. There seems little doubt, however, that Yate cannot compare in durability with either Jarrah or Wandoo; but it will be a distinct gain to the forest of Western Australia if, as one of the results of fire-protection, there is produced a more abundant growth of straight Yate timber.

Karri Virgin Forest: Donnelly River, W.A.

BLACKBUTT (*Eucalyptus patens*).

168.—*The limitations of the Blackbutt tree.*

This is a very popular and good light-weight hardwood. It should make a useful furniture wood, and English railway companies pay high prices for it. It is said to grow faster than Jarrah, but it has two drawbacks: (1) it is unsound and cuts up badly; (2) it is only found on rich, deep, well-drained loams. This last is probably a fatal objection to its continuance as forest in a country of generally poorish soils and dry summers.

WANDOO or "WHITE GUM" (*Eucalyptus redunca*).

169.—*Wandoo a close second to Jarrah timber.*

The well-known Wandoo or "White Gum" (*Eucalyptus redunca*) presents, generally, most of the characteristics of Jarrah, but it extends into drier forests. It appears to be the only really durable timber of Western Australia besides Jarrah, and, as shown me by Mr. Fox, the District Surveyor at Narrogin, it is a timber of undoubted merit. I saw posts that had been known to be in the ground for 30 years and I heard of others that were still sound, and had been in the ground since the occupation of the country, some 60 years ago. Mr. Julius classes it with Jarrah as a durable sleeper. In the old posts that I saw, white-ants had eaten the thin layer of heart wood, but had not touched the sap wood; indeed, split wandoo fencing posts struck me as having much the appearance and durability of "Sneezewood" in South Africa. Sneezewood is a tree known throughout the length and breadth of South Africa for its durability. I heard further of the good seasoning qualities of Wandoo; indeed, Mr. Hedges who has had some experience of good seasoning trees on the goldfields, describes Wandoo as the best seasoner of Western Australia; it is also said to furnish the best firewood.

Unfortunately, Wandoo grows in the drier, more open country of Western Australia, which was the easiest to settle, and generally, it is found on good soil, so that no tree has been more destroyed than it. But the merits of the tree are such that so far as possible such good forests as remain should be demarcated out and treated for improvement by fire-protection, etc.

It is a question whether those who have planted Jarrah in other countries would not have done better, especially in dry areas, if they had attempted to plant Wandoo instead.

TUART (*Eucalyptus gomphocephala*).

170.—*Tuart a tree of the calciferous drift sands.*

Of this useful tree I saw too little during my tour in Western Australia to offer any advice with regard to the management of its forest.

The timber is of great strength and weighs 71lbs. per cubic foot air-dry. Only Yate and Ironbark, among the hardwoods on Mr. Julius' list are so heavy, and though deficient in strength generally compared to Yate it is stronger than any Western Australian timber in "cross compression." It seasons and works well, and wears well in situations exposed to heavy work, as in trucks of railway carriages. It is comparable to Yate in many respects, but is of quite local distribution, being confined to small patches of nearly pure forest along the coast, on soil containing a large proportion of lime. I understand that the soil on which it grows is of little agricultural value, so that the demarcation and systematic im-

provement of the small area of this unique tree should be an unquestioned point in Western Australian Forestry. Under some misconception, or perhaps awaiting the strengthening of the Forest Department, its exportation from Western Australia has been stopped. The Tuart forest should be demarcated, conserved, and worked into order as early as may be.*

Tuart has been planted to some extent abroad, in South Africa, California, and in Southern Europe. It has generally done well whenever it has found its peculiar soil requirement. On calcareous drift-sand near Cape Town it has proved a tree of first-rate value.

CHAPTER III.

The Inland Forests of Western Australia.

171.—*A forest destroyed by the Mining Industry.*

In the goldfields districts a great chance has been lost through letting the mining timber be worked *a mort* (to death) instead of *a vie* (for life), to use the expressive French terms. A very little control, the glimmerings of a correct forest policy, would have allowed the Kalgoorlie regrowth forest to grow up before cattle or axes were let in again. At my visit, I saw Salmon-gum forest cut over in 1895-96-97, showing a first-rate regrowth. Gimlet (or Fluted-gum) here was nearly as good.

Now the good forest is all gone for a distance of some 20 miles from Kalgoorlie, and it is also at a distance from all the other mining centres of population but one; so that these centres have lost their beauty, their shelter from the bad winds of the goldfields, and have to pay a heavy transport tax on their firewood. The intense summer heat, the winter cold, a rainfall of nine inches, constitute a climate impossible for commercial tree-planting. In climates of extremes, the forest once destroyed can scarcely be restored. The people in Iceland once had forest; they let it go. They cannot now replace it, though they are trying hard.

Salmon-gum, Gimlet, and the smaller gums are the wonders of tree-growth in such a climate. For such forest as still remains the treatment is easy. There is no vegetation to burn here; and so both the fire-aid to natural regeneration in seedling-reproduction, and the fire-loss in coppice-reproduction are absent. The forest is free also from all the subsequent fire-loss usual in the Eucalypt forest. The Salmon-gum, Gimlet, and three other gums make up the Eastern Goldfield's forest, and yield, in good average forest, about four tons of fuel per acre. They are all heavy, hard timbers, yielding first-class firewood. Salmon-gum burns well, even when green. In nearly every case the centres of the trees are eaten out by white-ants to a remarkable extent, even for Australia, where nearly all the timber is "piped." But these old Kalgoorlie gums are often reduced to a mere shell, and actually are easier to break up in consequence. The regrowth wood should be mostly free from this defect, for white-ants will rarely destroy live tissue, and the regrowth will be cut before the old dead tissue at the heart has formed. An exceptionally good forest that I saw had been yielding five tons of firewood per acre. The goldfields require a yearly supply of about half a million tons.

* Unfortunately the tuart forests are for the most part privately owned, and their redemption by the Government will be necessary. [C.E.L-P.]

Gimlet Gum as a shelter for stock: Kellerberrin, W.A.

172.—*The "firewood" tax on gold production.*

It is extremely unfortunate, not only for firewood, but for beauty and climatic effect, that means were not taken to preserve the indigenous Eucalypts when the goldfields were proclaimed. The distance from which firewood has now to be brought represents a considerable tax on the industry; and the firewood supply of the Coolgardie goldfields is no small matter. It recalls the firewood supply to the Kimberley diamond mines, South Africa, before the coal discoveries. At my visit I was informed that one of the large firewood supply companies had by then supplied over four million tons of fuel.

No extensive reforesting measures can be undertaken on account of the dryness of the climate, and the uncertainty of how long payable gold will last. In the meantime, the usual measures for securing natural reproduction should be taken, with the closing of successive areas for a term of years until regeneration has taken place, and the young trees grown up out of the reach of damage from grazing animals. This is all the more necessary as in places goats are kept, and they, of course, if uncontrolled, are fatal to any forest reproduction. As a subsidiary measure, when a fresh area is opened in the future, a certain number of standard seed-bearers should be left, for the double purpose of affording a supply of seed and of marking the locality as one that is being treated for natural regeneration. In the dry climate of the Coolgardie goldfields Eucalypts generally do not reshoot when cut as freely as they do nearer the coast. The Forest Department ranger told me that, as a general average, not more than 70 per cent. of the Eucalypts cut would reshoot. In these same areas there might be a little planting of the hardier conifers of Northern Mexico, after a trial in an Arboretum, to which I shall refer later.

173.—*Introduction of the Mesquit tree suggested.*

There should also be a cautious trial of the Mesquit (*Prosopis juliflora* and *Prosopis dulcis*), and perhaps some other species of Prosopis. Mesquit furnishes a sweet pod, and the firewood is one of the best known. It would be equal or superior to the best of the fine Eucalypt hardwoods now in use on the fields; but Mesquit is considered a nuisance in parts of Texas, and when introduced into the island of Hawai it spread naturally at a rapid rate. It was welcomed there, both for the cattle feeding and the firewood; and I do not think there is much chance of its being otherwise than welcomed on the Kalgoorlie goldfields. However, to set this matter at rest, the Mesquit should first be kept under cultivation in a confined area, and its developments be carefully watched in a goldfields Arboretum. I have little doubt of the Mesquit growing on the goldfields. I had it for many years under cultivation in the Robertson plantation, South Africa; and in this same plantation the Coolgardie Gums, Salmon-gum and Fluted-gum (*Eucalyptus salmonophloia, Euc. salubris*), grew with great success, so that, in this locality at any rate, where the Coolgardie Gums flourished Mesquit grew also. The growth there was moderate, and for 10 or 12 years, at least, Mesquit showed no sign of spreading naturally.

174.—*Necessity for an Arboretum at Kalgoorlie.*

To develop the latent tree-growing arboricultural wealth of Western Australia, I have recommended (p. 154) a series of national arboretums. One of these should undoubtedly be established at Kalgoorlie. There is Government water available for obtaining good results at once with half-hardy trees, and perhaps gradually acclimatising them, though acclimatising is really a long and doubtful business. But the chief utility of an arboretum at Kalgoorlie, where there is such a desperate

want of trees and verdure, is to prove what trees can be easily grown in the locality with little or no help from artificial watering. I doubt if, on the whole, there are any trees better than the indigenous Eucalypts. But other trees are naturally wanted for variety, and there are a number of hardy and half-hardy conifers and other trees from Northern Mexico and Southern Texas which could be grown under goldfields climatic conditions and greatly improve the amenities of the locality.

I can recall the time when the Diamond-fields of South Africa were very much like what Kalgoorlie is now. The unrestricted dust and want of shade gave the locality the present bare and uninviting appearance of Coolgardie and Kalgoorlie; and the dust and glare probably helped to continue the "camp fever" which at that time characterised the locality. Now the "camp fever" has completely died out, and the scene, for a dry country mining town, is wonderfully improved. All this has been done practically by two trees, the Pepper-tree from South America and a Casuarina from Australia (*C. Cunninghamii*). Within the shade and shelter of these large, strong-growing trees is cultivated a number of smaller trees, shrubs, and flowers. I see no reason why Kalgoorlie should not be improved on the lines of Kimberley, and to do this the best means will be to establish a Government arboretum at Kalgoorlie. The Kimberley climate is not quite so dry as Kalgoorlie in rainfall, though there is but little difference; while evaporation at Kimberley is fiercer and frosts more severe. So that on the whole tree-growing is easier at Kalgoorlie. The arboretum would, of course, require to be under skilled direction —for no planting is more difficult than that in very dry climates—and a special knowledge of Extra-tropical dry-country trees would be required. But the experience gained in the arboretum would not be confined to the beautifying of Kalgoorlie. Material assistance might be rendered to the great problem of growing fuel for the goldfields. I have mentioned one such, Mesquit, which demands very careful investigation.

175.—*Blue Gum grown at a profit in a Kalgoorlie climate.*

The story of the Worcester plantation in a dry part of the Cape Province suggests the possibility of doing something in this way for Kalgoorlie. At Worcester an area of 70 acres was planted with Blue-gum (*Euc. globulus*), and watered with surplus water from the town of Worcester. The Blue-gum grew with a good average yield (acrim of about 550 cubic feet); it has been cut over once for pit-props and firewood, and is now about ready to be cut over again. The total cost (and it has not always been economically managed) has been £16,005, up to 1912-13, without reckoning interest. But the revenue has been £20,134 (also without reckoning interest). So that (without the interest calculation) there has been a surplus profit of over £4,000 on this 70 acres, and a second timber crop is just ready to cut.

There is no doubt that on a bit of ordinary good red soil, at Kalgoorlie, there could be got a yield (acrim) of some 12 or 14 tons (short) of dry firewood per acre, per year. It is a question, therefore (which could be easily worked out, but for which I have not the data by me), whether the water required yearly for an acre of Blue-gum is worth more or less at Kalgoorlie than 12 or 14 tons of dry firewood yearly. The Blue-gum would require to be wetted about twice a week in summer and one a month in winter. This might be equivalent to a rainfall of some 60 inches.

At Worcester, in South Africa, the Blue-gum plantation is the beauty spot of the place. A similar plantation would add to the amenities of Kalgoorlie, and possibly afford some shelter against hot, dry winds.

176.—*The coppice re-growth of Western Australian timber trees.*

Fire generally produces an abundant crop of seedlings. But with species that "coppice" or shoot again from the stump when cut, the effect of a fire may be to kill the greater part of the coppice reproduction. Here, therefore, we have the curious case of fire producing opposite effects, according to the class of forest that gets burnt.

The coppicing power of the different species of Eucalypts, by which I mean their ability to shoot from the stump when cut, is a subject which will be more studied with the advance of systematic forestry in Australia. Thus, in Western Australia, Karri seems to coppice well, Jarrah fairly, and Red-gum (*Euc. calophylla*) very well. I have seen stools up to 3ft. diameter shooting freely and vigorously. Yate (*Euc. cornuta*) is said to coppice readily, but not so strongly as the Red-gum, with which it is associated. This might account for the patchy distribution of Yate, for a great deal of shooting in the natural forest takes place from more or less badly burnt trunks. Here, again, it should be noted that a tree will often coppice when cut, but fail to coppice when burnt. Appearances seem to indicate that Yate does not shoot again so easily as many species, when the forest has been burnt. Thus, the effect of fire-protection may be to bring in more Yate—the tree which, according to Mr. Julius' tests, is the strongest large timber tree in Australia. It is certain that Yate does coppice fairly freely, since I have seen large old stools, or the remains of them, with three or four big trees growing from them. I have photos of such.

The coppicing power of all Eucalypts varies with the season. It is best in winter and early spring, worst in late summer. Many Eucalypts if cut in the middle of a dry summer will die straight away, or shoot badly with the return of better weather. Brushing off the shoots, as by cattle, will often destroy young copse. If the shoots are systematically knocked off, the stool will inevitably die. This has to be remembered in clearing for fire-lines.

A poor open forest, with the number of stems too few per acre, can be turned into a fully stocked good forest by the simple process of being cut over and fire-protected. This follows as a natural consequence of the very good coppicing power of most of the Eucalypts.

I can recall the case of a Eucalypt plantation in South Africa that had accidentally failed in part and was growing up into the poor timber of the sparse forest. It was proposed to crop the timber and replant it. Instead of this, I simply had the timber cut. The regrowth forest had four or five stems in place of one, and was sufficient to provide a full stock.

177.—*Mallet bark trees said not to coppice.*

The Mallet-bark tree (*Euc. occidentalis, var. astringens*) is said not to reproduce from stool when cut, or, if it does, to reproduce badly. If, therefore, any Mallet-bark country is to be preserved, it must be taken in hand at once, trees marked for barking according to the condition of the forest; and then, after reproduction has been obtained, closed till the trees are grown up eight feet high, and then opened for grazing for a term of years. Wherever Mallet-bark is now growing well, the area should be demarcated and worked for Mallet-bark reproduction. As long as Mallet-bark is on poor soil, this is the obvious course to folow, since then both the bark and the grazing are secured (p. 240).

178.—*The deficiency of Pole-trees in Australian forests.*

In the framing of detailed Working-plans for each "Section" of forest, there is nothing in which the benefit of Working-plans is shown more conspicuously than in the matter of pole-cutting. One has only to walk a few hundred yards into almost any Australian forest in order to see this. There will be, perhaps, in a very few places too dense a growth of poles in strips which have escaped fire: nearly everywhere else there is a striking deficiency of trees in the pole stage. For statistics on the subject one may refer to the number of stems in a normal forest in an identical climate, statistics carefully prepared by the Portuguese Forest Officers at Leiria (p. 103).

On the goldfields, and in the forest that I saw on the motor ride from the goldfields to Perth, and in the forest I traversed with Mr. Fox at Narrogin, in fact, in nearly every forest that I saw in Western Australia, the remarkable feature was the absence of trees in the pole stage. This is the result chiefly of fires, but near settlements the cutting of poles for farm purposes.

Pole-cutting, like grazing, is a matter which must be left absolutely to the discretion of the Forest Department. This is obvious, but in practice it is as difficult to get this recognised as it is that grazing must be under the control of the Forest Department. The first result of fire-protection and systematised natural regeneration will be the restoration of the forest in the pole stage. This is required to bring Australian forests generally into a normal condition. There will then be an abundant supply of poles, but just how and where these can be cut so as to improve instead of to deteriorate the forest, will be indicated in the detailed studies of the Working-plans. There is no more important feature in Working-plans.

CHAPTER IV.

Dues—Royalties—Felling Practice.

179.—*Computation of Royalties by the "Metric tickey" Standard and from gross Forest Revenue.*

The fundamental objection to low royalties is that it leads to waste in timber working. No one will trouble much about economising that which costs them nothing. In computing the cost of 100 years of bad Forestry, p. 173, the convenient figure £0.01 (sometimes called the "Metric tickey")* is referred to as an all-round figure, for the average value of marketable timber in the log as it stands in the forest before any labour has been put on to it. It is mentioned that this figure is a good deal below the average realised for South Africa, which in recent years has been from 4d. to 5d. a cubic foot. It is also below the royalty for some classes of timber in Australia, such as softwoods in Queensland; indeed the average Queensland rate is nearly 2d. But it is far above the average royalty in Australian forests, which I have computed from the data published by the Commonwealth Statist to average about ¾d. per cubic foot (p. 183). The last returns from South Africa show royalties about double the "Metric tickey" standard and about six times the average Australian royalty, reckoning that at ¾d.

*Note.—In South Africa a three-penny piece is known as a "Tickey." [C.E.L.P.]

Greenham & Evans, Photo. Salmon Gum Forest: Loading mining timber at Three Springs, W.A.

The quantity of timber sawn or hewn in Australia in 1912 being 667,554,000 super. feet = 55,629,500 cubic feet (p. 290, *Com. Year-book,* 1914). If we multiply this by two to convert the sawn cubic content to the log cubic content, and take the "metric tickey" standard, the total Australian royalty for 1912 should have been over one million sterling. Thus 55,629,500 × 2 × £0.01 = £1,112,590. It was actually only a quarter of a million sterling from timber and other sources of revenue. Thus, owing to political control, reckless timber leases, low royalties, or weak or non-existing Forestry Departments, Australia is only getting less than one-quarter of its forest revenue on the very moderate "metric tickey" standard.

Omitting South Australia, where forest conditions are exceptional, it is shown by the statistics of Forestry (p. 182) that, for the timber worked, Victoria is getting the best forest revenue and Western Australia the worst, except Tasmania, where the timber worked is more than Victoria, but where there is no Forest Department and practically no forest revenue.

Computed from gross forest revenue.—If one attempts to estimate the average royalty from the gross forest revenues, the result comes also near one-fourth the "metric tickey" standard. Taking the total quantity of timber hewn and sawn (*Com. Year-book,* 1914), and with this dividing the forest revenue (making some allowance for revenue other than that paid for timber, and for timber from private forest), we get near the average royalty paid. Thus 0.72d. may be taken as the mean royalty per cubic foot paid on Australian timber; now 0.72 × 4 = 2.88d. as against the "metric tickey" of 2.4d.

The mean royalty for Victoria (where more than half the forest revenue in 1914 was not from timber) is somewhere about 1¼d. per cubic foot, taking half the figure shown for Victoria (p. 183). Similarly, New South Wales is probably about 1¼d.; while Queensland, if we allow about half the timber to come from private forest, would have an average royalty of about 2¼d.

Low royalties in Western Australia.—In Western Australia, where, with a weak Forest Department, there is little more than timber revenue, the average royalty is probably near the figure computed, viz., 0.45d. per cubic foot. Thus, allowing for revenue not coming from timber sales, we may take 0.35d. or 0.40d. as the average price per cubic foot coming to the Government of Western Australia for the timber cut in the forest. This is a very low rate; it is about half the average rate assumed for the Commonwealth of Australia, viz., 0.72d., or about ¾d. I understand that the average rate now paid by the timber companies is 1s. to 2s. per load of 50 cubic feet; or say, ¼d. to ½d. per cubic foot.

It is thus seen that the average Western Australian rate is now little more than one-tenth the average South African rate. It is evident that, in spite of the unfortunately very low rates of the timber leases, some means should be found of making the forest revenue of Western Australia bear a reasonable proportion to the value of the timber felled.

180.—*Various Royalties compared.*

In Tasmania the State receives something less than 0.18d. per cubic foot of timber worked. I say something less because, as before, there are other sources of forest revenue besides timber. Taking the mill value of Tasmanian timber at 7s. per 100 feet super., the State of Tasmania thus gets something less than (84 ÷ 0.18) = one forty-seventh of the mill value of its sawn timber.

In Queensland, and other Australian States, where timber sales are well managed, the real market value of the timber is secured to the State by putting

the timber up to auction. This is the correct procedure, and is that followed in other countries. The Queensland Conservator reported to the Melbourne Conservators' Conference that all his important sales were by auction; and that average prices for 1911 were:—Hoop and Bunya-pine per cubic foot 2.9d. (2s. per 100 feet super.), and hardwood 1d. per cubic foot (9d. per 100 feet super). Cedar has been sold as high as 3s. 5d. per cubic foot (28s. 6d. per 100 feet super).

The low timber rates in force in New South Wales have been referred to in speaking of New South Wales Forestry (p. 310). Thus, in 1911-12 Cedar realised 3¾d. per cubic foot, and this for the most valuable timber in Australia! I have mentioned that in South Africa the most valuable timber is Stinkwood (*Ocotea bullata*), and that South Africa cuts yearly about the same quantity of Stinkwood that New South Wales does of Cedar. But the average price of Stinkwood as it stands uncut in the forest is close on 2s. per cubic foot for sound marketable timber. Thus New South Wales got under one-sixth of what South Africa gets for its best timber!

Again, to compare the royalty value of the timber in the forest with the value of the timber as it leaves the mills:—

The figure 0.72d. per cubic foot which I have taken as the average Australian royalty = 6d. per 100 feet super. If we take the average value of sawn hardwood at 8s. per 100 feet super., the mean Australian royalty is only one-sixteenth the mill value; or, if we take the mill value at 6s., it is one-twelfth; and, similarly, if we take the average Western Australian royalty at 0.40d. or 0.35d. per cubic foot, this bears to the average value of the timber sawn a still lower ratio—about one-thirtieth.

The Kingdom of Saxony, in Germany, has long furnished useful figures of forest statistics. The forest statistics of Saxony are perhaps more elaborate and more complete than any country in the world. The forests are Spruce, etc.; they cover 430,000 acres, and in 1909 yielded 30 million cubic feet, with a net income of £45,000, which works out to 21s. per acre. The average net price received for the timber lying felled in the forest was 3½d. per cubic foot.

In the United States of America the average value of timber in the forest is stated at rather less than one-fifth that of the sawn wood; in South Africa it runs about one-sixth.

181.—*Low royalties indicate absence of a correct Forestry policy.*

It is extremely unfortunate that in Western Australia and Tasmania the Governments, without taking expert advice, have tied themselves up for so many years' loss, owing to the very low rates granted to the timber companies. On the other hand, it is better that the timber should be given away at nominal rates than be left to rot or burn in the forests, as was the case before the advent of the timber companies. And where the timber companies have saved forest from reckless alienation without demarcation, they deserve well of the country. In a virgin forest, where nothing has been done by the Government to open up the forest, and where there are vast stores of over-mature hollow trees, timber rates must necessarily be very low. The root of the loss lies in the curious fact that, where so much has been done in Australia to develop the country, the forests have been left a neglected mine of wealth. Australian Governments have happily undertaken many duties for the public welfare that are left to so-called "private enterprise" in England; but Forestry, which is the special function of the State to attend to, has been left to take care of itself.

182.—*The importance of felling when the sap is down.*

I have elsewhere referred to the desirability of felling timber in season (Western Autsralian Timbers, p. 231, and Western Australian Regulations, p. 222). It will be sufficient now to add that A. O. Green, in a paper read before the Royal Society of Tasmania on "Timber Utilisation" in 1894, amongst a number of measures suggested for improving Tasmanian timber, put forward as his first measure, "That all timber be rung or felled when the sap is down."

I mention the matter again here because great care has been taken in Australia to ensure that only mature timber is felled, sometimes to the injuring of the forest; while felling timber in season, which is never to the injury of the forest, and probably as important to the timber as maturity, has been quite neglected. In the case of coppice reproduction it is at least as important to the forest as to the timber to fell when the sap is down—during late autumn and the first half of winter. Even Blue-gum, when felled at midsummer, will often entirely fail to coppice.

183.—*Evils of the minimum "felling-girth" system.*

A minimum felling girth has been established generally throughout most of the forests of Australia, and in the case of forest worked by "jardinage," or "selection fellings" it may be useful, though in any case it is but a rough method of choosing the best trees to fell. When, in 1884, Count de Vasselot, the eminent French Forester, introduced systematic working into the forests of South Africa, he insisted on the abolition of a felling limit, substituting in its place *the individual selection and marking of trees.* The event has shown that he was right, though I did not think so at the time! Individual marking is now in force in South Australia, and to some extent in Victoria.

The case of tan Wattle-bark is a good illustration of the inexpediency of making a hard and fast maturing rule. Black Wattle is cut at an age in South Africa that would be considered immature in Australia; it would not pay to delay the crop longer. Yet, although the more mature Australian bark is superior, the comparatively immature South African bark has ousted it from the market!

A girth limit is too rigid. A forest cannot be properly managed by such general regulations; it was tried in Europe 140 years ago and soon abandoned. A forest nowadays is *managed by Working-plans,* not by Regulations, and, however remote the forest, and however slight the working, a rough Working-plan is necessary.

In Eucalypt forests, where clean cutting is desirable (p. 221), the effect of these minimum felling areas is to add greatly to the cost of working, and to delay the regularisation and improvement of the forest.

Undoubtedly in Australia the minimum girth limit has had its uses, especially in other than the Eucalypt class of forest. It has perhaps, in some cases, saved accessible Eucalypt forest from destruction, though I fear not often, for in most cases the accessible forest is destroyed by fire and less often by grazing. Its general adoption in Australia (at some cost in the working of the forest) while more important measures, such as demarcation, fire-protection, and Working-plans have been neglected, is curious. It is part of the rule-of-thumb Forestry that has been practised or preached, such as planting three trees where one grew, planting trees in a dry country where there are no rain clouds, to make rain, thinning so that no branches may touch when the wind blows, etc.! The girth limit is, at best, an arbitrary make-shift method of selection!

184.—*Considerations which should determine felling girth.*

In all the Australian Forestry regulations there is fixed a minimum girth below which trees are not allowed to be felled. This even subsists in the negative forestry of Tasmania, where there is a minimum felling size for the various Eucalypts, for Conifers, and for Blackwood. Eucalypt timbers are not allowed to be cut under two feet in diameter.

In the case of Karri, the minimum regulation girth is now 90 inches at the base, and it is stated that trees are preferred that are not lower than 90 inches in the middle. It is said that where the Karri logs are lower than 90 inches girth in the middle there is too much white wood, and the wood cracks badly on seasoning, the timber also being soft and liable to break on felling.

It is true that the maturity of the timber is an important point, but it may be less important than is generally thought. Indeed, for some uses, immature timber is more useful than mature: in a sleeper, for instance, where the timber has to be impregnated with an antiseptic. In Europe, Oak sapwood takes creosote; but Oak hardwood takes it to so small an extent that it is generally considered not worth creosoting. Similarly, the immature Karri sleeper may make the best sleeper when impregnated. It is quite possible that the best sleeper that Western Australia can produce, after Jarrah, may be a zinced Karri sapwood sleeper finished with a bath of creosote.

The manager of the "Wood-bending, Nave and Spoke Works," Hobart, quoted in the official publication, "Tasmanian Forestry, 1910," says, "I have used many timbers, foreign and otherwise, but find the Blue-gum of Tasmania (*more especially that from a young tree*) as good as any timber I know of for my purpose."

In other cases immature timber is good enough for the purpose required. In Tasmania they use immature timber for apple packing-cases, and this is a rapidly increasing use. Indeed, when fruit packing-cases have to go by rail, the immature wood being lighter, is preferable.

In other countries saw-millers are able to find a use for timbers of various ages, and I am convinced that they will be able to do so to a great extent in Australia. In any case, they should, where it is in the interests of the forest to do so. be given the chance.

At present expensive saw-mills are erected, and frequently very costly tramways are constructed to feed the saw-mills, and all this for working an area which rarely has more than a fraction of its full stock of timber. If to this we add an arbitrary maturity limit, it is evident that the saw-miller's task in Australia is one which, already difficult from the nature of the forest, is rendered more so by mistaken ideas of forest conservancy.

As to how far quite immature trees should be cut will depend on circumstances. If the timber is to be impregnated immature timber will, in most cases, take the antiseptic better than mature timber, and that is the main consideration not only for sleepers but for all timber where decay is to be feared.

Again, in mature timber the chief difference between that and immature timber is that the mature timber has had the porous cellular matter filled up with lignine. It is often a much sounder business, financially, as well as structurally, to do that artificially and quickly with an antiseptic. In all forest matters one has ever to remember that money at 4 per cent. doubles in 20 years. Again, in many employments immature timber or sapwood is preferred to heartwood: that is the case with the ordinary Hickory, imported so largely from America for tool handles. It is the case generally where elasticity in timber is more important than strength, as in wheelwright's work. In Europe the practical stick of timber

that the Forester finds it most profitable to produce is, with softwoods, about one foot in diameter.

185.—*Selection of the most suitable trees for felling.*

As mentioned elsewhere, subject to the general provision of the Working-plan, and as far as it is safe to generalise—it is only the man on the spot, he who makes the Working-plan, who can speak with certainty—the clean-cutting of "Coupes" in open Eucalypt forest should be the object sought by the Forester, and the more the saw-miller can usefully take the better both for him and for the regularisation and fire protection of the forest. These two I found in South Africa always went together.

Thus, to resume, the minimum girth limit is not the best way to select the most suitable trees for felling, either in the interest of the timber-getter or of the forest, and there are many uses where immature timber is as useful, or is more useful than mature timber; as in tool-handles and wheelwright work, where elasticity is required, or where the timber is going to be impregnated with an antiseptic. The younger the timber can be felled without losing too much of its useful properties the better financially for the forest. Thus, 9in. to 12in. are common diameters for felling European softwoods, and often at that diameter the stems are nearly all sapwood. In the model Leiría forest I have averaged the heartwood in the felled Cluster-pine at less than half of the sectional area.

CHAPTER V.

"Timber Working" or Exploitation of Australian Forest.

186.—*Timber-getting as a branch of business.*

There should be no timber cutting without some kind of "Working Plan"; it need not be elaborate.

When an application is received to put up a saw-mill, the Conservator, or the special "Working-plans" officer, should go to the spot and frame a rough "working-plan": for an ordinary milling area, this would be a matter of from one to two hours, to one or two days; then the applicant should be informed what timber was available, and on what terms it could be cut.

The royalty tariff should exist only as a matter of guidance. In one case there may be timber in a difficult situation which it would be advantageous to the forest to have worked without royalty. In such a case, the Conservator (Chief Forest Officer) should have power to get the forest worked at the best price obtainable. I can remember on one occasion, when Ironwood was in super-abundance in South Africa and hindering the development of more valuable timbers, not being able to get it worked free, but finally getting it cut with a promise of free axes for as many as were spoilt in cutting it.

In another case, there may be good timber in an accessible situation, where only a rigorous auction sale will get at its real value; this must be insisted upon. The day of the timber speculator's easy fortune, the giving away of valuable timber grants, ceases as soon as the forest is organised and worked on modern lines.

There is no more reason why the State should give away its timber for next to nothing, than that it should part with any of its other property to satisfy private greed at the public expense.

No forests intended to be preserved should be worked either by the State or a saw-miller without a "working-plan." In forests where working-plans have not yet been prepared, either because they are inaccessible, or for other reasons, "Selection-felling" may be adopted, especially for certain classes of timber, such as wind-falls, dead trees, or trees which are badly piped. In such cases, in order to make supervision practicable the working should be done in sections of the forest as they are opened in rotation.

187.—*State Governments entering into Timber business.*

Western Australia heads the list of forest production among the States of the Commonwealth. It is seen in the table at p. 181 that on an average of the years 1908-13, Western Australia stands first amongst the Australian States in the quantity of timber worked, the total reaching the high yearly average of 184,185,800 super feet (= 15,348,817 cubic feet); the next State being New South Wales, and the third Queensland. It is sad to see on the same list that in the gross forest revenue Western Australia only occupies the fourth place, coming after Victoria, where the quantity of timber cut was only between one-third and one-fourth of that in Western Australia.

Looking again at the same table, it will be seen that Western Australia, though first in forest working, occupies only the fourth place in forest expenditure. It is only in recent years that Western Australia has attained its premier position in forest working. The table (p. 181) shows that in 1901 Western Australia was second in the quantity of timber worked, the first place being occupied by Queensland; while for the last year of which there are any official records, 1913, Western Australia has worked 219 million feet super. against 165 in New South Wales and 157 in Queensland. Western Australia has the highest forest production and ideal conditions of forest working, since only in Australia is the State working any forest on a large scale. There is small State working in Victoria and South Australia; but in Western Australia there is a healthy rivalry between the State and such a powerful corporation as Millar's Karri and Jarrah Co., Ltd.

Said the President of the Perth Chamber of Commerce at the deputation to the Minister for Forests in June, 1914:—

> "The forest area leased for working has increased in eight years from 885,000 acres to one and a-half million acres, and the production during the same time from 144 million feet super. (12 million cub. ft.) to 218 million feet super. (18½ million cub. ft.); or an increase of over 50 per cent. in eight years.

188.—*A timber-getting business without a Manager.*

At the same time, while Western Australia heads the Commonwealth in the energetic working of the forest, it is at the bottom of all the Australian States, except Tasmania, in the forest staff for administering the forests; for, while Queensland has a skeleton Forest Department, even weaker than that of Western Australia, it has a professionally trained Forester as Conservator. It is clear that with this enterprise in working the forest, to work it and not *improve* it, is a position that cannot be defended from any point of view. It is imperilling the credit of the State to-day, and casting to the winds great future wealth, probably the State's most valuable public asset, after its railways. It means the sending away to better governed lands all the large rural population which could be living on the forest industry.

189.—*The New South Wales system of "Lumbering."*

Conservative "lumbering," as understood in America, means certain restrictions imposed on the timber-getters which, without really hampering operations, are of great benefit to the natural reproduction and timber-growth of the forest. Whatever the condition of the forest, whether organised and systematically worked, or only left in its wild state with its mature timber culled, if the forest is to be preserved, conditions favourable to it should be imposed on the forest workers. Some advance has been made in this direction in timber working in Australia. In Victoria I saw care being taken against fire, crowns and waste being brought together and burnt.

The practice in New South Wales came up in discussion at the Sydney Forest Conference, and it was stated that the restrictions have caused no friction of any sort between the Forest Department and the timber workers. Regulation No. 22 of the New South Wales Forestry Act reads as follows:—

(a) No tree shall be felled unless first marked by a Forest Officer.

(b) Where so directed by an authorised officer, the holder of a license or an exclusive right, shall ring-bark, in the interests of re-afforestation (*sic*, forestry) any trees marked for that purpose within the area to which the license or right applies.

(c) Heads of trees shall be properly stacked as soon as felled in neat heaps, not exceeding dimensions of 50 feet in length by 25 feet in breadth and eight feet high, all limbs being chopped off and turned back on to the trunk of the tree.

(d) Conditions as to the thinning of seedlings and saplings by felling, grubbing, or otherwise.

(e) Conditions considered necessary to safeguard any public or vested interest during the exercise of a license or right.

(c) is an onerous condition which may, or may not, be necessary, according to the treatment applied to the forest for its fire-protection. The first paragraph (a) is a matter of forest administration, which, as far as possible, should be in force everywhere. The pith of these conditions is (b), enabling the Forest Department to get rid of trees by ring-barking, which should be cut down in the interests of forest regeneration though there might be some doubt (reading the discussion at the Conference) whether it is necessary to remove all the trees mentioned. The only men who really know in such cases are the local Forester and the Conservator (or his assistant), who goes round with the Forester from time to time.

190.—*The South African system of "Lumbering."*

There are in South Africa two large mills with plants valued at £12,000 and £17,000, and 17 smaller ones, all working the forest, as indicated by the Forest Department, for the perpetuation and improvement of the forest. There is much scattered timber, both in the virgin forest and in the forest, left as a legacy of the irregular fellings previous to 1880. This is worked by pit-sawyers—usually white men on the western side, kaffirs, etc., on the eastern side. There are no serious complaints of irksome restrictions. The forest is cut up into working sections, and no tree is cut that has not previously been selected, measured, and marked for felling by the Forest Department. This means a good deal of work, but it is the only sound way of conducting fellings. If only trees over a certain diameter limit were felled, the miller or bush-worker would not get a good many trees he ought to, viz.,

trees that have some defect, that stand too close, or which, for any other reason, are better felled now than allowed to stand for 20 years, which is the period of the rotation in South Africa.

191.—*The true place of the Saw Mill in Forest Improvement.*

Saw-millers seem scarcely to have had fair play in Australia. By the tree enthusiast they have been looked on with disfavour as *destroying* the forest; while they were really improving it in perhaps the majority of cases, and it was only the want of a little "forest science" that has prevented them improving the forest greatly. Saw-milling is the only practical means of working and improving the indigenous forest. It is a crude and practically impossible idea to cut the forest down and re-plant it. For instance, Victoria has four million acres of reserved forest. With the cost of labour in Australia, it would cost not less than £15 an acre to *replant* this properly, or £60,000,000 in all. And similarly, New South Wales would require £75,000,000 to replant its reserve of five million acres—

The compound interest on 135 millions would be, at 4 per cent.—

	£
For 10 years—135 x 1·5	202,500,000
„ 20 „ 135 x 2·2	297,000,000
„ 30 „ 135 x 3·2	432,000,000
„ 40 „ 135 x 4·8	648,000,000
„ 50 „ 135 x 7·1	958,500,000
„ 60 „ 135 x 10·5	1,417,500,000
„ 80 „ 135 x 23	3,105,000,000

" Building timber " will mature in from 30 to 80 years, " packing case timber " will mature earlier.

Such an expenditure is quite out of any serious consideration. No forest in South Africa or Australia could stand such a financial impost, and happily it is quite unnecessary. The saw-miller, if only he is properly handled, *will do the work for nothing*, as he does in America now, and as he has done for many years in Europe.

But in Australia the saw-miller has been hampered by unnecessary, and sometimes vexatious restrictions, partly the result of red-tape with "office" Forestry, and partly of unscientific Forestry. By the public he has been looked on with suspicion; instead of being welcomed as a friend in working and improving the forest, and assisted with roads to open up the forest. He has been specially handicapped in many places by being only allowed to fell timber above a certain limit in an already under-stocked forest, so that often, after making expensive tramways, he has not been able to get more than half the available timber. And, instead of being helped in making roads and tramways to open up the forest, he is often taxed at the rate of £1 or £2 per mile per year on the tramways he makes. In the matter of roads, so essential to the timber-working and fire-protection of the forest, there has been little co-operation between the Forest Department and the saw-millers. This is the most serious part of the saw-millers' bad treatment.

192.—*The value of "Concessions" when rightly applied.*

Forest concessions, though objectionable from many points of view, are often useful in the early days of forest working. The virgin forest represents a large capital, returning no interest, and in the early days, before there is competition, the only choice is for the Government either to work the timber itself or grant a concession for doing so. Australian concessions of considerable value have been granted, the most valuable being those in Western Australia and Tasmania. The point where these concessions are open to criticism is that they have been granted

by Government without technical advice, and thus frequently mischief has been done to the forest instead of benefit. Under skilled direction, a forest grant may be the most useful means of working and regenerating a forest. Not many years ago the Austrian Government granted a timber concession in Hungary involving an amount of £3,000,000 worth of timber, and I understand the working and regeneration of the forest under this concession are quite satisfactory.

193.—*The regrettable absence of Pit-sawing in Australian Forests.*

It is unfortunate that pit-sawing has been almost abandoned for the present in Australia. There are many good trees in inaccessible places which can only be worked by pit-sawing, and the work is so invigorating and healthy that many men who cannot stand a sedentary town life could earn a healthy livelihood by it. It is still practised in England for trees that are isolated and inaccessible, and in other parts of Europe is more common. On page 12 of my report on "Cyprus Forestry" are given some interesting pictures of pit-sawing in inaccessible forests. In South Africa all the scattered timber (and there is necessarily a great deal of this in the irregular wild forest) is worked by pit-sawing. In this class of timber, of which there is a great deal in Australia, pit-sawing competes easily with machine-sawing.

"The saw-milling system was defective, and the Forest Department did not provide proper facilities. A lot of good timber was wasted by paling-splitters," said Mr. Grundy at a recent deputation of the A.N.A. to the Minister in charge of Forestry at Melbourne.—(*Age*, 19th February, 1915.)

194.—*Hewing Licenses and their attendant evils.*

I saw a good deal in Western Australia of the waste resulting from hewers' licenses. Where timber has any value, or even in inaccessible forests, where it is likely to have a value in the early future, it is important that this waste in the present hewers' licenses should be stopped. I understand that sleeper hewers pay only a nominal fee of 2s. 6d. per load of 50 cubic feet, together with 2s. 6d. per month. They take any tree they like, and waste just as much as they list. A good Jarrah tree, for example, which looks inclined to split well is felled, but if on felling it does not split well it is left to rot. It appears further, that the time fee of 2s. 6d. per month was reduced not long ago from 10s., thus encouraging further waste. This abuse is ascribed to political control, a matter regarding which I have put forth suggestions.

The waste caused by sleeper hewers and paling splitters is indeed very great. I saw numerous instances of it during my tours in the Australian forests. One of the largest Jarrah trees I saw in Western Australia was a tree seven feet in diameter, with 78 feet of bole and 165 feet total height. This choice log had been let go to sleeper-hewers, who had taken one-third of the log, and left two-thirds to burn with the next forest fire! This waste is said to be largely due to the noxious system of political interference with details of forest management. Undoubtedly, the splitters and hewers are a class of men to be encouraged. Some of the finest men I have seen in Australia belonged to their ranks. They are of the first importance to the forest in working up inaccessible timber which the saw-millers cannot reach. But instead of being cared for with small holdings in permanent hamlets: and encouraged to make homes in the forest with local rural schools for their children and visiting doctors and parsons, supported by Government, they are given a premium in thriftless habits by being allowed to waste public property in timber. Actually, they are pauperised as surely as the unfortunate inmate of an English "Work-house." They are the men who, living within call of the forest

stations, are summoned in case of forest fires. With their time divided between Government work in the forest under the local Forester, and timber working, there should be no class of men in Australia who more deserve the sympathetic encouragement and legitimate help of the Government. The fire-protection, the cultivation work of the forest, is in their hands; there can be no cultivated forest without them. (Page 69, Organisation.)

195.—*Abnormally low "Stands" of timber in Australian Forests.*

In all forest working in Australia, and in the preparation of all working-plans, the outstanding feature that has constantly to be kept in view is that the stock or *stand of timber in Australian forests is abnormally low.* From this follows, nearly always, the inferior, crooked, knotty, timber of the sparse forest. Says Mr. P. North, the Melbourne Architect—

In Australia we have a few valuable hardwoods growing under favourable conditions, which produce timber of great value for certain purposes, but we have millions of acres of valueless timbers.

These words state exactly what I have seen in my tours through the extra-tropical forests of Australia. The bulk of the Eucalypt forests are very disappointing at first sight! But the Forester used to Eucalypt forests in other countries quickly perceives that the Australian Eucalypt forest is rarely seen at its best. It has generally been deteriorated by the long-time fires of the blacks, and more recently by the severe fires of the whites. It is too often but a skeleton of what it might be. And in the small areas where fires do not usually penetrate, it is an uneven-aged forest of very light-demanding trees (Eucalypts), killing or destroying every dominated tree near them. Sylviculturally, it is the Oak without the Beech in Europe, and though *Fagus cunninghamii,* and some other shade-bearing species in Australia are useful as soil coverers, they are usually too small or too slow-growing to grow up with the Eucalypts and shape them, or increase the stand per acre.

Only in patches of regrowth, Karri, *Euc. pilularis, Euc. saligna, Euc. globulus,* etc., that have temporarily escaped the fires do we see the forest fully stocked, and even-aged as it might all be if fire-protected.

Says Mr. D. Hay, the New South Wales Conservator:—"Wherever the regrowth is good, the stand is better in the regrowth than in the virgin forest." That is my view, after seeing the regrowth forest at Coopernook and Taree, on the Manning River, New South Wales. Hollow old trees, often crooked, are replaced by a dense regrowth of straight, sound trees. "In the Bellinger forest," adds Mr. Hay, "the loss on sawing up the old hollow over-mature logs is 58 per cent." In his last Annual Report (1913-14), page 4, the Conservator estimates that the average stand of timber in the forests of New South Wales is only 400 cubic feet of sawable timber.

Mr. Jolly, the Conservator of Queensland, has estimated as a general average that the Queensland forests are about one-third stocked. I understand it is the opinion of the Acting Conservator, Western Australia (Mr. Richardson), that the average stand of marketable Jarrah, taking the forest through, is not above 200 cubic feet. Mr. Gill, the Conservator, South Australia, quotes equally low figures. I have referred already to the estimates of Mr. Mackay, the Conservator, Victoria, for the various classes of forests in Victoria. These estimates refer to timber over the minimum girth felling limit. In any case, the total stand of timber is extremely low, far below the yield of the same Eucalypt forest in South Africa, South Europe, California, and India.

The better class Jarrah forests of Western Australia have been estimated to have an average stand of only 500 cubic feet. (This may be compared with 4,000 cubic feet, an average northern stand for Scotch-pine at 80 years.) When we consider the stock of timber that might be grown in these forests, it is evident, that from a productive point of view they may be looked upon almost as semi-waste areas; with the proviso, however, that scientific forestry with fire-protection and the introduction of self-spreading species would raise the productiveness to double, treble, or even more.

196.—*Normal Stands of Pine Timber in Europe.*

I may give some figures in support of this opinion. At Leiría, in Portugal, where the climate is the same in latitude, temperature, and rainfall as Albany, we have Cluster-pine growing with a normal stand at maturity of about 4,500 cubic feet. This figure may be compared with 4,000 cubic feet, the average stand quoted for Scotch-pine at 80 years in the North of Scotland and with Veise's normal stands for 90 years Scotch-pine in Germany: 1st class forest 7,900, 2nd class 6,100, 3rd class 4,600, 4th class 3,500, 5th class 2,700. They may also be compared with 9,000 cubic feet, the average stand of good forest in the "Black" forest when they are about to start a regeneration cutting: and with 14,500 cubic feet, the maxium stand in the "Black" forest.

The following table, showing the normal density of Cluster-pine at all ages, was given me by the Conservator at my recent visit to Portugal, and is quoted in my British Association paper, read at Sydney, and now being printed by Dr. Ewart, of the Melbourne University.

NORMAL "STAND" PER ACRE OF CLUSTER-PINE IN THE STATE FOREST OF LEIRIA.

——	Diameter.	Total Height.
10 years—5,600 trees, which then average	2 inches	16 feet
20 „ 1,940 „ „ „	4 „	39 „
30 „ 976 „ „ „	5 „	46 „
40 „ 396 „ „ „	6 „	55 „
50 „ 296 „ „ „	8 „	62 „
60 „ 180 „ „ „	9 „	69 „
70 „ 96 „ „ „	10 „	74 „
At 80 years the forest is clean-cut, when the trees average ..	11 „	79 „

The diameter is that at five feet above the ground; the height, the total height of the trees. These trees yield first-class clean timber, similar to Pitch-pine.

It will be seen how widely these figures depart from the stock of timber in an average Australian Eucalypts forest in all the younger stages. It is in the young stage of a forest that the trees acquire their straight and well-drawn-up height-growth. And Cluster-pine, like the Eucalypts, is a very light-demanding species; according to the forest officers in the South of France, it is as light-demanding as any forest species can be. In this respect, therefore, we have a tree of the same constitution as the Eucalypts. The climate at Leiría is almost exactly the same as that at Albany; if there is any difference, it will be that Leiría is slightly drier. I may add that the straight young trees from the forests of Cluster-pine in Portugal and Southern France are the main source of supply of mining timber to the coal mines of Wales. From the one port of Bordeaux alone, in Southern France, there is an export of nearly 1,000 *tons of pit-props to England per each working day* throughout the year. The above figures relate to an average normal stand of timber.

197.—*Average Stand in the Karri Forest.*

In Australia, where fires are preventable and there is a good rainfall, the stock (or stand) of timber is much heavier; there only remains then, the uneven age to prevent its attaining its maximum stand. Thus, I have figures of a maximum stand of an acre of Karri forest on the Donnelly River, 12 miles from Bridgetown, which yielded over 400 loads, or 20,000 cubic feet of merchantable timber, say, some 30,000 or more cubic feet as a total stand per acre. The stand of timber in some of the dense patches of Karri forest is quite remarkable. I have seen good forest near Manjimup, where big Karri trees of almost giant size were standing at an average distance apart of only about six yards. This was estimated by the timberman (bush boss) and myself conjointly. I have heard of Karri forest which could only be attacked from the outside; there was not room to swing an axe inside! As far as my information extends, the Karri forest has the heaviest stand of timber of any forest in Australia. The measurement of this stand by an expert Forester is a national matter which may well claim the early attention of patriotic Australians. It should prove one of the highest in the world.

This figure of 30,000 cubic feet for the Karri stand may be compared with the figures for the *Eucalyptus regnans* forest on the mountains of Victoria, quoted by the Conservator (Mr. Mackay) at the Sydney Conservators' Conference. This figure was 14,400 cubic feet of merchantable timber, say, some 28,000 or more total stand per acre. It may be compared also with the Geeveston saw-miller's estimate, that he could get £500 worth of sawable timber off an acre of choice forest in S.E. Tasmania. This would mean a gross stand in the forest of about 14,000 cubic feet of sawn timber, say, 28,000 gross stand. It will be understood that these are maximum stands for Eucalypt forest in Australia. Average good forest would be about half this. Eucalypt forest in other parts of the world presents similar high figures.

198.—*Average Stand in the Appalachian Forest, U.S.A.*

The average stand in the Appalachian forest may be mentioned here; it affords a good illustration of the difference in the average stand of even the best "wild" forest compared to the "cultivated" forest. A few years ago Dr. Somerville, the well known Oxford professor and editor of the *Quart. Journ. of Forestry*, went on a tour through the Appachalian forests, the best in the Eastern United States of America. He reported an average timber stand of only 1,400 cubic feet, and never saw more than a 3,000 cubic feet stand in the best forest on the Appalachians.

199.—*Average Stand of Blue Gum in the Nilgiris, India.*

In 1882, the Inspector General of Forests, India, was on special duty in Southern India, and I was deputed, under his supervision, to ascertain the exact rate of growth which had been realised in a small group of Blue-gum (*Eucalyptus globulus*) plantations on the Nilgiris. The results were published in a forest Blue-book, which can be obtained from the Madras Government, and they are instructive as showing what can be obtained from a Eucalypt forest under the most advantageous circumstances, *i.e.*, of maximum sun power, heavy rainfall, and, at the same time, a climate which in mean temperature is the same as Southern Australia, and is well suited to the growth of Blue-gum. Two main results were obtained: (1) There was a maximum average yield in the best plantations of 700 cubic feet per acre per year. Taking the air-dry weight of Blue-gum at 60lbs. per cubic foot, this equals an average acre increment (Acrim) of 21 metric tons. (2) The Blue-gum when planted as dense as most European trees fell off in both height-growth and diameter-growth. When planted moderately close it produced good timber, and presented a bulk of timber greater than any other known timber tree. When

planted sparse, there was approximately the same yield of timber, but inferior in shape and quality. Fire did not enter into these calculations, all the plantations being efficiently fire-protected.

Three years ago, that is to say, after a lapse of 30 years, the growth in the same plantation was measured again by an Indian Forest Officer, Mr. Cowley-Brown, and his results have also been published in an Official Blue-book. He found that the previous figures of growth obtained by myself 30 years before had been maintained, and with the further data available, he estimates that the maximum yield of the Blue-gum on the Nilgiris is reached with a rotation of 75 years. The stand then would be about 52,000 cubic feet, which is rather more than the equivalent gross stand recorded from any Australian Eucalypt forest of 200 or 300 years old.

200.—*The probable Stand of mixed Eucalypt and Pine Forest.*

These figures have an important bearing on Australian Forestry, since they indicate the maximum yield from a Eucalypt forest under the most favourable conditions of sun power, rainfall, a temperate climate, and the methodical treatment of a cultivated forest as regards thinnings and fire-protection. Similar yield figures have been obtained from fire-protected Blue-gum (*Eucalyptus globulus*) in South Africa, California, Southern Europe, and Africa.

These figures are far in excess of those of the best pine forests in Europe. Thus, Weise's normal for first-class Scotch-pine at 90 years of age, in middle Europe, is 7,590 cubic feet. In the Black Forest, in Germany, 9,000 cubic feet per acre is the average stand in good first-class forest of Spruce and Silver Fir, at the time when they are about to start the regeneration fellings.

It will be interesting to note what stand could be expected from the Jarrah forests if they were filled up with pines. Here I may quote figures from the wild forest of Aleppo-pine in Cyprus, in a dry extra-tropical climate where the wild forest is traversed by fire, and is about as open and suffering about as much from fire as the Jarrah forests of Western Australia in their present state. The Aleppo-pine, I may mention, is well-suited to grow in the drier parts of the Jarrah forest. I have seen better Aleppo-pine in Western Australia than anywhere else in Australia. In the part of the Cyprus forests, where there had been but little cutting, not very much goat-grazing, and where there was a rainfall about equal to the average of the Jarrah forest, the stand of timber averaged only 2,021 cubic feet per acre.

M. Madon, a French Forester, employed by the Cyprus Government to report on the forests of Cyprus, averaged the stocking of the Aleppo-pine forests there as not generally above one-quarter that of a fully-stocked Pine forest. This low stocking of the forest, though due partly to preventible causes such as fires, goat-grazing, and irregular and excessive felling, is also due to two causes which are common in many of the forests of Australia: (1) Dryness of climate; (2) a light-demanding species like the Aleppo-pine, growing without admixture with shade-bearing trees.

It should be noted that the light-demanding constitution of the Aleppo-pine is comparative only; it is not nearly so pronounced as that of the Eucalypts of Australia. On the other hand, it is only the driest of the Eucalypt forests of Australia that are as dry as the generality of the Aleppo-pine forests of Cyprus. Aleppo would grow with little more rainfall than the Kalgoorlie goldfields rainfall.

201.—*Limitation of Stands in dry countries.*

It is, of course, useless to attempt a general dense stand of timber in dry country. The continuance of forest growth is dependent primarily on the supply of moisture in the soil, and as soon as the supply fails, the forest begins to thin out. The question then arises, what is to be done to ensure the advantage of clean timber, resulting from a dense stand, and at the same time to obtain sufficient subsoil moisture for a good height-growth. In such a case, the only plan left to the Forester is to seek a growth as dense as may be in the low-lying parts of the country, to which surface water and subsoil moisture gravitate (but where there is, at the same time, drainage), and thus to cultivate a *dense forest in patches.* The distribution of forest in dry countries shows Nature doing this, more or less; it is left to the Forester to improve on Nature by a clearing or turning into grazing lands of the forest on the drier slopes, and thus improving the sub-soil moisture necessary for a good tree-growth in the generally deeper, damper soils of the hollows.

202.—*Different treatment of Karri and Jarrah forest required to improve Stands.*

Throughout the forests of Western Australia, the task before the Forester is to improve the stock of timber. This will be done in the Karri forest by getting the stand more complete, and arranged in even-aged sections or groups. In the Jarrah forests, and such forests as may be demarcated in the dry country to the east of the Jarrah belt, there is much more to be done in order to raise the present stand of timber up to that which the soil and climate can carry.

203.—*Forest Stands of various timbers in other countries.*

Name.	"Stand."	Remarks.
	cubic feet.	
Spruce (*Abies excelsa*) .. .. / Silver Fir (*Abies pectinata*) ..	9,000	The ordinary "Stand" in the Black Forest, Germany, at the period selected for a regeneration-cutting.
European Red Deal (*Pinus sylvestris*)	7,950	1st class forest.
Do. ..	6,100	2nd „ „
Do. ..	4,620	3rd „ „
Do. ..	3,530	4th „ „
Do. ..	2,690	5th „ „ 90 years is the maturing period allowed for each class.
Aleppo-pine (*P. halepensis*) ..	2,020	The matured irregular forest in the island of Cyprus.
Yellow-wood (*Podocarpus elongata*, and *P. Thunbergii*)	4,706	Average of the good mountain-forests Trans-Kei, South Africa. The only native large timber in South Africa; maximum diameter = 11ft.
Californian Red-wood (*Sequoia sempervirens*)	100,000	The extreme maximum yet recorded. The Douglas-pine and the Oregon-pine have also nearly reached this figure.

We may compare these figures with some maximum stands of timber known in the world, and which have usually been reported from small areas of wild forest. They indicate the maximum possible obtainable under the most favourable conditions. From the Red-wood (*Sequoia sempervirens*) forest of California there are photographs and measurements of a stand of 100,000 cubic feet per acre, incredible though it may seem; and there are measurements of Douglas-pine and Oregon-pine which come near to this figure.

204.—*Australia's maximum Stand to be double the European maximum Stand.*

It is interesting to note that when going through the "Black Forest" in Germany with the English Arboricultural Society two years ago, I was shown a maximum stand (over a small area) of 14,500 cubic feet; this was the European Silver-fir (*Abies alba*). Very curiously, this is almost exactly the figure which Mr. Mackay, the Conservator of Forests, Victoria, quoted at the Conservators' Conference at Sydney as the net yield of merchantable timber which will be perhaps less than half the gross yield. These stands are not known to be surpassed in either case, so that here we have the maximum stand in an Australian Eucalypt forest about double that of the maximum stand in a European forest: while taking the maximum Karri stand quoted above, perhaps 40,000 cubic feet, the Australian maximum Eucalypt stand is nearly treble the European maximum stand of Silver Fir and Spruce, viz., 14,500 cubic feet and 40,000 cubic feet.

205.—*The main features for working a Western Australian Forest.*

Thus, in making Working-plans for Western Australian forests, three outstanding features have to be considered:—

1. The low stock of timber now in the forest.
2. Fire.
3. Uneven age, and consequently uneven growth.

1. The low stand or stock of timber in the forest may be put down, as I have shown, to two causes—(1) Fire; (2) Uneven age in a forest stocked with Eucalypts which are very light-demanding. The remedies for this low stand of timber are two—(1) Fire protection; (2) Introduction of less light-demanding species, particularly Pines.

2. Forest fires in their various aspects I have discussed separately (p. 20). They are, in Western Australia, neither so bad in their effects nor so difficult to control as in the more fertile climates and soils of the Eastern States. With systematic Forestry, there should be little difficulty in keeping fire out of the Karri forest; under normal conditions it is self-protective. On the drier side of the Jarrah forest zone, and in the still drier forests of the eastward, fire can be easily controlled at slight expense.

The only forest in Western Australia that offers fire work of any difficulty, and which compares with the difficult fire-work of some of the Eastern forests, is the wetter side of the Jarrah forest zone. This is probably the most valuable forest in Western Australia, and it is here that systematic fire-protection offers the richest reward to the Forester!

3. The uneven age of the forest, and the uneven growth which accompanies it, will gradually disappear as the forest, with scientific working, gradually becomes converted into an even-aged forest, with graduated ages in the different sections.

And this will be arrived at *slowly*, by continuing the present method of "Selection" or "Jardinage fellings," but the working of the forest must be in sections, with a fairly long rotation. The longer the rotation the more rapid the improvement to the forest, and the easier and more economical working to the miller, but there will be greater delay (and consequently loss to the State) in marketing the over-mature timber of the virgin forest.

And the same can be arrived at *rapidly*, by clean felling. Hence, as I have endeavoured to show, the management of the Eucalypt forests of Western Australia should embrace clean felling as far as possible.

206.—*The four stages of working a Forest by Working-plan.*

The four stages, which those who make the Working-plans for each forest will have to consider, are briefly these:—

1. *"Clean-cutting"* to replace "Selection-felling" as far as may be. It will be in the accessible forest where this can first be done. In the quite accessible forest everything has a value, even the litter on the soil for farm animals' bedding and stable manure; and the strips of bark shed from the trees. In the inaccessible forest, only the choicest timber, and often not even that, has any value.
2. *A burn* if necessary. This is pretty certain to produce a strong regrowth of seedling reproduction, but it tends to destroy the coppice reproduction.
3. *Fire-protection without grazing.* Very careful fire-protection for the first few years, till the regrowth has closed overhead, has got out of harm's way from stock grazing, and has begun to kill down the ground herbage.
4. *Fire-protection and grazing.* Grazing is now beneficial. It may greatly assist fire-protection; but it can only be let under suitable guarantees against "fire-raising." This is the stage when the Spanish goat (as well as sheep and oxen) can come in. Two Spanish milch goats on this forest herbage will give as much milk as one cow on grassed-land (page 60).

CHAPTER VI.

The "Cultivated" Forest.

207.—*Winning the most valuable crop the soil can give.*

The cultivated forest is the ideal of modern scientific forestry. The whole of the forests of Europe are in a more or less cultivated state. The most advanced European nations—France, Germany, Austria, Sweden, Belgium, Holland, Denmark—have their forests in the most advanced condition of cultivation. One has to travel to such distant countries as the mountains of Turkey to see European forests in quite the wild state. When I was first introduced to a cultivated forest in France, forty years ago, the whole thing was a revelation. The forest looked perfectly natural. But I had not been long with the French Forest Officers and had the working machinery explained to me before I realised that I was in the presence of a complicated piece of mechanism, the result of a hundred years' patient labour, careful experiment, and scientific thought. This forest, too, was the most valuable crop the ground could carry. As one travels through France and Germany one sees patches of forest and patches of cereals and other crops interspersed. It is just a shade of difference in the soil that turns the balance as to which is the *most paying* crop, forest or cereals.

208.—*No conception in Australia of the "Cultivated" Forest.*

Now, in Australia there is this curious position: the ideals of modern forestry methods are wanting. There is no conception of the "cultivated" forest. It is as unknown and undreamt of as was radium twenty years ago. In Australasia, and particularly in New Zealand, this absence of the ideals of modern forestry is very

remarkable. The apathy and neglect of forestry in Queensland, New South Wales, and Tasmania are not seen in New Zealand. The forest in New Zealand has been worked energetically and nearly one-third of a million sterling spent on its forest plantations. There was probably not the least necessity for spending that one-third of a million sterling on forest "plantations."

Frequently in discussing forest matters I am met by questions such as the captain of a wooden ship, in Nelson's time, might address to the commander of a dreadnought to-day. The popular idea is that working a forest destroys it, and that to have a new forest you must go to work with a plantation, like planting an orchard or a cabbage garden; whereas the cultivated forest of modern science is a continuous business, the timber always being cut and the cuttings so arranged that the forest is continually being improved. As a rule, Nature's laws which ensure the reproduction and regeneration of the forest are utilised by modern forestry science. In certain cases, where seed and labour are exceptionally cheap, artificial planting and sowing are resorted to, to have time. This is a contingency that is of little interest for Australia, where neither seed nor labour is cheap, and where natural reproduction, especially after a little study, can be effected by the forester so economically and expeditiously.

209.—*Australian official view of Forest lands is "Forest Waste."*

Neither is it realised that the cultivated forest may give more employment, and may carry a denser population, than many Australian farms. The average employment afforded in the forests of Bavaria is at the rate of one man per 130 acres (p. 204). Taking the short Australian working hours, this would be about one man per 100 acres in Australia. It takes 100 acres of good farming land to support a family. It will at once be asked, "How is this forest labour to be paid for?" The answer is, "Out of the £10,000 a day now going out of Australia for imported timber. The bulk of this imported timber comes now from cultivated forests—it will soon be all from cultivated forest. The timber can be grown as well in Australia as in the Baltic countries, or in America. It is simply a question whether the cultivated forest, and the population it supports, should be here or elsewhere. And this has to be remembered: that good cultivated eucalyptus forest (with which I am very familiar in South Africa) will yield more than the best Bavarian forest with its long, cold, dead winter season. It is not to be supposed that, with the present small population of Australia, there will be much forest cultivation on the Bavarian scale at present; but it is necessary to look forward to the possibility of this, and to get away from the official view (p. 164) that all forest is waste and all farm land is population and progress. The real facts may be quite the contrary, as Victoria has found to its cost when it laid waste the Otway forest (p. 18). Only a careful, impartial forest demarcation, worked out on the ground, can settle the question as to what the land is best suited for—whether it be agriculture, cultivated forest, or grazing. The Englishman's conception of the American "backwoods" as typically characteristic of a forest country and how it should be dealt with has been inherited by Australians, and very much to their loss (p. 164).

210.—*The difference between the "Wild" and the "Cultivated" Forest.*

In any scheme of Forestry, the difference between the cultivated and the wild forest must always be borne in mind. In his works on scientific Forestry in America, G. Pinchot, the eminent American Forester, has often urged this point. In his monograph on the Adirondack Spruce he says:—

> A natural forest contains alike, valuable timber, unsound and worthless trees, and species which have at present no merchantable use. The virgin forest is an idle capital. On any considerable tract the growth is about equalled by the loss through windfall and decay.

Yields compared—Cultivated and Wild Forest.—The wild forest is usually characterised by very heavy yields of timber over certain areas, but with a much lower useful and general yield. Some of the record yields of timber from the virgin forests are astonishing—up to 100,000 cubic feet per acre in the case of Redwood and certain patches of heavily stocked Coniferous forest. The Douglas-pine (*Pseudotsuga douglassii*) has perhaps the heaviest stock over any large area; but the general position is that the cultivated forest is much more productive than the wild forest. It is the main part of the science of modern forestry to so regulate the cuttings that the forest undergoes a gradual and continual improvement. Statistics show that the yield from many of the cutivated forests of Europe has doubled during the last half-century. Careful statistics showed that the Prussian forest doubled in value between the years 1850 and 1890.

Sir Wm. Schlich, in a paper read a few years ago at the Colonial Institute, London, showed how a comparatively small area of the well-cultivated forest of Europe would afford a supply of timber equal to that obtained from huge areas of wild forest in Canada. Taking only fairly good productive forests in Canada, his conclusion was that one-seventh of the area of average European cultivated forest would do the work of the wild forest in Canada.

The Douglas-pine, which in various small plantations in England has shown a yield of 200 and 250 cubic feet per acre per year, has a general yield over its wild forests in America averaged at only 12 cubic feet.

We may also note the comparatively low yield of the "wild" forest on the Apalachians, the average "stand" according to Dr. Somerville being only 1,400 cubic feet.

In Australian forests a more rapid improvement may be looked for, since, as we have seen, they are at present in general only about one-third stocked (p. 102). Along with the regulation of the cuttings, they will be improved by the systematic exclusion of fire and cattle, the planting of vacant spaces, and the introduction of valuable exotic trees. This is more especially the case in weak forest floras, such as that in South Africa, or in areas such as the forests of Australia, which have long been sheltered from the competition of a great variety of other species.

211.—*Four years of "Cultivated forest" growth equals a century of Virgin forest growth.*

It will be useful to quote an illustration of the differences that may exist between the yield of a cultivated and of a wild forest, taking not extreme cases but good forest of each class, growing side by side, under the same conditions.

South Africa—Yields of "wild" and "cultivated" forests.—In South Africa, Eucalypt plantations, Hogsback, etc., worked at a rotation of 12 to 18 years, yielded 600 cubic feet per acre per year: the Nilgiris maximum, we have seen (p. 104), was 700 cubic feet. This is about the quantity of timber obtained, when all the mature material is worked, on an average acre of indigenous virgin forest at the Cape of Good Hope (Amatolas). We do not know how long it has taken to produce the stand of timber in the indigenous forest—not less than 100 years, perhaps 200. If we take the mature timber as half the gross yield, and these special Eucalypt yields as half average yields, that would show a yearly yield from the cultivated as about one-quarter the "stand" of timber in the wild forest; or, in other words, *the cultivated forest makes in four years what the wild forest does in from* 100 *to* 200 *years!*

Australia's choice.—This illustration is a good indication of the profits to be looked for in the future, with systematic conservation and cultivation of the wild

Photo: E. L. Mitchell. Vegetation of the inland Forest country: Spring time.

forests of Australia. There is this prospect on one side, and, on the other side, the loss that Australia has now to face through the bad Forestry of the past 100 years, which it is shown (p. 176) will probably total not less than £588,500,000 sterling sterling 30 years hence.

The forests of the world show three classes of forest: (1) the wild virgin forest; (2) the cultivated forest (practically all the European forests are in this class); (3) regular forest plantations.

Australia has a rapidly dwindling area of (1), none of (2), and very small beginnings of (3). For the great bulk of Australian forests, now is the critical time. Will it become the valuable cultivated forest, or worthless scrub and bush? There is no medium course. Fire makes the dividing line sharp and unmistakable.

CHAPTER VII.

Tan-Bark Wattles.

212.—*Natal farms grow profitably an Australian poor soil product.*

Wattle-bark planting is referred to in connection with Wattle destruction in Tasmania (p. 346). Australia was losing, on the outbreak of war, some £250,000 yearly over Wattle-bark, adding together the import and the loss of export; the figure includes Mallet-bark from Western Australia. The export of tan-barks declined from £154,087 in 1905 to £44,610 in 1912, or a loss of £109,477 in yearly export up to 1912. Victoria once supplied all its own wants, and had an export of some £100,000 a year. Now it uses plantation-grown bark, and the tanners have been asking for the duty to be taken off as they say it is impossible to supply their wants without importing heavily. In 1912 local tanners used 26,739 tons of tan-bark, while 8,402 tons only were exported. The loss from the reckless Forestry of the past is naturally more swift and apparent in a quickly-maturing product like Wattles than in timber. Wattles are more easily destroyed by fire and grazing than timber, but they grow up again more quickly.

The general position is that Natal is planting Black Wattle on good agricultural land, while Australia is still destroying tan Wattle and Mallet-bark on poor agricultural land, which poor land, when it produces tan Wattle-bark, is giving its best return. These Natal grain fields are now producing about double the tan bark of Australian forests—in 1912 Australia 34,000 tons, South Africa 59,000 tons. The semi-wild bark coming from South African forests is at present negligible.

An important point to notice is that since the Natal bark is grown on good agricultural land, fitted for cereals, as soon as better Forestry in Australia brings back once more an abundance of bark it will pay the Natal farmers better to grow Maize and other cereals than Black Wattle. They will not be able to pay somewhat expensive imported Indian labour as they are now doing (and lose good land which might be growing a crop of Maize) to compete with Wattle growing wild in the forests of Australia where, ordinarily, the only expense is fire-protection. The area under Wattles in Natal is about 160,000 acres, and, according to the last advices, is not extending. There was an export from Natal in 1912 of 59,000 tons, valued at £283,000.

213.—*Wattle-planting cannot compete with Wild Wattle.*

No doubt the Wattle-bark question in Australia has suffered from the popular misconception mentioned elsewhere with regard to Forestry. The man in the street thinks that Forestry consists in cutting down one tree and replanting another! He does not reflect that for every tree that dies of old age nature will reproduce 100 if it is allowed to. Making Wattle-bark plantations tends to obscure the main issue in Forestry, and deprive Australian forests of part of their legitimate revenues.

Thirty years ago Baron von Mueller, whose usefulness as a botanist caused him to be mistaken as a Forester, advocated the making of Wattle plantations, and it was thought that doing so would prove a lucrative industry. Unfortunately, the cost of doing it was under-estimated. The price of labour has risen, and it is necessary now to go back to the simpler method of taking the Wattle which Nature has planted on the bare hillsides and in the forests; with this proviso, however, that Nature be protected against man and against his fires and grazing animals, for both Black Wattle and the Golden Wattle of South Australia (*Acacia pycnantha*) are particularly sensitive to fire and grazing. Last year one of the Wattle plantations in Victoria was destroyed by fire and almost every forest fire in Victoria and Tasmania sweeps away hundreds of acres of young Black Wattle.

214.—*The choice of Wattles for growing in Western Australia.*

When I was in Western Australia there was a question of a Government grant to encourage Wattle-planting, and the matter has come up in the annual reports of the Western Australian Forest Department. Against such a grant, there are the facts that: (1) Wattle growing is now less remunerative than it was; (2) the returns from Wattle-planting are sufficiently rapid for the work to take its course according to the ordinary laws of supply and demand; (3) the probable success of Black Wattle over only a small area in Western Australia.

In the south-west of the Cape Province of South Africa where, stimulated by the planting in Natal and Eastern South Africa, Black Wattle has been a good deal tried, it has only succeeded where, exceptionally, there was access to moisture in summer. Thus I should only expect Black Wattle to succeed in Western Australia under similar exceptional conditions. It will grow, it is true, in localities where it is very dry in summer, but then only in a stunted form almost useless for bark. The dry summer climate Wattle is the Pycnantha Wattle. Futher than this, Black Wattle (*Acacia decurrens var. mollis,* and probably all its other varieties) is, within my experience, useless for planting on poor soil or for sand-drifts. Black Wattle wants a god soil, and it delights in a cool damp mountaini climate. There may be small areas in the mountains suited to its growth in Western Australia, but the absence of any summer rain in Western Australia is, in my opinion, a bar to the commercial cultivation of the Black Wattle on any large scale in plantations.

215.—*The largest Wattle Plantation in Australia.*

When in Victoria I went over the largest Wattle plantation in Australia, that at You-Yangs. There is a planted area of 3,200 acres there; it is within a few miles of a railway, 35 miles from Melbourne, and 14 miles from Geelong, where there is a good market for all the bark that can be produced. The Wattle planted there is Pycnantha Wattle, the rich tan-bark Wattle of South Australia and the western plains of Victoria. The nearness of this plantation to its bark-market at Geelong enables it to yield the good return of £3 net per acre per year. This is a good return from a poor soil in a dry climate, though it is nothing like the golden

prospect held out by Baron von Mueller in his writings on the subject. At You-Yangs there are 2,200 acres of the Pycnantha Wattle, of which 700 acres is natural regeneration, so that here we have virtually an organised and fire-protected forest. The yield at the end of 10 years is from 5 to 7½ tons of bark per acre. This Pycnantha bark has the *high average tan content of* 46 *per cent.* It is the best tan bark produced in Australia, being some 4 per cent. to 5 per cent. higher than the best Black Wattle-bark.

216.—*The Pycnantha Wattle in various countries.*

Pycnantha Wattle is that which is best suited for growing in the semi-dry districts of Western Australia, such as that along the railway from Perth to Albany. In such country in South Africa and Portugal the Pycnantha Wattle has become naturalised. It there shows a strong natural reproduction and requires no care beyond that of fire-protection; it is, therefore, a desirable tree to introduce to the Western Australian forests. It is pretty certain to run wild there, as it has done in South Africa. It is well suited, climatically, to all the inner coast districts of the South-West, with about 20in. of rainfall.

The Pycnantha Wattle has the valuable property of being somewhat shade-bearing. There is thus every chance of its spreading freely in the Jarrah forest. At the interesting Kuitpo plantation, in the Mount Lofty country near Adelaide, I saw it growing vigorously, self-sown among sparse Gum trees. It is a species which adapts itself to considerable variation of climate outside its natural habitat. Thus, as a planted tree, it is quite hardy at Hobart, Tasmania, so hardy in fact that it is selected, curiously enough, to plant as a memorial tree.

On the Cape Flats of South Africa it was at first rather difficult to get the Pycnantha Wattle to grow; the soil there was too poor for it. Now, in the second generation, after the soil has improved, it seems quite hardy, coming up strongly self-sown. It looks better, generally, in the south-west fertile corner of South Africa than at You-Yangs. In the drier inland districts of Portugal, in Mr. Tate's plantation, I found it growing as well as in South Africa, run wild and coming up self-sown in profusion.

There has been a grievous falling-off in the export of Pycnantha Wattle from Adelaide. It is said that, roughly, where formerly £70,000 worth was exported, the figure has now sunk to £17,000. Nevertheless, there should be trial sowings of Pycnantha Wattle in the Western Australian forests, on the chance of their extending and furnishing a valuable secondary forest product. It is said that with the rise in the price of labour and the fall in the value of bark it will not now pay to strip Pycnantha bark in South Australia; if so, and it often happens that the Pycnantha Wattle grows weedy, extract should be made. I saw a largish private plantation in this condition in South Australia waiting for better times.

But the main factor, no doubt, in the shrinking of this fine industry in South Australia is the want of forest demarcation in the early days, and the alienation of all the best forest on the Mount Lofty Range. Had this remained as State forest, under modern scientific methods, the Pycnantha Wattle would have been propagated and conserved naturally. And it would almost certainly, after supplying all local needs, have been able to compete on the world's markets with the lower-grade plantation Black Wattle from Natal.

Pycnantha Wattle I saw growing well in the Hamel plantation, Western Australia, where two strains of it were cultivated. I understand that in the Ludlow plantation it is growing equally well.

I do not think there is the least doubt about its thorough and early success in Western Australia, though whether it will pay to grow it on cleared land as against

agricultural crops as is done with Black Wattle in Natal, may be doubtful. Its certainty of success is as a semi-wild product in the fire-protected Jarrah forests, and no effort should be spared to disseminate it there, as soon as the first forest is organised and fire-protected.

217.—*A West Australian Sand-binding Wattle.*

As stated in "Drift-sand planting in South Africa" (Appendix II), the Wattle (*Acacia saligna*) has had a wonderful record on the sandy flats of the Cape Peninsula. It has there become completely naturalised, transforming large areas from a barren waste of shifting sand to an area suitable for valuable farms; fixing the sands and improving the soil by the addition of vegetable matter; and, no doubt also, by a fixation of the free nitrogen of the atmosphere, for the roots of this Wattle show the nodules that are associated with the nitrogen fixing bacteria. This Wattle is indigenous in Western Australia; I mention it here in order that its propagation may not be lost sight of where shifting sands have to be fixed. It comes up readily from seed, after boiling the seed in the usual manner; and the seed is easily gathered, abundant, and cheap. It gives a useful tanning bark, though not of the high tan content of the Black and the Pycnantha Wattles. It may thus be used for sand-drift planting, if Pycnantha Wattle is found not to succeed. It may itself not be quite so hardy for sand-drift planting as *Acacia cyclopis*, but even this is doubtful, while its value for tan-bark places it far above *Ac. cyclopis*.

218.—*The tannin dry extract from Quebracho-bark.*

Rather curiously, tannin has not yet had its chemical constitution exactly determined, though it has been made synthetically; but the process gives little promise of any comercial out-turn of synthetic tannin to alarm the grower. It is considered that tan export in the future will take the form of a *dry solid extract*. This will facilitate the making of extract from inferior Wattle-barks in Australia and also facilitate the Wattle-bark industry in the inaccessible forests, to which it has now been pushed by the bad Forestry of the past years. At present the tan extract is being made in increasing quantities from the Argentine Quebracho, and those who are familiar with the huge area of Quebracho forest available in the Argentine are of opinion that in the future the tan market of Europe will be mainly filled up with Quebracho extract. At present French tanners use little else. As has been mentioned, imported Quebracho and Natal Black Wattle are gradually displacing the old Oak-bark industry of England.

219.—*Australian tan-wattles need a tariff protection.*

The question of a tariff protection for the tan-bark industry in Australia is discussed under Tariff, p. 192. On every ground Natal bark should be kept out of Australia as far as possible. It is an economic loss that the raising and export of cereals in Natal should be reduced by growing Wattles as a field-crop, while in Australia, simply as a matter of bad Forestry—mostly delay in organising the forests—Wattle is being destroyed wholesale by burning and grazing. The position with regard to Mallet bark in Western Australia is not so clear. I have discussed that at pages 239 to 241. Australian Forestry requires the help of the lucrative tan-bark industry; the more Natal bark that is let into Australia the more the economic waste in both countries is encouraged.

CHAPTER VIII.

Forest Haulage Animals.

220.—*Hauling gear not economical.*

In areas where there is a good stand of timber a hauling gear works easily, and is probably the most economical means of transport. But a hauling gear is expensive to put up and maintain. A small 10 H.P. one I saw employed in North-West Tasmania cost £270. An ordinary hauling gear will cost £600 or £800, so that to begin with, when the stand of timber is scattered, as happens over such a large area of the forests of Australia, a hauling gear is no longer economical, and "slipping" the timber with animal power has to be resorted to. The question of economically working the forest resolves itself, therefore, into one of what animals are the most economical to employ.

221.—*Dray horses costly to keep.*

In Australia, both dray horses and oxen are used. The dray horse is not an economical animal though it is easy to work with, and farmers prefer to breed dray horses to breeding mules. Merely as an illustration it may be mentioned that the cost of feeding a dray horse in England equals the cost of feeding 13 stalwart labourers in Equatorial Africa. A large German timber company working in a cool climate on the highlands of Equatorial Africa employed a stock of French Percheron horses, a breed unsurpassed in Europe for strength in hauling. I spent some days, a few years ago, seeing the timber-working there. The Percherons did excellent work, but they could not compete against the ordinary oxen of the country *in economy.*

222.—*Mules the cheapest animal for its keep.*

In South Africa, the Mediterranean, and in every extra-tropical country with which I am acquainted, the mule for its feed will do a considerably higher percentage of work than the dray horse. Years ago, the exhaustive experiments undertaken by the Indian Government, before Lord Roberts' expedition to Kandahar, showed that, for what it ate, the mule was decidedly the most economical of all transport animals.

223.—*Oxen the best haulage teams.*

Horses and mules are necessary where quick draught is required, but usually, with timber, it is oxen that will pull the heaviest load, and they will either feed themselves or require the least expenditure on their keep; and here three points have to be considered:—

1. A breed of oxen bigger, stronger, and hardier against heat and poor feeding than the British breeds from which Australian oxen are descended.
2. Buffaloes.
3. Employment of cows for timber hauling.

A powerful ox, suited to the poor, dry grass and herbage of warm countries, able to withstand extremes of heat or cold, and larger and stronger than the British oxen, is to be found amongst the various breeds of Southern Europe, or,

perhaps, more so among those in South Africa; for in both countries are breeds of oxen that have been obtained by centuries of selection for heavy draught work; and in South Africa are oxen which are able to endure far greater fatigue and privation than British breeds.

British cattle are primarily beef or milk breeds. It is many years since they have been bred for draught. When imported to South Africa for milk or beef, they are looked on as of little use for draught, being too small, weak, and delicate. Yet it is these breeds that are used in Australia for draught.

To the Boer for the last three centuries the ox has been his livelihood, and often his chief possession. It is doubtful if better draught oxen could be secured for Australia than the draught oxen of South Africa, though those of Southern Europe are very good. To the South African farmer, whether Dutch or English, the ox is what the horse is to the Australian farmer. A big, powerful, draught ox, able to feed itself, I have seen, or heard of, nowhere in connection with timber-working in Australia.

224.—*Tame Buffaloes the best heavy draught animals.*

In Southern Europe and in India there is an animal, heavier, stronger, and keeping in condition on poorer food than any breed of oxen. This is the tame Buffalo. They are seen throughout the extra-tropical countries of the Mediterranean, but are more abundant on the eastern side. It was they who were referred to as "wild Buffaloes" in a recent war cable as employed by the Italians to drive through Austrian wire entanglements.

In India they are most abundant in the hilly country, especially where the climate gets cooler and becomes extra-tropical in character. It is especially in wet countries, where the herbage is of the thinnest and poorest, that Buffaloes thrive best; they have been used in India for hauling timber from time immemorial. I can recall a sleeper contractor in the hilly country of Southern India working forest in extremely difficult mountainous country. He had teams of oxen and buffaloes. All the heaviest work was reserved for the buffaloes. I have notes of timber-working in Hungary in a timber concession of considerable value, the timber being valued at over £3,000,000, the grantee a Hungarian nobleman. Timber-working there is on a large scale, and among his best animals are draught buffaloes. He has a particular breed of them on which great store is set, and which are milk-white in colour.

225.—*Sentimental objection to Cow teams for haulage.*

Amongst Englishmen, there is a sentimental objection to the employment of cows for draught purposes, but that objection is limited to English-speaking people, and is founded on as little as many of the other traditions which have come down from the British farmer. There is no more reason why a cow should not be put to work than a mare. A cow employed in draught work is more useful for milking purposes afterwards say those who know; and the cow employed in draught work is as strong as the ox. I have a photograph of a mixed team of oxen and cows working in the historic Black Forest of Germany. I saw timber hauling there when on a tour with the English Arboricultural Society in 1913. The use of cows astonished the Englishmen, and the timber-hauler was closely questioned. He said that a team of cows was in every respect as strong as a team of oxen, and better tempered!

In the Canary Islands, cows and oxen work together in hauling carts and waggons; and in India and other countries the same practice prevails. It may be said that this is a small matter, but when large teams of animals have to be kept

for draught purposes, it is necessary that they should be utilised to the fullest extent in order to secure the most economical working of the timber. The Germans say English timber working is wasteful! Said Lord Roseberry in his famous Chatham speech:—"We are a people of *enormous* waste!"

226.—*Forest grazing for the haulage animals.*

I have mentioned under "Demarcation" the practice that prevails in other countries of demarcating into the forest sufficient open land to provide grazing for the transport animals. In many of the Australian forests, it is necessary to go a step further than this, and in order to provide sufficient grazing, have areas in which the timber has been felled and grasses sown. This fits in with the grassed fire-lines described (p. 25) under "Fire-protection."

CHAPTER IX.

Forest Plantations.

227.—*Seeds for Australian Plantations should be a Federal business.*

Seed, as the beginning and foundation of all constructive Forestry, is naturally a most important consideration, but when Forestry is allowed gradually to grow up it is liable to be overlooked. This is reported as having happened in New Zealand.

It was early realised in South Africa that, for the national Forestry of the country, special arrangements were necessary to procure seed. About twenty years ago I erected a large, dry, airy, three-storey building in Cape Town, with properly arranged bins so as to have the seed secure against rats, mice, and insects' attacks. In this building are stored the various seeds iming to hand from the Government plantations and from suppliers abroad. For some years the South African Government had a special collecter in Mexico, and it has, from time to time, arranged for special collections from the various countries whose seeds it was desirable to grow in South Africa.

It is important that such a Government seed store should be established in Australia, *and it should be a Federal business.* There would be no difficulty in arranging the finances of such an institution, because it should be managed merely to pay expenses, and any State, public body, or individual could buy what seed they wished at rates named in the yearly price-list. The prices in this list should be those at which the seed had been obtained by Government, plus the cost of testing, care, and handling in the seed store. It is on this basis that the seed store is maintained in South Africa.

228.—*Forest seed not in ordinary private business channels.*

The necessity of a Government seed store will be readily understood. The seed obtainable through ordinary business channels is only such as to meet the public demand for the growing of vegetables, flowers, and perhaps a few ornamental trees. It has no relation to the great issue involved in growing for economic purposes the trees of a distant country in a new Continent such as Australia or South Africa.

As far as any comparison can be made between the seed issued by the Government seed store in Cape Town and those purchasable from nurserymen, it is found that seed from the Government store is obtainable at only a fraction of the cost of those purchasable at shops. This is natural, considering that the latter can only work on a small scale, while the Government works on a large scale, and has its own sources of supply.

229.—*Government seed comes up true to name.*

Of more importance than the price of the seed is that it be of good quality and true to name. This result is only achieved as a consequence of a continual watchfulness and care. Each parcel of seed, as it comes to hand at Cape Town, is tested for germination and authenticity, by being grown in trial plots under the eye of experienced nurserymen. Many seeds, unless tested in this way, or unless obtained from a particularly reliable source, are valueless. Thus, most of the Eucalypt seeds cannot be distinguished until after germination.

230.—*Method of packing succulent seed for long transport.*

Succulent seeds present some difficulty. Usually when Acorns, Chesnuts, and such seeds are imported from the Northern Hemisphere they arrive in a worthless condition, mouldy, or dried out, so that the germination is gone. I have found after long experience in packing this class of seed that the preferable packing medium is fairly dry earth mixed with dry leaves; in fact the top soil of the forest as usually found under trees; this is the only medium in which the seed keeps good for many years; will keep, in fact, as long as it is dry. The earth must not be too dry or the soil will dry out, and if appreciably damp the seed will, if in the tropics, start germinating; the latter is the lesser evil, so it is better to keep on the dampish side with the dry earth. I have found this mixture of dry earth and leaves preferable to charcoal, cork dust, coir fibre, or any other of the more usual packing mediums.

Some countries have a regulation against the admission of any kind of soil, on account of the danger of importing pests; in such a case chalk may be substituted. Chalk in Europe costs practically no more than ordinary earth, but it does not preserve the seed quite as well as the "top-soil and leaves" mixture. Equal bulks of seed and earth are commonly used; or, to be quite safe, two parts of earth to one of seed.

231.—*Vendors of pure seed in Australia and elsewhere.*

As mentioned in speaking of Forestry in New South Wales, the Eucalypt seeds imported from Australia to South Africa have been mostly obtained through the kind offices of Mr. J. H. Maiden, Government Botanist of New South Wales. The largest and most reliable seedsmen in Europe are Messrs. Vilmorin, Andrieux et Cie, 4 Quaie de la Mégisserie, Paris, France. They not only have a larger stock of seed than any other European nurserymen, but have their own collectors in the extra-tropical portions of France on the Mediterranean. An Italian seed firm who at one time shared the Mediterranean supply of seeds with Messrs. Vilmorin, Andrieux et Cie, was Messrs. Damman & Co., San Giovani è Teducii, Naples, but I understand that their business is closed.

In speaking of the supply of Cluster-pine seed, I have drawn special attention to the fact that the Portuguese Forest Department have offered to supply seed at the same price as the Paris quotations. This is of importance, since Lisbon seed represents the exact climate of South-Western Australia, and the Cluster-pine at Leiría is the finest strain of Cluster-pine known to me.

The two pine seeds used on the largest scale in South Africa have been Cluster-pine and Canary-pine. For the latter a good reliable source of supply at the Canary Islands is Mr. Alfred Perry, of Puerto, Orotava, Teneriffe, who is an Englishman in business and long resident in the Island. He has for several years collected for the South African Forest Department.

For the supply of carefully gathered Eucalypt seed of East Australian Eucalypts the New South Wales Forest Department recommends Mr. Murphy, of Wyong, near Gosford, New South Wales. I have found his seed good and reliable.

An attempt has been made in South Africa to obtain seed by tender through the Agent General in London, but this involves some delay, and there is little real competition. All North European firms should be avoided as they only obtain their extra-tropical seed second-hand, and it is obviously preferable to get it direct.

Seed from North America is best obtained through the Forest Service, Washington, United States.

For the distribution of seeds in South Africa, *see* p. 272.

CHAPTER X.

Softwood Planting in Australia.

232.—*Australian consumption of Softwoods.*

Outside the general Forest question in Australia, or, as a special branch of that question, has to be considered the planting of softwoods. In "Bulk of Imported Timber" (p. 187) it is shown that this means, at present, the economic loss of paying for the carriage of some 50 million cubic feet from the northern hemisphere, requiring on an average a fair-sized steamer of some 3,400 tons arriving every day. The war transport of all the Australian troops to the northern hemisphere was but a flea-bite to this.

And, on top of this, is the loss to Australian industry of the growth and work on the pine timber till it is put on board ship. The cost of the work on the timber and the daily steamer average out to about £10,000 per day. The only remedy for this loss is softwood planting in Australia.

233.—*Western Australia's imports of Softwoods.*

Western Australia imported £120,000 worth of timber for the year ending 30th June, 1913, an increase of £22,000 on the previous year. The figure must rise rapidly with the industrial development of the State. Western Australia has no softwoods now in the forests, but a climate in which softwoods will grow well. This is shown by the South African experience of the last 300 years.

234.—*Curtailment of Australia's supplies inevitable.*

Queensland once had a large supply of softwoods in its forests, New South Wales had a fair supply, and Tasmania had, perhaps, enough for its requirements. But the bad Forestry of the last 100 years has nearly ruined this. Queensland has alineated half its softwood forests; Tasmania has alienated or burnt all its *acces-*

sible softwood, and within a little of its whole supply; New South Wales' softwood is estimated to last only 15 years longer. It will be many years before the best Forestry can increase the present supply of softwood from Australian forests. The prospect for the next 15 or 20 years is a rapidly diminishing local supply of softwoods, and after that either imported softwood, or the timber from local softwood plantations.

A portion of the present supply of softwood comes from New Zealand; but there has been no scientific Forestry there, and the published accounts speak of the early exhaustion of New Zealand supplies, even for home use.

If Australia had started scientific Forestry when South Africa began, in 1883, there would now be in hand a sufficient supply of softwood to make unnecessary a large part of the present importations. I am supposing that plantations of Insignis-pine, Aleppo-pine, and other conifers were then laid down; planted not quite so far apart as they have been planted in Australia (8 feet), but sufficiently far apart to give an early return of a fair second-quality timber. It is curious to reflect that in Forestry where one has usually to deal with such long periods—100 to 150 years for Oak—so easy is Forestry in the fertile climate of Australia, that if only 30 years ago the planting of softwoods had been taken in hand the present loss of £10,000 a day, to pay for the big steamer-load of timber arriving daily, might have been in great part saved.

235.—*Failure of Home Supplies in Europe and America.*

Australia is not the only country that is suffering from the evil of having to pay for imported timber, but there is this difference that, putting aside England and its free-trade nostrums, other countries, even after they have utilised every scrap of waste land, often cannot grow enough timber for the industrial pursuits of their teeming populations. That is the case in modern Germany. About one-fourth of the area of Germany is under forest which is worked according to the best scientific methods, and which is rapidly rising in productiveness; but the industrial development of the country has been rising faster, and on the outbreak of war Germany was importing some £18,000,000 worth of timber yearly from abroad, a figure nearly equal to the gross yearly production of timber from the forests of Germany, of which the value is about £23,000,000.

In France there has been no great industrial development in recent years. Returns indicate that France is now spending £5,000,000 per year on imported timber. There have been considerable fluctuations in this figure, although on the whole there has been a slow steady increase. Thus, in 1880 France imported over £9,000,000 worth of timber (Annuaire des Eaux et Forets).

Italy is now importing £6,000,000 worth of timber per year, and £12,000,000 worth of coal which could largely be replaced by wood-fuel; but Italy is spending one and one-third million pounds yearly on Forestry. The importation and the expenditure on Forestry are both of recent date. They have come with the industrial development of recent years.

England, when the war broke out, was importing yearly the enormous amount of nearly £43,000,000 worth of timber and forest products. In this are included thirty-four and one-third million pounds' worth that climatically could be grown within the British Isles, and nearly four million pounds' worth of hardwoods, most of which might come from Australia. The increase in the last four years (1909-13) was from a total of twenty-five and a half million pounds to thirty-seven and one-third million pounds for timber of all classes, while paper-pulp increased from four million pounds' worth to five and a half million pounds' worth.

The United States of America—which up to 20 years ago was as backward in Forestry as is Australia to-day—is now paying about £3,000,000 a year for imported timber, and that figure is rising by leaps and bounds, the present consumption of timber in the United States being reckoned at three and a half times the yield of the local forests.

South Africa has still to import (while the timber is maturing in its forests and plantations) from £1,000,000 to £2,000,000 worth of timber yearly. The normal timber bill is about £1,250,000.

236.—*Southern Range of the Wild Pines of the Northern Hemisphere.*

Cypresses, cedars, and other conifers represent the first-class softwoods of the Extra-tropics. Busaco Cedar (*Cupressus lusitanica*), now completely naturalised in Portugal, is an incomparable timber. In climates like that from Albany to Perth it flourishes to perfection, coming up freely with a strong natural reproduction. *Cupressus macrocarpa* is only second to Busaco Cedar in growth and natural reproduction, and the timber is nearly as good. Where these two Cypresses flourish, the Deodar will nearly always grow well. Of the planting of Cypresses and Deodar in Australia there is, unhappily, almost nothing to record. No attempt has been made to grow Busaco Cedar forest in Australia, though it grows about as fast as most pines, and is as easy to raise and plant out. There are no plantations either of Californian Redwood or Deodar. Pine timber is the great want in Australia; and it is doubtful whether Pines could be entirely replaced by Cypresses even if that were desirable. Some of the Cypresses, under certain conditions, grow as fast and straight as Pines, while the average Cypress timber, though it has not got the transverse strength of the Pine, is, as a class, more durable.

In Nature, the offshoots from the great Pine-belt of the northern hemisphere have extended in the New World as far as Nicaragua (*Pinus lusitanica*), and in the Old World as far as Timor (*P. occidentalis*). It is a curious reflection as to what would have happened if, in Nature, Pines had spread from Timor on to the great unoccupied area of Australia. Man is now completing this work where Nature has failed. Both on the Andes and in Timor, Nature has taken Pines to the edges of great unoccupied continents, and then, before Nature could overreach slender barriers, Man has stepped in and definitely launched the Pine family in South Africa, in South America, and more recently in Australia. From Timor to Western Australia is a narrow strip of sea only about twice the distance from Tasmania to Victoria. We shall never know how long the southern migration of the Pines has halted at Timor, or if it is the fires that have kept Pines out of the Australian forests.

237.—*Pines though easily naturalised become subject to disease.*

According to Scott Elliot, the Botanist, the Insignis-pine is now quite naturalised in South America. Two Pines have been naturalised in South Africa for about 300 years. They are Cluster-pine (*Pinus pinaster*) and Stone-pine (*Pinus pinea*). After some 250 years of healthy development the Stone-pine developed a fungoid disease which for about 20 years past has threatened to exterminate it. But the indications are now that, as with canker on Larch in England, the worst of the disease has passed, though it may never be possible to grow Stone-pine in large close plantations on account of this disease. A great number of other Pines introduced to South Africa during the last 20 or 30 years seem to be thoroughly naturalised; but time is required to establish the fact of their complete naturalisation. They may at any time develop a fungoid trouble like the Stone-pine. Hence the

advantage of having, not one or two pines, but many pines, in forest plantations. One or two may develop disease: that will not risk the ruin of the plantation.

238.—*The Insignis-pine in Australia.*

In Australasia, the only Pine that has yet been largely planted is Insignis-pine. That, according to present appearances, seems to be completely naturalised. Though a short-lived tree—very often dying straight away at 40 years—it grows with surprising vigour and at a rate far surpassing that of any other softwood, and it shows a strong natural reproduction from seed as soon as the conditions are at all favourable. On the other hand, it shows considerable sensitiveness to fungoid disease. If it spreads naturally in the fire-protected Eucalypt forests of Australia, as I have seen it doing in South Australia, it will be worth millions to the Commonwealth as cheap softwood timber and paper-pulp, while the Eucalypt forests will be straightened up and improved by its presence.

It is possible that when the matter is put to the test other Pines may produce timber nearly as quickly, or of a better quality than *Pinus insignis*. Especially is this the case in Western Australia, where, with the dry summers, the Pines show a better growth than in Australia generally. But, when one considers that Insignis-pine is one of the best timbers known to impregnate with an antiseptic, and probably is a good paper-pulp timber, it seems difficult to imagine a more generally useful tree. Good marketable timber will be produced by it in 25 or 30 years, and the cost of doing this may be set down at three times the cost of planting, for at 4 per cent. compound interest a sum of money trebles in 28 years.

239.—*Pines profitably planted for Railway sleepers in South Africa.*

Plantations of mixed softwoods and hardwoods in South Africa average £8 per acre to the "closing stage." A large part of these are designed for sleepers, and for sleepers almost the whole stem is utilisable. On an estimated yield of 200 cubic feet per acre per year, and the high price paid for sleepers in South Africa, these plantations, it is computed, produce every year a growth of timber which, at sleeper rates, is worth £8 to £12 per acre, or the total original cost of planting. From this has to be deducted the cost of felling, sawing, and loading on to the railway trucks, which in the case of accessible forests is little. And there is an interest calculation also to figure in the cost, for, of course, the timber cannot be cut till sufficiently mature.

240.—*Conditions determining relative Pine growth in Australia and South Africa.*

Canary-pine (*Pinus canariensis*) has been planted along with Insignis-pine, from the beginning of white occupation in Australia, but not on a sufficiently large scale to test its growth, like the growth of Insignis has been tested. On the other hand, through growing more slowly than Insignis, it shows no liability to die off early, and, as far as known, is practically free from fungoid diseases.

As has been mentioned elsewhere (p. App. II.), Canary-pine and Cluster-pine are the two pines that are being grown on the largest scale in South Africa, Insignis-pine being found to be generally less hardy than either. As a general result, it may be said that Insignis-pine does not grow so well in South Africa as in Australia, and that the Cluster-pine does not grow so well in Australia as in South Africa.

This result is explainable by the fact that the great bulk of the pine-planting in Australia has been Insignis, and in South Africa Cluster (Maritime) pine, and that Insignis in Australia gets more of the good soil and climate than it wants.

In New Zealand, where the soil and climate average better still, we see Insignis at its best.

Insignis is the good-soil and good-climate pine of the Extra-tropics, and when it gets these responds by a growth of astonishing rapidity.

241.—*Pines have not occupied poor soils from choice, but under stress in the struggle for existence.*

An important point to remember in Pine-growing is that the Pines grow in poor, dry, and stony soils where other trees will give no remunerative return. They make less demand on the soil than "Leafwoods" for either plant-food or water. Scott Elliot, in his interesting work "Botany of To-day," describes the Conifers, more especially the Pines, as the "Kelts of the northern hemisphere." They have been driven out of the better soils and situations by the more recently developed leafwoods, and they occupy the mountain tops and barren areas where the leafwoods cannot follow them. I have heard it said in the Eastern States of Australia that Pines want good soil. Possibly this error may have arisen on account of the soil requirements of Insignis-pine. That Pine, as pointed out, will not flourish on the poor soils of many other pines.

But the general rule that has been observied in South Africa planting for many years is to put Conifers on the poorest soil, Gums on a better soil, and the northern hemisphere leafwoods on only the best soils, such as alluvium.

242.—*The Cluster-pine recommended for the sandy tracts of Western Australia.*

In Western Australia we may assume that Cluster-pine and Insignis-pine will behave as they do in the west of South Africa, the climates being identical. If so, it will be Cluster-pine rather than Insignis-pine which will be employed for reforesting sandy tracts, the ground being ploughed and the seed sown like wheat. It may be worth noting that though Cluster-pine is usually more slow-growing than Insignis-pine, it may nearly equal it. In the last Yearly Report from South Africa (1912-13), in a very favourable wet mountain locality there is reported a mean "yearly figure of growth" (Acrim) * for Cluster-pine at 12 years of 498 cubic feet; the same figure from a somewhat more favourable area being, for Insignis-pine 571 cubic feet, and for Busaco Cedar (*Cupressus lusitanica*) 222 cubic feet. It will be understood that these Pine figures of growth are from small areas, and are exceptionally high, also they represent the total woody content of the tree, not the sawable timber only.

Some peculiarities with reference to the introduction of exotic pines are perhaps connected with the growth of the mycorhiza at the roots. The observations are very interesting, but cannot be discussed here.

* "Acrim" is a term used by South African foresters to mean the annual increment in cubic feet of one acre of growing timber.—[C.E.L-P.]

CHAPTER XI.

Present Pine Plantations in Australia.

243.—*South Australia producing plantation timber for Fruit Cases.*

Both South Australia and Victoria have grown pine timber on a small scale, "from seed to sawdust." These are the only States in Australia with any old pine-planting. There are small recent plantations of Insignis-pine in New South Wales and Western Australia. At Ludlow, twelve miles from Busselton, in Western Australia, is a little plantation of 570 acres. It is five years old, and for some reason seems to have been made by the Agricultural Department. There is an older, but even smaller, plantation at Hamel (p. 135).

The largest and best plantations of old pine-planting are in South Australia. In both Victoria and South Australia it is a sparsely-grown, coarse-timbered pine that has been raised in cheap sparse plantations, and the timbers have been used for little but packing cases. At Wirrabara, the South Australian Government has a sawmill, and turns out bushel fruit-cases which sell freely at 1s. each, as against the imported cases at the shops costing 10d. each. In 1913-14, 84,000 cases were sold. In a recent letter Mr. Gill tells me that he got altogether 200,000 fruit-cases off 45 acres, which works out to an average of 4,377 cases per acre. These were nearly all Insignis-pine, and were cut at 35 years. This was quite rough timber from trees grown as far apart as from 8 feet to 16 feet. Wirrabara has a 27-inch rainfall. The best pine-planting now to be seen in Australia is at "Whyte Park," near Wirrabarra. This is described under "Forestry in South Australia" (p. 287).

In 1903 the South Australian Government brought out a useful pamphlet written by the Conservator of Forests, on the growth of softwoods in Australia, and the foreign sources of supply: as far back as 1903 Australia was sending nearly £250,000 yearly out of the country for imported pine timber.

244.—*Victoria's estimated stand of Insignis timber = £180 per acre.*

The Victorian experience in softwood planting was given in a paper by Mr. Mackay, the Conservator of Forests, at the Conservators' Conference in 1912, at Sydney. He said:—

Planting 8 feet apart prompts quick growth. . . . . And from about the tenth to the twentieth year onward produces, as thinnings, cut under the selection method, boles about 5in. to 8in. in diameter; fit for narrow flooring-boards, wall-linings, cart bodies, wheel-barrows, and packing cases. In Victoria the timber of Insignis-pine is worth about 11/- to 12/- per 100 feet superficial, (1/4 to 1/5 per cubic foot) when the trees are well-grown and not weakened by many knots. There is on Mount Macedon a stand of Insignis-pine of about 60 acres, the trees being from 45 to 60 feet. The plot is from 30 to 32 years old, and a careful estimate fixes the yield of timber at about 1,900,000 superficial feet or, taking the ruling price, the value of it converted would be at least £180 an acre. We have had several estimates prepared, based on the actual prices realised from thinnings, and the average annual increment of this tree in the soil and climate of the plantation concerned. The probable yield of timber works out at from £150 to about £200 per acre on a fairly conservative basis. . . . . Caution is necessary in planting Insignis-pine. . . . . It is not a long-lived tree, and between its thirtieth and fourtieth year, when fairly mature or approaching maturity, it is sensitive to drought, or even a short period of great heat. This applies especially to stiff basaltic or shallow clayey soils overlying hard sheets of rock. Where, however, the roots can strike deep and penetrate into beds of gravel or boulder clay, it flourishes remarkably well even in dry districts. But it loves cool, sheltered valleys where the hills approach the coast, where it has in winter protection from harsh gales, and in summer the coastal showers and general humidity, where land and ocean currents of air meet.

Laricio-pine—First in quality of timber and second in good growth.

This is his estimate of the Corsican-pine, together with the Pallasiana and Taurica, varieties of Laricio from the Black Sea. In some instances the Corsican variety overtops the Insignis-pine as early as the twelfth year:—

Logs of Laricio, of 14 to 20 years' growth, have been sold and cut up from time to time the boles being 6in. to 9in. in diameter. The timber is dense, even in growth, inter-locked strong, and finer in grain than Insignis-pine. This pine also loves well-drained hill slopes, with an easterly aspect, and flourishes best in cool uplands near the dividing range. Although the rotation will be somewhat longer and the yield per acre less than Insignis-pine, its finer qualities will, to some extent, compensate for these drawbacks.

For Victoria high-level planting he places the Oregon- or Douglas-pine third on his list. It grows best in deep, sheltered valleys, and should never be planted exposed to the wind. Rabbits, unfortunately, do a great deal of mischief to it. He adds:—

It does well in our mountain ranges at fair elevations—up to about 3,000 feet, but it promises the best growth among the hills of the sea coast.

The Cluster-pine, *Pinus pinaster*, is one of the least exacting of pines, growing on the sandy strips of the shore-line, on poor granite drift and on shales and slates, some 50 miles from the coast. It, however, does best on the coast, but it is always a somewhat ungainly tree with an open covert, and a somewhat wide-branched crown. The tree often has a list from the prevailing winds. The timber is cross-grained and somewhat brittle. Our best hope with this tree in South-East Australia I think, is to grow it for the production of turpentine and inferior timber only.

Here the Conservator expresses the common opinion regarding Cluster-pine. As I have shown elsewhere in speaking of the Portuguese Cluster-pine, it may be a much better timber if Portuguese seed is obtained, instead of that from the comparative stunted tree on the French coast, the tree that usually furnishes the Maritime-pine seed of commerce.

245.—*The Pines that progress in Victoria.*

At Macedon there are good specimens of the more valuable pines and conifers generally. I saw also good trees of Sitka spruce (*Picea sitchensis*) and the great western pine of America (*Pinus ponderosa*), together with *Pinus subiniana, P. jeffreyi P. strobus,* Deodar, and the Himalayan spruce (*Picea morinda*).

It makes the mouth water to think what a rich feast of knowledge has been lost here by not making a regular arboretum 50 years ago (p.). Unhappily, the knowledgeable men were too much gathered together in the overgrown capitals, and Extra-tropical arboriculture there was little knowledge anywhere in Australia! There is the same sad reflection when one visits Gosford, New South Wales, and gathers up the crumbs of arboricultural knowledge there.

Californian Redwood (*Sequoia sempervirens*), the most valuable timber on the cooler side of the Extra-tropics and probably in the world, has been grown to a slight extent in Victoria. There are also one or two specimens in South Australia. Whenever the climate is cool and damp enough there is no softwood that can equal this in the quality of its timber, and the growth in fairly good soil is rapid. The isolated tree loses sawmill value on account of the excessive taper, but this is absent when the tree is grown under good forest conditions. This tree should succeed along the mountains from a little south of Sydney to the end of the good rainfall area of the south-east of Australia. *Sequoia gigantea*, the so-called Giant tree (for the Redwood is the taller), is not worth planting for timber by the side of *Sequoia sempervirens.*

246.—*Softwood Forests twice more valuable than hardwood forests.*

It is necessary to be very clear as to the relative merits of hardwoods and softwood. It has been the fashion, in urging the claims of Australian Forestry,

to pretend that the hardwoods of Australia are as generally useful as softwoods. *This is certainly not the case.* The forests of Australia are a very valuable national asset, but their value would have been at least doubled if they had been softwoods instead of hardwoods.

Says the Commonwealth Statistician:—

For durability and beauty the Australian timbers are unsurpassed by any timbers in the world.

This statement is not quite accurate. In nearly every part of the world there are timbers more durable and more beautiful. I once heard an Australian sawmiller characterise such statements regarding Australian hardwoods as "Australian blow" !

The hardwoods are good; they are well worth preserving, but it cannot be regarded otherwise than as a misfortune that Australian forests should contain so large a proportion of hardwoods compared to softwoods. Timber users must have softwood, and if they cannot get it on the spot they will import it: nine-tenths of all the timber cut in the world is softwood. Hence the necessity of making plantations of softwood, and getting softwoods into the existing forests where, as soon as these forests are organised and fire-protected, many valuable introduced trees will spread themselves naturally. This self-spreading, as has been seen, is happening already at one or two points in Australia, and on a rather larger scale in South Africa.

It must never be forgotten that the most valuable timber trees for Australian forests, with certain rare exceptions, are not those which are in the forest at present, but which will be put into it by scientific Forestry. It is only natural that the most valuable trees should be selected from the northern hemisphere, on account of the much larger field of choice.

247.—*Exaggerated notions of vast Australian Forests.*

It is customary when speaking of Australia to dwell on its vast distances, on its wide areas. As regards Forestry, however, there are no vast distances. The area of good timber forest in Australia is quite small, and never could be more under present rainfall conditions. The total area of Australia with a rainfall sufficient to produce a really good growth of timber (rainfall over 30 inches) is only a little over three times the area of the British Isles, and more than half of that is in the tropics.

Australian area with rainfall over 30 inches ..	259 million acres
British Isles (total area)	78 million acres

Thus the extra-tropical forest flora of Australia must be looked upon as within quite a small area, and, as is the case with all small areas, the members have rarely the vigor of larger areas, where the struggle for existence is more intense. In some small islands the forest flora is so weak that the least introduction of stronger forest species, or the least alteration of conditions, will cause it to die out altogether. This happened in St. Helena, where the only trees growing strongly there now are the introduced trees. There are numerous similar instances. A. R. Wallace shows this to be the case generally with island floras, and in Forestry the strong tree kills out the dominated tree in a very short time. In South Africa we see a diminutive extra-tropical forest area with very weak members. No South African species, in a Forestry point of view, is comparable with the introduced species in rapidity of growth or strength of natural reproduction.

248.—*Australian Forests have not yet got their Best Trees.*

The Australian extra-tropical forest flora is larger than the South African, but if we consider the good timber forest as restricted to an area not very greatly above that of the British Isles, it is easy to see how, while certain remarkable trees have been evolved, the best species generally are those which will be culled from the incomparably larger extra-tropical forest flora of the northern hemisphere. It is quite certain that there would have been no practical commercial forestry in South Africa but for the introduction of the stronger exotic trees. It is equally certain that the Australian forests have not yet got their *best* trees, and that the first thing to consider in Australian forests—after fires have been got under—is to introduce the choice extra-tropical trees of the northern hemisphere.

CHAPTER XII.

The Forming of Australian Forest-Plantations and Forest-Nurseries.

249.—*Distinction between "Tree Plantations" and "Tree Naturalisation."*

The Australian forest does not now carry all the timber it could, any more than did the land before the white man came to the country! Everything has been done to stock the land, nothing to fill up the forest! Yet as one travels through these open, half-empty forests, day after day, and month after month, there is no question that forces itself more strongly on the attention of the Forester. The question divides itself at once into: (1) The formation of regular plantations; (2) the introduction of hardy species, which shall spread and make their way in the forest as the numerous weeds do in the open country.

Regular plantations may be formed by merely sowing seed, as in a field of wheat, or the planting out of nursery plants.

The most simple form of plantation is the sowing of Pine trees on sandy wastes. I was near an area of this sort, which has been reserved on the coast near Albany, Western Australia. I trust that the sowing up of this will be proceeded with this winter. Early and late winter are the best in wet situations, mid-winter in dry ones, but it will be necessary to order the seed at once (p. 118). I think it probable that Cluster-pine (*Pinus pinaster*) will succeed better than Insignis-pine, and the seed of Cluster-pine is cheaper than any other, and the poorer the soil the better the Cluster-pine will grow. *Pinus insignis* will give a better return on better soil, and on very poor soil, such as drift sand, will fail.

If there is but a little lime in the soil Cluster-pine will not grow, and then Aleppo-pine must be substituted. There is no great difference in the growth and quality of the timber produced (p. 257). During the last three years, an average of 25 tons of seed has been used in South Africa, the bulk of this being employed on broad-cast sowings. This is not the place to go into the technical details of forest planting, but I may mention one or two points.

The sowing of the seed may be either broadcast or drilled. In broadcast sowing, it is sometimes more economical to sow a sufficient quantity of seed to choke down the weeds at once, and afterwards, when the pines are about 9in. high, to hoe out the surplus pines to a distance of about a foot apart. The alternative is to

hoe out the weeds, but it will depend on circumstances which method is cheaper Drilling makes weeding easier, but it is somewhat more costly than broadcast sowing.

Where the growth of weeds is not feared, and where the sand is not liable to blow, a light sowing is naturally indicated. Sometimes where the ground herbage is not too strong, nor the summer drought too severe, it is sufficient to plough strips four or five feet apart, and to sow or drill along the strips. It is economical, but increases the danger of fire where there is ground herbage. I have used it to some extent on the Table Mountain range, and saw it practised recently on the French "Landes" in Gascony. It may easily reduce the cost of planting by a half!

250.—*Systems of Planting in Nurseries.*

In planting from a nursery in South Africa all the evergreen nursery planting, whether coniferous or not, is done from *trees rooted in planting trays.* The ordinary kerosene tin is split down lengthways, so as to form two trays about 4in. deep. Each tray, measuring about 12in. x 14in., accommodates 25 seedlings. The seedlings are pricked out into these trays, five rows on each side, so as to give 25 plants in each tin, and here they stand, for five or six months for Eucalypts and quick-growing stuff; for a year, or even more, for slow-growing plants. Then, with the first good winter rains, the trees are taken out to the planting ground; each young tree carefully lifted with a planting trowel, and planted out. I think this is the best system of raising transplant for the often difficult work of planting in the dryish climate of the Extra-tropics, where a few days' scorching sun, or hot wind, will kill acres of open-root planting.

The planting tray made of a split kerosene tin costs about a penny; the old kerosene tins being collected from house to house, and sold to the Forest Department at about 2d. a piece. The life of the tins can be prolonged for many years by tarring, and this is usually done in South Africa, except in the case of tins that are being sent away with trees for private planting. A cauldron of hot tar is rigged up, and the tins dipped into it one after another, stood to drain on sheets of roofing iron ranged round, and then put to dry in the sun. Private planters, not too far away, usually return their tins and are allowed for them. These planting trays furnish a strong transplant that carries well. I have known a large consignment of young trees, sent by rail as far as from Cape Town to Bulawayo (say, Adelaide to Brisbane) and plant out quite well. The Railway Department in such cases water the tins on the way. There are, of course, holes in the bottom of the tins for drainage, and a layer of sticks or leaves over the holes.

When I went to British East Africa, I found the natives using the kerosene tins for water buckets, so that kerosene tins commanded too high a price there for use as planting trays. I found it advisable then to use wooden trays made from the durable Cedar wood of the country. These wooden trays in cost, come out a little more than the cost of the split kerosene-tin tray, but they are built to hold more plants. The timber being Cedar is durable, and the trays are worked up from the small stuff which would otherwise be thrown away at the mills. The East African Cedar-wood trays cost 3½d. each or even 4d., but they are made large enough to accommodate 50 plants, so that they come out per plant at about the same price as kerosene planting trays. The wooden planting trays are made up of two end pieces ½in. thick, and the other parts of ¼in. pieces 4in. broad x 16in. long. I see no reason why similar planting trays should not be made out of Jarrah from the mill waste. They would want dipping to preserve them. For them, the kerosene-tar dip would probably be the most economical. On the rubbish heaps of Melbourne, I noticed old kerosene tins carted out by thousands and thrown away.

Of course there are other systems of planting: the single pot or tin in dry countries where planting is very difficult, and open root planting where the climate in winter is damp and mild. In Australia, open-root planting in the English style is usual, but single pots of various forms are also in use. In South Australia considerable planting is done in little pipes of reed, popularly called Bamboo (*Arundo donax*). For the most difficult planting in South Africa I used old jam tins, collected from the rubbish heaps, and split down the sides with a tin opener. This gives as strong a transplant as the planting trays but costs more.

The bamboo-tube has been perfected in South Australia, and used there for a number of years. The reed (*Arundo donax*) is grown in special plantations and a little steam engine employed for cutting up the sections. But I have found that even in South Australia the system has great limitations. *It will only succeed with certain species,* usually Eucalypts, and other species have to take the chance of open-root planting, or not be planted at all! Thus, for instance, a good deal of difficulty has been found with planting *Pinus canariensis*. In South Africa, with the tray system of planting, I cannot remember any particular difficulty in the planting of Canary-pine!

I tried the "Bamboo system" many years ago in South Africa, as soon as I heard of its being employed in Australia; but with no success. Latterly, again on hearing repeated accounts of its success in South Australia, I determined to give it a thorough and systematic trial in South Africa. It was then tried in various nurseries by different nurserymen, but always with the same result. There was a heavy percentage of failures in the nurseries, and the transplants that survived were poor and weak, compared to those in the kerosene trays. The system was then finally abandoned in South Africa.

251.—*Cost of the Bamboo-tube system of Planting.*

Mr. Gill, Conservator of Forests, South Australia, has kindly given me the following note of details of nursery charges worked out by an experienced nurseryman:—

BAMBOO-TUBE NURSERY PLANTS—PER 1,000 PLANTS.

		£	s.	d.
Cutting reeds	Per 1,000	0	5	6
Plunging	do.	0	0	9¾
Carting soil and filling up	do.	0	0	6½
Sowing	do.	0	0	9¾
First taking up and thinning	do.	0	4	5
Replunging first time	do.	0	2	2
Taking up second time	do.	0	1	8
Replunging second time	do.	0	2	2
Taking up for planting	do.	0	1	8
Watering	do.	0	1	8
		£1	1	5

The Bamboo-tube planting compares thus with other systems of planting in the same nursery:—

		£	s.	d.
Pot plants, per 1,000		1	13	0
Plants raised by cuttings, per 1,000		0	14	3
Open root—	Pine seedlings, per 1,000 .. .. 5. 6d.	0	13	2
	Bedding out and hoeing pines, per 1,000 7s. 8d.			

The opinion I have formed, after seeing the "Bamboo" system of planting in South Australia, is that where the Spanish reed can be grown easily and to a large size, the planting in reed sections system is economical and useful for the most

difficulty dry-country planting. But it rarely gives strong-growing transplants like those in the ground, or in pots, or in trays; the reed sections are of so small a diameter and the root system is so pinched, that the transplants are always stunted and many species will not grow at all in the reeds. Eucalypts are what is commonly raised in the tubes in South Australia, and probably Wattles would do equally well. Pines usually fail. On the other hand, it may be argued that a transplant of Eucalypt or Wattle, to be of use for transplanting, should be restrained or stunted, either by top-pruning or root-pruning, or growing in a pot or pan. The reed section does the restraining successfully, and gives a transplant which is ideal for the most difficult dry-country planting, provided the tubes can be obtained large enough, but this proviso is a difficulty which cannot readily be met.

252.—*Dry-Country transplanting needs special care.*

For really dry-country planting, the trees must go in with absolutely no disturbance to the root, and at the same time, they must be strong, healthy transplants. The most practical way of effecting this is a twist of tin, which can be unwrapped and used over again, or a cylinder of prepared cardboard, which can be inserted into the ground with the transplant. A good many kinds of prepared cardboards and thick paper are on the market now, being used for flooring purposes. It is just a question of which of these can be obtained cheap enough, and preferably ready-cut-up for use in pieces about 4½in. x 7in., so as to give a little planting tube about two inches in diameter, and five inches deep. I saw one or two forest nurseries in Australia where such tin-twists were used with entire success.

253.—*The "Failure" Patches from sowing broadcast.*

It often happens that in broadcast sowings, the seed will fail in patches. Water may stand there in winter, or drought or brackishness may strike in summer. Within a few yards away, the young trees may be standing too thick. Then, it is best to shift a sufficient number of transplants, with a circular planting spade or an old sharp miner's shovel. Where sowing has failed once, it is likely to fail again, whereas a transplant in a shovelful of earth is the strongest and safest form of transplant. Planting transfers are sometimes very useful, and a little money spent on it may transform an ugly piece of irregular planting to good regular planting. Irregular planting has to be avoided, not only for its own sake—the spoiling of the timber, but in order to keep clear of the patches of weed growth and the danger they present from fire.

254.—*The choice of Planting-distance.*

The common planting distance in forest plantations in Australia is 8 feet x 8 feet. For Pines this is excessively wide, even for the fastest growing. It may bring in a heavy bill for weeding and pruning, and it must give inferior timber up to the time that the plantation closes, and for some time afterwards. These are the truisms of Forestry. Planting in South Africa has not been further apart than 4 feet x 4 feet for Pines, or the near equivalent 5 feet x 3 feet to make cleaning and weeding easier. Nevertheless, with the very quick-growing Insignis-pine in Australia, good results have been produced with the wide 8 feet x 8 feet planting, when the cost of better-class close-planting would have been prohibitive. Insignis-pine is a phenomenally fast grower. It soon closes, and then takes a better shape and makes a better class of timber. The matter is largely one of expediency. Where large areas have to be covered, the cost kept down, and the timber required is only of a coarse character—such as packing cases and sleepers—it is evident that

the wide Australian planting may answer the purpose, and be economical. I saw some Insignis planting in South Australia, done originally at 8 feet x 8 feet, and now a picture of good growth; tall, clean stems, 100 feet high. The only bad effect of the wide planting here will be some coarse wood, and live knots in the centre and near the base of the logs; no detriment at all for packing cases. Where a better class timber for flooring-boards, shelves, and joinery is required, closer planting is necessary. A finer grade timber demands better work. To a great extent the Forester has in his own hands the moulding of the timber that he produces. Certain trees, too, denizens of open forest such as Canary-pine, get along fairly with very wide planting.

Funds available, weed growth, quality of timber required, have all to be considered. I am of opinion that South Africa might have often employed cheap inferior open planting and saved money. It is *certain that Australia has erred in always putting in very low-grade open planting.* It is mainly this that has given Insignis-pine its reputation as a coarse timber in Australia.

255.—*Risks incidental to pruning.*

There may be a difficulty in the future with wide planting in Australia in this way. Wide planting necessarily means pruning until the planting closes. Foresters do not prune conifers in Europe on account of their liability to fungoid diseases. It is held in Europe that a tree is much more liable to the entrance of disease germs when a branch is severed than when a branch falls off in the ordinary course of decay and the growth of the tree; but this danger, this liability to fungoid diseases, is much lessened in the Extra-tropics. It is the common practice in Mediterranean countries, to prune conifers freely. Often every side branch is lopped from top to bottom, and the trees get no disease. It may be that the Extra-tropical pines are generally more resinous, and thus more self-protective when a branch is cut; it may be that the generally drier climate of the Extra-tropics is protective; but, in any case, here is a possible danger ahead with wide planting and pruning; a danger which might be escaped while the Pine-planting was confined, as at present, to comparatively small scattered plantations, but, which would make itself felt with the advent of larger plantations. *Pinus insignis* seems somewhat liable to fungoid diseases.

256.—*Weeding essential to success in dry climates.*

A dry climate renders the total suppression of weeds a necessity in any style of planting out. Without weeding, little of the planting survives the first hot season in South Africa. The weeding is accomplished by ploughing between the lines of planting with a light plough and mule. On ground that will not plough, scarifiers are in use. On mountain slopes where hand hoeing has to be resorted to, the expense of planting is greatly increased. This has to be remembered in connection with the small value of timber grown in inaccessible mountain forests.

257.—*The system of "Cut and Mulch."*

When it is necessary to plant-up glades in heavy forest where there is a fertile soil the cost of continued weeding would be prohibitive without the adoption of what is known as the "cut and mulch" system. Before this came into use I have known the cost of cleaning and weeding render planting impossible in just the place where it would give the best timber—a rich fertile forest soil. The more the ground is cleaned and worked in such a locality, the more vigorously come up the weeds. On the "cut and mulch" system the weeds are allowed to grow so high that they come near to injuring the planted tree; then they are *cut with a sickle and*

laid round the planted tree. Not only is the cutting with a sickle less costly than cleaning with a spade or hoe; but, the mulching stops the further growth of weeds; and, as every cultivator knows, keeps the moisture in the ground, and finally enriches the ground by its decay. I have not seen this system described in text-books, but it is often the *sine qua non* of forest planting, and deserves particular mention here. It is practised by some Australian Foresters, but not generally.

258.—*"Thinning" in its Woodcraft and Economic Phases.*

Thinning is an essential part of woodcraft. In nearly every part of the world, amateur tree-growers want to thin too heavily. The Forester has to make up his mind to some expenditure over the first thinnings; but, with better (closer) planting than that practised in Australia, if the locality is accessible and other circumstances favourable, there should be thinnings at from 15 to 30 or 35 years of age, that may wipe off all the debt on the plantation, leaving the trees then to grow unhampered by debt to the age of maximum yield. This is a matter of calculation between the incremental value of the timber as disclosed by periodic valuation surveys, and the growth of the capital value of the stock at current rates of interest; and this again checked with the general cultural rules of thinning:—(1) Keeping close canopy till full height growth is reached; (2) watching crown development. In the case of inaccessible forest the Forester is often confronted with grave difficulties. It will not pay to thin, and all that can be done is to leave to Nature the suppression of the weaker trees. This has actually happened in parts of South Australia. I may once more urge here the primary necessity of accessibility in choosing sites for forest plantations in Australia.

259.—*The selection of a Plantation Site.*

It is necessary to avoid the error, common with popular writers on Forestry, that any bad land is good enough for forest plantations. This is only true so far as that it is advisable to avoid land which has both an agricultural and forest value. Whether or not this can be done, it is certain that almost everywhere in Australia, land for forest plantations must, wherever droughts are to be feared, be deep and moist. It may be very stony, but must be penetrable by roots.

At the Sydney Conference in November, 1911, there was an interesting discussion on this point. Mr. Rodway, the Tasmanian Government Botanist, coming from a usually damp climate, expressed the popular view of the matter, while the Conservators of Victoria and South Australia expressed the opposite view. Said Mr. Gill, the Conservator of South Australia, speaking of the comparative requirements of cereals and trees:—

> The great importance of selecting land for tree planting with a good subsoil is at once apparent. If a surface soil is poor it can be enriched, but if a subsoil be bad, it can never be changed for a good one. . . . . It is the good subsoil that backs up the tree in times of drought. We want the very best land in South Australia to grow Eucalypts. Of course the very best land for Forestry purposes is one thing, and what is the best land for Agricultur e is another.

Mr. Mackay, the Conservator of Victoria, pointed out that in natural forest in Victoria, the best timbers grew, not on the richest soil for cereals, but on the strongest soils, that is to say, soils rich in plant food, and open enough to be penetrable by plant roots.

260.—*Deep Soil indispensable to successful Plantations.*

The necessity for a deep soil in a dry climate was clearly shown in the forest planting that I saw in the island of Cyprus. Following the North European practice, attempts had been made to plant on rocky hill-tops, and always with complete

failure. In Cyprus the soils were generally good. Cereals or agricultural crops could be grown anywhere where there was soil, but ground fitted for planting required the most careful selection. Only where there was an *abundant subsoil moisture* was it of the least use attempting to plant forest trees.

It is necessary to mention this point here, because it is the reverse of European practice. In countries where there are no droughts it may be quite sound financially to attempt to establish forest plantations on poor soil, because the general effect of forests is to enrich the soil; but the general effect of planting in the extra-tropics, even in a country with so temperate a climate as Tasmania, is that shallow soils must be avoided. This is proved by the poor growth of trees on the Domain, Hobart, where, in spite of a moderate climate, where droughts are not very severe, the growth of trees is of the poorest.

CHAPTER XIII.

Considerations of the Cost of Plantations.

261.—*Wages costs of Plantations.*

In South Africa, near Cape Town, not where there is cheap black labour, but where the general average of prices is similar to prices in Australia 10 years ago, the average cost of the Railway plantations has worked out to £8 per acre. This is the cost up to the time of the complete closing of the planted trees. It is a good average figure to instance, because these plantations were begun comparatively recently, when, with the knowledge previously acquired, there was no waste in experimental work. The Railway plantations were established from the outset on a purely commercial footing.

At the Sydney Conservators' Conference, the South Australian Conservator, Mr. Gill, who has had the greatest experience in Australia in planting, gave the following figures for three types of plantation where the cost of clearing the timber varied:—

	Per acre. £ s. d.
Kuitpo, in the Mt. Lofty country, where there was heavy timber clearing	9 16 9
Mt. Burr, moderately timbered land	8 3 9
Mean cost of planting 428 acres of lightly timbered land	4 7 6

Comparing South Australian and South African planting, it must be remembered that two different things are compared, the planting in South Australia being done at 8 feet apart (680 trees per acre), and that in South Africa at distances, varying according to the character of the trees, from 3 feet apart to 5 feet apart (say 3,000 trees per acre). In New Zealand, where the planting was of a quality similar to that in South Africa, the cost was somewhat above that in South Africa, owing to labour being higher, though the cost of the New Zealand plantations has been kept down by the considerable employment of jail labour. The same cause operated in South Africa, where, in the large plantations near Cape Town, jail labour has always been largely utilised.

262.—*"Failure Patches" to be replanted once only.*

The usual planting rule is that, before proceeding with new work in any area, the failures in the planting of the previous year are replanted. Neglect of this rule has produced considerable irregularity in Australian plantations and exaggerated the already too wide planting. It must be remembered that vacant spaces in a timber plantation are liable to become covered with undergrowth, and thus invite fire, while every irregularity means an inferior quality in the timber produced. At the same time it is possible for an enthusiastic forester to carry "replacing failures" too far. It is rarely successful beyond the first year. By the second year the difference in size between the trees being planted and the planted trees is such that it becomes nearly useless to attempt to replace failures, or, if it be done, the cost is not commensurate with the expense.

It should be remembered that it is exactly the wide planting that has been followed in Australia that requires particular attention to be given to filling up vacancies.

263.—*Interest charges against plantations limit the profitable sizes of trees:*

In the discussion of "Working-plans" reference is made (p. 72) to the points requiring consideration in financing a plantation. The interest charge on the prime cost may be noted here. Taking this at 4 per cent., the rate at which the State borrows, we have a plantation costing double in 20 years, trebling (rather more) in 30 years, becoming four times in 35 years, the age at which Insignis-pine, when it grows well, will have reached its full maturity. For timbers that mature later, the interest charge piles up at a rate far beyond any growth value which can be added by the timber, and then it becomes necessary to crop the timber, even though it be immature, and even though cropping immature timber entails the cost of subsequent treatment by impregnation. Thus, at 50 years the original cost of planting has to be multiplied by 7, or, in 60 years, by 10½ times, while by 80 years, which is the common time for quick-growing coniferous timber to mature in Europe, the *original cost of planting* has to be *multiplied by* 23 *times.*

If there are no plantation charges, as in the case of the wild forest, or introduced trees spreading self-sown, then the stock value of the timber begins piling up interest charges just as soon as the first marketable age is reached. Hence the value financially of a pine like Insignis, which reaches a good sawable size, say 15in. or 18in. in 25 or 30 years, and which also readily takes an antiseptic. In such a case we get rid of all the interest charges while the timber is maturing. A consideration of these interest charges shows how it is that foresters in the highly cultivated Black Forest of Europe aim at an ideal timber of only 12in. in diameter.

264.—*Trees planted in sandy soil need Manure.*

As in the case of the poor sandy lands near Cape Town, there is also much land in Western Australia which, though deep and fitted to carry a fine growth of timber if once the timber were established, is at present too poor on the surface to grow either cereal crops or trees. Near Perth I was shown land which had been proved to be of an open sandy nature to a depth of over a thousand feet. Such land is of first-rate quality for timber-growing, provided the surface soil can be improved. The question of forest manuring has then to be considered.

In dealing with similar land in South Africa, I made it a practice, when planting a tree, to put in a handful of prepared bone-dust. The bone preparation cost little. The bones were purchased wholesale from a dealer and prepared by

Insignis Pine, 12 years old: Hamel Plantation, W.A.

Photo: W. F. Hooton.

burning, roughly pulverising by hand, and then left to partially decompose mixed with fresh stable-manure. The net cost of this surface-fertilisation for the soil was calculated at less than the cost of one hand-hoeing, and it being mountain work where either ploughing or scarifying was impracticable, it was considered that the growth of the trees in this instance was so stimulated as to save the cost of one hand-hoeing. The use of the bone manure had the further precious quality of feeding the infant tree until it had grown up and could get its roots into the deep subsoil, and thus obtain its own plant food. It must be remembered that in the economy of the tree a little phosphate-manuring goes a long way, and whatever there is remains for the tree growth; it is not, as with agricultural crops, carried off with the crop.

In Matthew's work on "Tree Culture in New Zealand" it is stated that 120 lbs. of bone-dust per acre costing 5s. 6d. doubles the growth of planted Blackwood (*Acacia melanoxylon*).

In planting poor but deep soils in northern Belgium, in the country known as the Campine, fertilisers have been used with advantage, and in planting poor moorland in Scotland, basic slag has been used with the best effect.

It must be remembered that these are exceptional cases, but the exceptional conditions appear to exist in Western Australia, where there is great depth and moisture in the soil but poverty at the surface.

265.—*The Hamel Plantation in Western Australia.*

I had an interesting day in the small plantation at Hamel. The points chiefly noticeable there are:—

The fine growth of two or three Camphor trees in damp ground. As mentioned elsewhere, the Camphor tree is only suited for planting in Western Australian localities where there is a complete and unfailing supply of subsoil moisture during the summer, but the growth of these trees is very encouraging.

The Insignis-pine, though not seen at quite its best in Hamel, shows an excellent growth. It averages a height growth of nearly 4½ feet per year, up to 16 years; and it grows 6 feet per year during the first 8 or 10 years. But a good many of the trees show the defect observable in Insignis-pine when not growing at its best. The tree ceases its regular growth and sends up a long leading shoot, the "Rat-tail" Insignis-pine of South Africa. It was perhaps injudicious to photograph and show these trees in one of the Annual Forest Reports, because under more favourable conditions a better growth would be assured. As mentioned, the Insignis-pine will show its best growth in Western Australia on cool mountain slopes.

The nursery work at Hamel is excellent. I was particularly pleased with the large shade house, and the careful packing of the trees sent by rail. There were some interesting special cultivations there, such as *Callitris arborea*, the Cedar from the Cedarberg in South Africa (p. 35), and the Silver-tree (*Leucadendron argenteum*) from the slopes of Table Mountain. It would probably be more economical, and certainly produce a more efficient transplant, if the young trees were raised in trays (p.). For this purpose Jarrah trays, obtained from the Government sawmills, will probably be the most useful. The omission of the usual arboretum is regrettable, and also the restriction on the issue of the trees (p.).

266.—*Planting Conifers with other Trees.*

Eucalypts and Pines.—Planting Conifers amongst Eucalypts is more fully discussed under Forest Management and Working Plans, with regard to filling up

the Jarrah forest with pines (p. 79). It is one of the safest ways of planting Conifers in Australia. As a rule, Conifers are easy to raise in nurseries (taking precautions against "damping off"); they have an abundant natural reproduction, and shed so much seed that very commonly, even when the forest is burnt, there is enough seed in the ground to produce a complete restocking. Conifers yield about nine-tenths of all the wood that is used in the world, so that ordinarily they are the first chosen forest trees to propagate. They can grow on the poorest soils, and in the most unfavourable situations: the broad-leaved trees have gradually pushed them out of the best soils. Scott-Elliot for this reason christens them the Kelts of the forest world!

267.—*Mixed trees are an insurance against Pests.*

But Pines, and most Conifers, are particularly subject to fungoid diseases and insect pests. They came into the world before the leaf-shedding trees which have displaced them from the best soils. The more recent development of the leaf-shedding trees is probably due to the fact that, renewing their leaves, they start every spring afresh with renewed youth and renewed growth organs.

In Europe, the general position is that it is more profitable to grow pines and conifers than leaf-shedding trees, but there are risks and limitations in doing so. In the warmer lowlands of Europe fungoid and insect pests are so troublesome that it is either not safe to plant large areas of pines or conifers, or else it is considered wise to mix them with leaf-woods. Forty years ago the invasion of "Nun" caterpillars in Germany caused a devastation such as the traveller now sees in passing through the burnt forests of Australia. It was not merely trees suffering in their youth, and dwindling, as one sees commonly happening when conifers are attacked by fungoid or insect pests, but this "Nun" caterpillar pest, after two or three years, had entirely killed the forest. One travelled mile after mile through a blackened and absolutely dead forest; it was exactly as if fire had passed.

It is unlikely that any very large areas comparable to the pine forests of the northern hemisphere will be planted in Australia; but in the meantime, it is well to be on the safe side, to keep plantations, as far as may be, small and isolated, and particularly, on more grounds than one, *to mix the Pines with the Eucalypts.*

268.—*Extensive Plantations not advisable in Western Australia.*

With the present cost of labour, it seems doubtful whether any extensive plantations should be undertaken in Western Australia, except where a good growth can be assured, with a rainfall averaging not much below 30 inches. Of such a rainfall, the area on the rainfall maps appears to be somewhat less than that of Ireland. There is a larger area within the 20in. zone, which appears on the rainfall map about equal to the area of England and Wales. Partly within this area is the eight million acres of Jarrah forest, the area which is discussed (p. 79) as offering such a strong inducement for planting to fill up the poor Jarrah forest with Pine plantations. As a class, Pines can be grown remuneratively on poorer and drier soil than hardwoods; and, as a general rule, the great bulk of planting should be Pines and softwoods.. Only exceptionally should there be planting of hardwoods. The hardwood planting in South Australia has been the least successful. Except to regularise existing forests, it is difficult to justify the planting of hardwoods in Australia; and it is certainly absolutely illogical to leave hardwoods to be burnt in the forests, and spend money on hardwood plantations, as has been done to some considerable extent in the Eastern States.

269.—*The general forward movement in Plantation Enterprise throughout the World.*

The extensive plantations being made by the Japanese are referred to in contrast with Queensland Forestry (p. 297), and with France (p. 81). These, of course, are only instances of the general planting that is going forward everywhere where systematic Forestry is practised. South Africa has now an area of some 80,000 acres, planted in 163 separate plantations, the largest about 6,000 acres (Appendix II.), Up to March, 1912, the total cost had been £881,115, and the revenue £267,644. Nearly all of this revenue has come from thinnings, the main crop not being yet mature. In addition to this, some £500,000 worth of trees are being planted yearly in the indigenous forest to fill it up and protect the edge against fire. This is mostly Australian Blackwood.

The United States of America is now planting not much more than South Africa, but the intention is to raise the planted area to 200,000 acres yearly. It is estimated that planting can be done at a cost of £5 per acre, so that the planting expenditure contemplated is about £1,000,000 yearly.

CHAPTER XIV.

Organisation of Department.

270.—*Training and recruiting Australian Forestry Staffs.*

When once a forest policy has been settled, the most important point for consideration is the Forest Staff. Usually, in the early days, competent men with local knowledge are appointed to carry out certain forest duties, but as soon as a forest policy is settled, a trained staff with some knowledge of Forestry becomes necessary.

It has to be remembered that an organised staff, besides being more efficient, is more economical. The Forest Departments at present existing in Australia are usually deficient in both rank and file, and professionally trained Chiefs. In South Africa the controlling staff are men with a University training, while the Foresters have a practical knowledge of wood craft, and receive a remuneration that permits of their number being multiplied to meet the needs of forest organisation. The Forest Services of other countries are similarly organised. It is not necessary to multiply examples. The number of men employed in the Russian Forest Department, where there is a huge area of wild forest to deal with, has been already referred to, viz., 32,000 subordinate and 1,400 superior officers, and 3,022 officers of intermediate grade (p. 70).

The trained forest staff may be recruited in two ways:—(1) Getting trained men from abroad; (2) Sending abroad picked local men for a training in Forestry. Both courses have been adopted in South Africa.

"The forests of Norway, Sweden, France, Germany, and India have become great national possessions because they are managed by responsible, skilled directors—men who have spent their lives in the study of forestry and its attendant industries, and who exercise a power backed by extra knowledge."—Melbourne *Age*, 22nd August, 1914.

271.—*Anomalous position of the Staff in Western Australia.*

Since the death of Mr. Ednie Brown, who was not a trained Forester, the Forest Department in Western Australia has been carried on by the Chief Clerk, under the title of Acting Inspector General of Forests. But the office work is naturally not the most important part of the duties of the Chief Forest Officer; and the question naturally arises, who should be appointed to take up the duties of Conservator of Forests. The matter, I understand, has been in abeyance for 12 or 13 years, not only with incalculable loss in the administration of the fine forest estates of Western Australia, but to the hardship of the Forest Department itself. I submit that, after these years of waiting, suspense, and necessarily low pay (because next to no work was being done in the forests) it is now the manifest duty of Government to deal liberally with the present forest office staff.

272.—*Chief Officers should be selected from countries having similar climates.*

South Africa as a recruiting ground.—For the post of Chief Forest Officer, who (in accordance with the practice prevailing in other English countries) should be called "Conservator of Forests," I cannot recommend that a man be obtained in Europe, the conditions of Forestry in the cold temperate climate of Europe differing so greatly from those in the Extra-tropics. The trees are *all* different, and the conditions under which they grow are widely divergent. Often, what is right in European Forestry is wrong in Extra-tropical Forestry. In European Forestry the main controlling factor is light; in Extra-tropical Forestry it is moisture. A trained Forest Officer from Europe in Western Australia would have nothing more than the bare theory of Forestry to his credit, and he would have much to unlearn. He cannot always do this, and then there is disaster. This has been seen in South Africa in certain cases.

The same remark would apply to a Forest Officer obtained from India. India is a world in itself, with social conditions quite at variance with those prevailing in a British colony. In addition to the great difference of climate, there is a different system of forest administration and methods which are foreign to those prevailing in Australia, in South Africa, and in the United States of America.

Obviously the natural course is to obtain a Chief Forest Officer from a country where the climatic conditions are similar to those in Western Australia, viz., from South Africa, the Mediterranean, California, or South America. It is not necessary to consider South America. It is Spanish, and only with the beginnings of Forestry. South Africa is naturally the first country to suggest itself. The *cultivated* forest trees, and climate, are the same; and conditions are similar to those prevailing in Australia. I am referring, more particularly, to the Cape Province of South Africa, than to the warm parts where there is cheap black labour, Indian and Kaffir. Cape Town, in mean temperature, comes between Melbourne and Sydney; and the outdoor labour, though coloured, has rates of pay that do not differ greatly from those of Australia ten years ago. Indoor skilled labour is usually white, and quite as costly as in Australia.

Practically the whole of the forest staff in South Africa is white. It has been computed that the personnel of the forest staff in South Africa is about equal to the number of white Forest Officials employed in all the Indian Forest Department. In the only indigenous forest which is much worked in South Africa, Knysna, the bush-workers are white; their earnings differ little, as far as I can learn, from the average earnings of splitters and bush-workers in Australia. Ploughing—one of the chief items of expense in forest work for planting and for fire-lines—averages somewhat cheaper in Australia owing probably to the greater fertility of Aus-

tralia and the lower price of fodder. Thus we arrive at the result that the climate and trees in extra-tropical South Africa and extra-tropical Australia are the same, while the working forest conditions closely approximate. Systematic Forestry began there thirty years ago. The progress that has been made in South Africa with systematic Forestry is described at considerable length (pp. 399 to 402 and pp. 122 to 130). South Africa would thus seem to be naturally the country in which a Chief Forest Officer for Western Australia should be sought.

273.—*Foreign travel indispensable for supplementing local knowledge.*

At the same time, I am of the opinion that facilities should be afforded to Forest Officers to acquire, by foreign travel, a knowledge of forestry, apart from local knowledge. There is ample precedent for this. Agricultural, geological, and other students have been sent to America and Europe by various Australian Governments for many years. In the early days of India, while the forest staff was being formed, the existing members who were lacking in a knowledge of Forestry were sent to Europe for a course of study and travel. For many years there were regulations in force enabling Indian Forest Officers, when on leave, to study Forestry in countries abroad, at fixed allowances from the Indian Government. The advantage of such a training will naturally depend to a considerable extent on circumstances, and on the age of the student. A middle-aged man cannot be expected to go to school again; and if he did, would not follow the same lines of study as a junior.

274.—*A Plea for a Federal School of Forestry.*

In the natural course of events a Federal Forestry School will be established in Australia. I trust that this is near at hand. With £10,000 going out of the country *daily* for imported softwoods that could easily be grown in Australia, we may consider that a school of Australian Forestry would pay for itself the first day it was started. In the meantime, the selection of capable juniors on the present Staffs, and training them in Forestry in some Extra-tropical country where scientific Forestry is practised, should be considered.

Many South African forest officers have been trained abroad. Five have been trained by Sir William Schlich at the forest schools at Cooper's Hill and at Oxford, in England, while two have been sent to the Yale Forest School in America. Three (including myself) were graduates of the School of Forestry, Nancy, France. But the larger number have been trained at a forest school instituted in South Africa in 1904. This Forest School is now no longer in existence, partly because it was found that the number of men required for the higher forest training in South Africa was not sufficient to support a forest school in itself, but chiefly because there was no forest in South Africa that had been treated scientifically long enough to afford the practical instruction necessary for students in Forestry. Thus, the South African forest school has now been converted into a school of secondary forestry training, similar in character to that at Creswick, in Victoria (p. 322), and to the forest school in connection with the Adelaide University (p. 284).

For a secondary forest training, I recommend that students from Western Australia be sent to Creswick or Adelaide, or Mr. Maiden's forest class at the Sydney University, followed by a year at Tokai, near Cape Town. The forest school at Creswick is better equipped than that at Adelaide, but at neither is there a forest which has been systematically treated for a long enough time to now afford a complete course of study. At Tokai, near Cape Town, there is an arbore-

tum which is, I believe, unique in the Extra-tropics, though I have not travelled in South America nor seen the trees in the Botanic Gardens at Buenos-Ayres.

For the higher forest training, South Africa is now taking Rhodes' scholars, trained at the Oxford School under Sir William Schlich, but this is only a temporary arrangement; Sir William Schlich is himself retiring in two years. If there were a good "School of Extra-tropical Forestry" in Australia, with arrangements for a finishing course in Europe, probably South Africa would send students to the Australian Forest School.

275.—*Foreign Forest Schools available to Australian students.*

Foreign Extra-tropical Forest Schools.—The language difficulty is a serious obstacle, but I should mention in this connection the good schools of extra-tropical Forestry that exist at Madrid, in Spain, and at Florence, in Italy. The Italian and Spanish Forest Schools have both excellent records. The Italian Forest School, which I visited a few years ago, has trained many foresters for other countries. The Spanish Forest School, which I visited last year, is surprisingly well equipped, and Spanish (the other world-language with English) is one of the most useful languages for an Englishman, and a peculiarly easy language to master. Italian is nearly as easy for an Englishman to acquire, and at Florence there is a permanent English community, representing the population of a medium-sized town.

Japan has most complete forest schools of every class. But Japan, in addition to the great language difficulty, and others not necessary to enumerate, has a climate differing from that of the other extra-tropical climates of the globe, in both its peculiar wetness and great range of temperature. Its rains are summer rains. It has a tropical summer and very cold winter. While trees from extra-tropical South America, South Africa, Australia, California, and the Mediterranean are interchangeable, those from Japan rarely succeed much in other extra-tropical countries.

The French School of Forests at Nancy is of world-wide reputation, but the teaching there has most to do with the forests of temperate mid-Europe, though Forest Officers are also trained there for the forests of the South of France and Algiers.

For European Forestry there is the choice of three Forest Schools in England; and the fact that there are 176 Rhodes scholars at Oxford, a large proportion of these Australians, makes it easy to obtain for Australia trained graduates from the Oxford School.

276.—*Training the Rank and File.*

For recruiting the rank and file of a Forest Department the outlook is easier. Besides the Australian "Forest Schools" mentioned above at Creswick, Sydney, and Adelaide, there is an excellent school for practical working foresters in the forest of Dean, in England. A large number of students pass through this school every year, so that a good supply is available for colonial employment; and good men are obtainable as well as well-instructed men. I obtained several foresters from the forest of Dean School for British East Africa, and they all turned out well.

The building up of a good staff of Foresters is one of the first essentials in any scheme of Forestry. A pay of £120 per year, and the house and land usually given to Foresters, was the remuneration given in British East Africa to foresters from the Forest of Dean; it is about double that to which they had been accustomed in England. In Australia, as in South Africa, Foresters should have a commencing salary of not more than £100 a year; and unless they are men of exceptional cap-

abilities so as to be given a commission in the officers' grade, their pay should not rise beyond £200. With the other advantages which they enjoy (pp. 44-48), it is not difficult to get capable working Foresters for this salary; and for the due organisation of the forests, where for every quarter of a million acres some 10 Foresters are required, it is not possible to pay them more.

277.—*The trained workers of the Forest of Dean.*

A point to be remembered is this: these Forest of Dean Foresters, straight from a rural district in England, are the class of emigrants most required in Australia, so that should a percentage leave the Forest Department and take up land, it is getting on to the land the best class of men that can be put there! Indeed, it might be a question whether the Emigration Department should not provide passages for all working Foresters recruited for the Forest Department. No better class of emigrant ever landed in Australia. The address of the Head of the Dean Forest School is: C. O. Hanson, Esq., 3 Malvern Place, Cheltenham, England.

I heard a few days ago from Mr. Hanson that the Dean Forest is temporarily closed during the war, nearly the whole body of students having gone to the front.

278.—*The Forester's work not a "Government Job."*

In speaking of the Forest Stations (p. 162) the Foresters in charge of them are described. After the Conservator, the Forester residing in the forest and at the head of the Forest Station, is the most important forest official. My invariable experience has been that a good staff of Foresters is the foundation of all success in forest administration. A Forester residing in the forest soon gets to look on the forest as the beginning and end of most things for him; and that is how it should be! A Forester who is not keen on his work, be he at the top or the bottom of the service, had better leave it. The forest is not a mere matter of pounds, shillings, and pence, like a butcher's shop, or a "Government job."

279.—*The units of a fully organised Forest Establishment.*

The following may be taken as representing in brief the units of an organised forest establishment:—

The Forest Staff.

"*A Conservancy*" is the Conservator's charge. There is usually one Conservator now in each Australian State; there will be more hereafter. He must have at least one assistant, usually termed "Assistant Conservator." The head of the forest administration in South Africa, with seven conservators under him, is styled "Chief Conservator of Forests."

"*A Range*" or District is the charge of a Verderer, Ranger, or District Forest Officer. The term "Verderer" is the old English forest title. It has been largely replaced by the recent clumsy office-invention of "District Forest Officer." Verderer is an ancient and honourable forest title going back to William the Conqueror. There are various Rangers—Game, Sanitary Inspectors, etc., down to Bush-rangers! But a verderer must be a *Forester*. A "forest" is the forest unit in charge of a Forester. It can, of course, also be a forest plantation.

A Surveyor should also be attached to the forest staff for such surveys as are necessary in the course of forest demarcation, for the survey of areas in valuation surveys, for surveying planted areas, etc. He should divide his time between work in the field and work in the forest office, and have charge of all maps and plans belonging to the Forest Department. It is usual to have a Surveyor in every well-

organised forest office. I had one in the forest office at Cape Town. The Melbourne office has a map room, in which two men are perpetually working. One of the clerks in the forest office at Adelaide is a draftsman. In Cyprus, when under the British Government in early days, there was very little systematic Forestry; they had, nevertheless, a Surveyor permanently attached to the staff of the Forest Department, though the demarcated forests themselves have not yet been surveyed; in fact, it is the special plans required in plantations, and for detailed surveys, that are more necessary in the earlier stages of Forestry, than plans of the actual forests themselves.

As a rule in Australia, in-door Forestry is far ahead of out-door Forestry, but there are certain lapses. It was only in Victoria that I found a map of the forest reserves—a good map, showing clearly the two classes of Reserved Forests.

Too often in Australia, notably in Brisbane for many years, a clerk with a smattering of Botany has been taken to represent a Forester.

280.—*The Forester's status and condition of service.*

A Forester's career is an honourable one. In France and other countries the Forester ranks socially above the soldier. He is a soldier of the State and something more. He will accept pay and do work that he would not outside the Forest service.

It should be the policy in Australia to foster that *esprit de corps* which is such a conspicuous feature in the Forest Services of other countries. When the Forest Service is organised, none but men with a University training should be in the higher ranks; or men specially promoted for efficiency. The Forester in charge of the Forest Station should have the status of an honoured and trusted Government servant; and though his pay must necessarily be small, everything possible should be done to promote his self-respect and the comfort of his family. He should be given a good house and have an ample allowance of good land for his little home farm. He should have two or three suits of uniform per year, both rough for the forest, and "Court" for official appearances in the Law Courts and in towns. His rifle should be of the best, and he should be allowed to shoot such game as falls in his way. Usually the game-law administration in his forest is in his hands.

There should be a pension, together with a widow and orphan fund. This the Forest Department share with other branches of the public service in South Africa. The Chief Conservator has lately retired on a pension of £700.

Pensions are on quite a moderate scale in France, and a Forester's life being one of the healthiest, the fund costs the State comparatively little.

It will be said that in Western Australia this is not the policy of the State in other branches of the service. It may be replied that the law of supply and demand ceases to operate in forest economics. The want of Forestry is costing Australia now at the rate of £10,000 a day for imported timber; and if Australia were to start a vigorous forest policy at once, it will take 30 years at least before the country can supply its needs in timber. The inevitable loss that has to be faced before a sound position is reached in 30 years must amount, with interest, to the crushing figure of £558,500,000. A Forest Officer, or a Forester in charge of a Forest Station, are not functionaries like clerks, to be recruited to-day and dispensed with to-morrow. Knowledge of the forest is not to be acquired in a day, and the man who possesses it can not be shifted without injury to his work, and consequent loss to the State.

281.—*The useful functions of a Forestry Department in State administration.*

It is curious to note how, in England and Australia, the wants of the public service suffer owing to the absence of that branch of it represented by the Forest Department. In South Africa when, for any reason, scenic, historical, or otherwise, it is desirable to preserve public land for the *perpetual* use of the public, it is only necessary to bring out one of the usual proclamations, adding the land to the list of *inalienable* State Forests. In England, there are various societies, and a public land trust, which effect the same object in a round-about way.

In Australia, if a piece of forest or other land is reserved as a park or national reserve, there is always a dread of the fire fiend; and there is no branch of the public service, except the Forest Department, which can be held responsible for fire-protection. Thus, in the various Australian States, and in New Zealand, there have been formed nature reserves and national parks; and, as soon as they begin to fulfil their purpose, comes the danger of fire. Very often before the public come into the use of the national park, it gets burnt by the irresponsible persons employed in making roads, paths, and fences.

282.—*The Forestry Department as Trustees for Public Scenic grounds.*

The most beautiful mountain scenery district in Western Australia—the Stirling Range—has now been dedicated as a "National Park." There is another area of fine mountain scenery turned into a national park in Queensland. New South Wales has two large national parks at no great distance from Sydney, and scenic reserves in the Blue Mountains. South Australia has its fine "National Park" in the Mount Lofty Range, though this rather gives the visitor the impression of being in a condition of arrested development. Tasmania has just proclaimed a reservation of 27,000 acres near the Russell River as a national park. Victoria has its nature reserve near the coast, and it ought soon to have millions of acres of real scenic reserves and nature parks in the fire-protected forests of its mountains. These fire-protected State Forests should be worth many times all the other fire-swept areas put together! And the other areas will never be preserved from fire under civilized conditions till there is a branch of the public service with a skilled organisation on the spot to keep out fire.

In Australia, modelled on English lines, the "Forestry" branch of the Public Service is either absent, as in Tasmania, or in a more or less elementary condition, as in the other Australian States. Municipalities have their fire service, the Government of the country is without it; yet the Government stands to lose more by fire than the municipalities.

CHAPTER XV.

Official Administration.

283.—*Conservators' Conferences promote unity of action.*

Two most useful Conservators' Conferences (Interstate Forest Conferences) have been held in the two chief towns of Australia. The first at Sydney in November, 1911, the second at Melbourne in November, 1912.

Reading through the reports of these Conferences it is impossible to avoid the conclusion that they must have been of the utmost use to those who took part in them. I am decidedly of opinion that when the next Interstate Conference is held, presumably after the war, that every facility should be given to the Conservator of Forests, Western Australia, to attend; in fact, I think that the Chief Forest Officer in each Australian State should be instructed to contribute a formal paper and proceed to the Conference: Government, of course, paying all travelling expenses. I can remember the meetings of Forest Officers at Simla, in the early days of Indian Forestry. The Conservator, or an officer specially deputed by the Conservator, was sent from each State; and before union, there were Conferences of Forest Officers in South Africa. *It seems the necessary corollary of Federal Government in Australia*, that in such a subject as Forestry, where the various States are intimately connected, there should be *unity of action*. This unity of action will be most easily preserved by periodical meetings of the Chief Forest Officers in each State.

Whether the Conferences should be annual is another matter. Now that the ground has been broken by the two Conferences at Melbourne and Sydney, it seems probable that the most useful results will be obtained by Conferences meeting in the other States at intervals of two, or perhaps three years.

284.—*Importance of Departmental Yearly Reports.*

The yearly Forest Report is to the Forest Department of more importance than to most Government Departments, since most forest work runs on, continuously, for many years before its value can be gauged and a record of its progress made. The annual Forest Report should contain a clear record of all forest work. It is the account of the Conservator's stewardship.

It is quite easy for a good deal of money to be spent on certain forest items, and in a few years all record be lost, both in the forest and the Forest office. But the Treasury have the item against Forestry, piling up expenditure at four per cent.!

Annual Forest Reports tend to run to "tabular statements and pleasing platitudes," with perhaps a little planting thrown in, and guarded references to the want of funds and the dissipation of the forest reserves! What should be insisted on is a simple solid record of progress achieved along the various lines of estate management. And if these lines are to be readily comparable year by year, the Forest Reports must be cast in the same mould.

It is important, therefore, with the beginning of systematic Forestry, to have a "cadre" for the annual Forest Reports laid down and communicated to the Forest Department, to be hung up on the wall and followed, for the information

required; for the Forest Report should be gathered throughout the year, not left to memory and compilation from the reports of the District Forest Officers. That is the origin of the "platitudes and planting" report!

285.—*The Model for the Yearly Report.*

There may be difference of opinion as to the model to be adopted. Of those reports that I have read from Australian States, South Australia conveys the impression of being most business-like, Victoria the most interesting and detailed, but it has the curious feature of being half by the Conservator and half by some other person whose identity is not revealed. The South African model of Forest Report is unsuitable for Australia, in the respect that the chief work there is forest *planting*, while in Australia it is the utilisation and regularisation of the great native forests.

The yearly reports of the Indian Forest Department have been proposed as models for general adoption; but this has not been found quite practical in other countries. The Indian yearly reports are models of administrative ability, carefully sifted figures, and condensed details. They are ideal for a strong bureaucratic Government and the peculiar conditions prevailing all through the juxtaposed nations which go to make up the huge empire of India; but they are unsuited to the comparatively small democratic communities of whites which are seen in Australia and South Africa. The cost alone of these Indian Forest Reports would be prohibitive in Australia or South Africa. In India a good native clerk can be obtained for about one-fourth the cost of a clerk in an Anglo-Saxon community.

I submit, that the maxim for Parliament and the Minister in charge of Forestry in an Australian State should be to employ as Conservator the ablest and best qualified man procurable, and judge his work, not superficially, or by hearsay, but by the solid record of progress set forth in his annual report, coupled with such inspection of his work as they can see for themselves. And it is not difficult for them to obtain some most useful personal inspections of what is going on in the forests when once these are organised, since each forest unit has a Forester's cottage, with an inspection room, in the centre of the forest, with radiating roads and cross-paths for fire-work and inspection. Obviously, some personal inspection is the most satisfactory way for the Minister and Permanent Head to obtain that grasp of forest work which is necessary for reasonable control and Parliamentary debates.

Forest work is not like other work which everyone sees. As a rule, it is only seen by interested people, and their personal interests may easily lead them astray. I can speak from experience of the necessity which exists for a proper judgment of a Conservator's work, and some personal knowledge of what is actually going on in the forest. One Conservator will be a good writer, another a good speaker and interviewer. These are estimable qualities, but not those by which progress in Forestry is to be judged. And it is necessary to have a right judgment of a Conservator's work; for if he be a faithful public servant, he must obviously do things which are necessary to the public weal but which may be distasteful to local interests. As a rule, the public can only judge the work of the Forest Department through the Annual Forest Reports.

The following seems a useful cadre on which to model the Yearly Forest Report:—

1. *Progress of Forest Demarcation,* with statement showing the area and location of the Forest Reserves in each class: (1) Inalienable and final; (2) temporary reservations; (3) protected forests. There will be transfers in these classes for many years to come.

2. *Alienations of Land in the State Forests.*—As matters now stand in Australia, alienations are liable to do as much harm to the national forest estates of Australia as fire. Alienation should be watched against like fire; and it is one of the Conservator's chief functions to be fully conversant with such alienations as occur, and to record them in his yearly reports for the information of Parliament and the people of the country; for it is they who are the ultimate sufferers in cases either of forest fires or forest alienations. As long as there are political influences in the management of the State Forests, alienations will be liable to occur.

3. *Progress in Forest Organisation.*—What forest is organised, and how far organised (p. 45) with a hill-top or out-look forest station, and a resident Forester, able to drop on to any forest fire with an average run down of ten minutes (p. 45).

4. *Forest Fires.*—(1) Area attempted to be protected. (2) Losses. (3) Net area protected. Approximate area not under fire-protection. A brief account of the year's fire-work. Character of season; its casualties and successes.

   Notes should also be added from the Conservator's Inspection Book of the condition of previous burns, whether reforesting naturally or wanting artificial help.

5. *Planting.*—Here there has to be a distinction between largish regular plantations and small scattered areas, in glades and open places made for the purpose of introducing self-spreading trees, or filling up with planting dirty spots liable to get burnt.

   The Forester may have simply a large plantation, or he may be in a forest where no planting is required beyond, perhaps, the introduction of a few self-spreading species. In the larger plantations there will have to be complete records of planting, under two heads: (1) Replacing the previous year's failures; (2) New work. This is important for record purposes, since (2) is new ground gained, while (1) is not. (1) should never be omitted for one year, or sometimes two or three years in the case of slow-growing species (p. 134).

   In view of the economical position in Australia, £10,000 a day (soon to be increased to £20,000) going out of the country for imported softwoods, reasons should here be given for any planting which may *not be of softwood timber* trees, climatically suited to the locality. There is an additional reason for this, in that every Forester has his pets amongst trees, and it is necessary to guard against preferences, often unconscious, which may not be always justifiable. It is necessary also, that those who come after should be able to see in the record the reasons which led to the planting of such trees.

6. *Arboricultural Notes.*—These should be very carefully compiled from the Conservator's own note-book. They are necessary for two reasons:—(1) Their general scientific interest to students of arboriculture; (2) for record and the information of other forest officials. Without such notes there is very likely to be duplications of work, either at intervals of a few years, or in different parts of the Conservancy, for it is impossible for the distant district forest officers always to be in touch with one another's work; and it is equally impossible for the Conservator to personally superintend details everywhere.

7. *General Observations* on the work of the year in the Conservancy, and any notes bearing on it regarding contemporary Forestry in other countries.

8. *Revenue, Expenditure, and Finance,* with reasons for increasing or abating expenditure.

286.—*The usefulness of Yearly Reports increased by a "Ten minutes Summary."*

A very useful feature in some of the Cape Forest Reports was to prefix or conclude them with a summary, "the ten minutes' summary" as it has been termed. For a busy man, interested in Forestry, for a Minister in the hurry of a Parliamentary debate, this feature has been found useful. To dictate a summary means very little extra work when the report has been finished, and the Conservator has it at his finger ends. It will be understood how useful a summary is to those who have not got the details at their finger ends, or who can only approach the subject with a limited leisure at command. Forest reports cannot, from the nature of the work, be omitted or cut down like some other Government reports; but *they tend to become too long*, and the busy man's time for reading them *too short*. A summary bridges this difficulty!

It is important that the Yearly Forest Report should be as brief as is consistent with completeness, so as to save the cost of printing and the reader's time; but it must be detailed enough and sufficiently well-illustrated to be interesting. Tabular statements should be omitted as far as possible, and long tabular statements barred. Tabular statements cannot, of course, be avoided; but the cost of printing the report would be considerably reduced if, after being prepared, tabular statements are filed in duplicate in the Conservator's Office and in the Ministerial Office; only results and leading figures being printed in the Report. This is enough for record. The last South African forest report cost £60 printing and £16 illustrations. Just so much need be printed as is necessary for complete clearness in after years; remembering that Forestry results may run for a generation before the crop is reached and finality achieved! Ministers come and go, and the official life of the civil servant is only a fraction of the life of a tree!

Whatever form of forest report be adopted, whether with or without the "ten minutes' summary," there should be an index. This is a useful addition often omitted. It takes little time as a matter of office routine, and costs little to print. It should run on pretty much the same lines every year; so that the same subject or item can be turned up and followed without difficulty in the file of the Annual Reports. Thus, for instance, if information be wanted on the planting and growth of Insignis-pine, it should be possible to turn up at once the narrative of Insignis-pine planting year by year.

287.—*Biennial and Triennial Reports with Yearly Interim Reports advocated.*

"Two-yearly" forest reports have been advocated in some quarters, the intervening year having only a tabular statement and a brief note of the year's work. There is much to be said in favour of biennial forest reports. They nearly halve the cost of preparation and printing (the preparation of the yearly report often takes up time which the Conservator can ill afford to lose); and more than this: two years in Forestry forms a more convenient period than one year for reporting progress. It is often difficult to judge of planting and other forest work, the effect of a burn, etc., till after a year has elapsed. Droughts and administrative accidents cause interruptions which are smoothed out and more truly gauged after a lapse of a longer time than the average six months in the customary annual re-

port. I was authorised to adopt, and did adopt, "two-yearly" forest reports before leaving South Africa; and though they have certain disadvantages, I consider that on the whole they are the most convenient. I should even be inclined to suggest that, looking at the long periods with which Forestry deals, a "Three-yearly" report might be most convenient for the reader and for purposes of record. In that case there would be two "Interim yearly reports" followed by one complete and well digested "Tri-yearly" report.

Division III.

POPULAR FORESTRY.

CHAPTER I.

The General Lack of Interest in Forestry throughout Australia.

288.—*Australia's anomalous mental attitude.*

Public opinion on Forestry is nearly absent in Australia. Among all strange sights and sounds on the island Continent there is nothing more remarkable than the attitude of the people with regard to modern scientific Forestry. Australia is paying out £10,000 a day for imported timber; it must inevitably be the loser over Forestry by some £588,000,000 (p. 167) during the next 30 years; the country in its most fertile part is losing its beauty and its perennial waters, owing to the destruction of its forests; and yet its workers, its public men, and its men of letters, with few exceptions, know little of what modern Forestry science is doing for other countries.

The only explanation I can find for this strange mental attitude is the tendency to look at everything in Australia through English glasses; but this will hardly account for all the facts, since the recent English and American literature on Forestry science is practically unknown and unread in Australia.

289.—*Experience of British Association—the great forest problem untouched.*

At the meeting of the British Association in Australia, few branches of modern science were not touched upon; but on the greatest social question now facing Australia—its wrecked forests and its vanishing millions—nothing was said. The £588,000,000 loss the country has to face during the next 30 years was not even hinted at! Probably the British Association for the advancement of science in all its meetings and travels has never, in this one particular, had a more remarkable experience!

As we journeyed through Australia our thoughtful hosts provided us at every turn with instructive pamphlets regarding the new and interesting country we were traversing. By the time the tour came to an end in Tasmania, the quantity of this literature was sufficient to fill quite a heavy handbag, as much as an ordinary man could conveniently carry in one hand!

The first thing that strikes the visitor landing in Australia is the strange desolate-looking forest! He has it with him throughout his travels in all the better

and more fertile regions; and the first point he naturally asks for information about is this unique forest; these wonderful trees! There is no other forest at all like it in the world!

But, exhaustive though the hand-books were in their information, the only one that had even a chapter on Forestry was Victoria. The best general hand-book was the Federal one; but it contained absolutely no article on Forestry. The forests were only mentioned as subsidiary to other subjects—some general remarks embodied in what was probably the best chapter in the book, "Australian Vegetation," by J. H. Maiden: and three-fourths of a page under agriculture, containing a few truisms and some bald statistics, a childish paragraph that would scarcely read well in a village school primer!

On the other hand, nearly half of this otherwise useful publication is taken up with geology and mining, 230 pages out of 598; while, under astronomy there were 53 pages of highly technical details, which I had to abstract in order to bring the book within manageable limits for travelling.

When the British Association came to South Africa in 1905, though there was not time for them to see more than scraps of the small area of native forest, a considerable section of the hand-book was, naturally enough, devoted to the trees and forestry of the country. The question at issue there was £1,250,000 of imported timber: Australia has £3,500,000, and says not a word!

At the meetings and social functions of the British Association in Australia, I had the advantage of conversing with men representing Australian thought and research on various points. Regarding the greatest social question facing Australia, its Forestry, few had any pronounced views.

290.—*Paucity of Australian forest literature,*

In serious Australian literature, Forestry is a blank! In those most valuable publications, the official *Year-books of Australia*, are given lists of publications of general interest, valuable for reference. Thus, in the last official *Year-book* for 1914, is a list extending from page 2 to page 13. It includes the researches of Baker and Smith on the Eucalypts, Sydney, 1902: their fine work on the Cypress Pines of Australia, Sydney, 1910, and on the Cabinet timbers of Australia, 1913: and a few works of such very minor importance as Guilfoyle's "Australian Plants," Melbourne, 1901. But in all these 11 closely printed pages of recent Australian useful reference literature, I have searched in vain for a single work on systematic Forestry, as commonly understood in other civilised countries. In Europe there is a voluminous forest literature. In North America the books on Forestry are increasing at a rapid rate. Even in England, where State Forestry, as has been mentioned, is only beginning, where the area of Government forests is infinitesimal compared to that of Australia—66,000 acres, England, against some 102,000,000 acres in Australia—a forest literature of some importance has sprung up in recent years. Thus the almost entire absence of a forestry literature in Australia is extremely remarkable. The little that does exist is scattered throughout botanical works, official reports, and museum timber catalogues, and is quite of an elementary character.

291.—*Three million books in Public Libraries; not twenty on "modern" forestry.*

During the last 30 years, and more particularly recently, a considerable forest literature has arisen in the English language; but little of that has yet found its way on to the shelves of Australian libraries. Indeed, the absence of forest literature in Australian libraries is remarkable.

Said the Melbourne *Age* of 17th March, 1914:—

So little attention has been paid to Forestry, that our public and Parliamentary libraries may be searched in vain for any modern work on forest science. The collection labelled " Forestry " at the Melbourne Public Library, except for one or two technical treatises of ancient date, would disgrace a six-penny lot of second-hand books.

It is estimated that there are some 3,000,000 books in the public libraries of Australia—there are over 2,000,000 books in the public libraries of Victoria and New South Wales. I may safely venture to assert that among all these 3,000,000 books (a large number for the population of Australia) there are not 20 of the ordinary forest treatises on modern Forestry methods!

292.—*A missing link in a University Library.*

In the large new library built during the last few years at Hobart there is not a single Forestry work of reference, and this, too, in the one all-forest State of Tasmania, where there is the very climate for planting those same trees for whose timber Australia is now paying out £10,000 a day! In Tasmania, such a well-known work of reference as Veitch's *Manual of the Coniferae*, last edition, is not to be found in any of the public libraries. I had a search through them, aided by two of the Professors of the Hobart University. It appears that there once was a copy of this work, not in a public library, but belonging to the Government Botanist. This is a standard work, treating exactly of those Conifers which Tasmania should be planting, and of which there are just enough specimens in the Botanic Gardens, Hobart, to excite curiosity regarding the others.

The man in the street and the Australian newspapers, with certain shining exceptions, such as the Melbourne Press, show an absolute ignorance of modern Forestry. I have put together (p. 162) some of the curious popular errors on the subject that have cropped up during my short stay in Australia. The problem now is, how to educate public opinion?

In Europe and America, Forestry is taught at the various Universities, and degrees in Forestry are conferred. At one of the meetings of the British Association there came a hesitating proposal to establish a chair of Forestry at an Australian University, and the proposal received a doubtful reception. Who could teach Forestry suited to Australian conditions, was asked, and what class of students would be attracted? The matter was sent to the Botanical Section. I did not notice a Forester present.

293.—*Commonwealth Governor-General utilises Melbourne "Cup Week" to break ground for correct forestry.*

During "Cup" week in Melbourne, His Excellency the Governor-General took the opportunity afforded by the presence of the various State Governors to hold a round-table conference by way of breaking ground. No public statesman in England has so complete a knowledge of Forestry as Sir Ronald Munro-Fergusson. Unfortunately, he stands alone among public men in Australia!

294.—*The dawn of an increased interest in real forestry.*

Since I have been in Australia a few young men have questioned me as to the best means of getting a forest education. I have suggested their going to America, or to Oxford, in England; or, better still, if they could master French or Spanish, to Nancy, in France, to the Madrid Forest School, in Spain, or the Italian Forest School at Florence, in Italy, where there is a large settled English community.

CHAPTER II.

How to Arouse a Correct Public Opinion on Forestry.

295.—*Better defined teaching in the Public Schools wanted.*

The Educational Department in Australia has apparently to do much before it can meet the wants of Australia. It is criticised as teaching not what young Australians should know, but what the teachers, with their old-world knowledge know. At any rate, in the matter of Forestry, this criticism is well founded.

Says the cynic:—

Australian children don't want to go to school to learn Forestry like stupid Frenchmen, Germans, Italians, Spaniards, Japanese, Americans, etc., living in climates like that of Australia. The children can learn something more useful at school—Greek, Latin, and modern languages spoken at the other end of the world! These are of practical use; but Forestry! They say the want of it may tax us all heavily or perhaps burn us out of house and home. That is nonsense. *We know our own business.*

If every child were taught at school how to manage small private forests and at elections only to vote for men who would stop the burning and alienation of the great public forests, these two items might be of as much practical use to that child and to its country as are the rest of the child's education, after the "three R's." The Australian child, like other children in the same climate, should be taught to class the forest-destroyer with a thief, a drunkard, or now-a-days a Hun; to ostracise the forest-destroyer as a social pest, an enemy of society. Then there is the study of arboriculture; the beauty of and the wealth in individual trees. No text-book of Extra-tropical arboriculture exists in English, though there is quite a literature on this subject along the Mediterranean, where grow the most valuable trees suited to Australian climates. But these works are not of much use to the average Australian. They are in Greek, Italian, French, Spanish, and Portuguese. There is also some quite useful extra-tropical arboricultural literature in South America, but that also is in Spanish.

296.—*The example of Japan.*

Think for a moment of the example of Japan. They have taken over all that makes for material progress in the world of civilisation. How do they treat Forestry in their educational system? Forestry permeates the whole educational system of modern Japan from the village school to the University. The first forest school in Japan was established in 1882. By 1904 there were 60 schools where Forestry was taught to 2,011 graduates and 5,657 students. Their great Spring-time festival is the Cherry-blossoming. Australia has its Wattle-day, but few of the Wattle holiday-makers realise that want of Forestry has, in a few years, brought to Australia a Wattle loss of £250,000 yearly! (p. 111).

297.—*The "Arbor Day" in Australian Schools.*

The three best practical "object-lessons" in Forestry and Arboriculture are (1) Arbor-day planting; (2) Suburban forests; (3) Arboretums. These have each a thoroughly good practical use in educating public opinion.

Says Mr. North, the architect and maker of some small forest plantations near Launceston:—

I believe that in all Elementary Public Schools in the country districts, the elements of Forestry should be taught, and efforts made to interest the children in the subject.

Arbor Days have a considerable educational value; they instil that love and veneration of trees which is seen more or less among all civilised peoples. 605 million trees are stated to have been planted on Arbor Days in the drier States of North America, where the Arbor Day institution first began. Arbor Days seem to have been taken up in nearly every country but England, and particularly lately in the warm Southern countries of the Mediterranean region with climates resembling those of Australia. I heard of Arbor Days in Greece, when I was in Cyprus amongst Greeks. In the recent Forestry revival in Italy, Arbor Days have become very popular. A year ago, in Portugal and Spain, I found the Governments taking active measures to foster Arbor Days. Descriptive pamphlets on Forestry and beautifully got up cards are prepared and issued from the Head Forest Offices in Madrid and in the provinces.

On account of their practical educational value, I consider that every encouragement should be given to Arbor Days in Australia; but, for the sake of economy, and in order to obtain some effective results, the organisation should be done by the Forest Departments and Educational Departments working together. A good deal of the failure which has resulted from the Arbor Day tree-planting has been due to the praiseworthy but necessarily amateur efforts of school teachers and others in the Educational Department. Arbor Days have been fixed at the wrong time of the year, the wrong trees planted, and in positions where there was no hope of their growing successfully. It is the after-care of trees that is of more importance than the planting. Trees of an educational value should be chosen; thus for Western Australia in the colder wetter parts, Californian Redwood (*Sequoia sempervirens*) or the beautiful and valuable Busaco Cedar (*Cupressus lusitanica*); in the drier parts Canary-pine, and in the still drier southern parts *Cupressus arizonica;* and more to the north, especially if there is water, a good variety of Persian Lilac (*Melia composita*). There should be a vote on the Forest or Educational Department's Budget for Arbor Day trees, and the Forest Department should be held responsible for the due fencing and care of the trees after they are planted.

298.—*Aboretums at Forest Plantations.*

The Forest Arboretum is not an expensive matter; it amounts to little more than an extension of the planting area as soon as a forest organisation and planting areas become established. There is none of the expense involved in maintaining parks and gardens. Once the trees are planted they are left to grow, and require little attention beyond fencing, thinning, and the cleaning away of grass and undergrowth. And these are items of which the expense rapidly goes down with the upgrowth of the trees and the practise of mulching (p. 131).

Under ordinary circumstances, there should be *a national arboretum under the Forest Department at each centre of population and at each planting centre.*

299.—*Examples of Arboretums in South Africa.*

In South Africa it is usual to have an arboretum at most of the large plantations. I made it the practice to get seed of every new tree that I could hear of as being worth growing in the extra-tropics; and as soon as any new species of tree was raised in any plantation the first 40 were put into the "Group Arboretum." The ordinary single specimen arboretum is useful for show purposes, but it is the

"Group Arboretum" in which forest conditions are imitated that really supplies the test. Thus in the arboretums in South Africa the practice is to have trees planted, both singly and in groups of not less than 40 trees. G. Pinchot, the long-time head of Forestry in America, relates how, in his earlier days, when called upon to form a big arboretum, he successfully followed the group method in forming the "Biltmore" arboretum.

The largest arboretum in South Africa and one of the best in the Extra-tropics, is that at Tokai, near Cape Town. Here there are some 150 species of Eucalypts, in fact, every kind outside a few quite-dry-country and tropical kinds which would not grow there. Softwoods are nearly as well represented as the Eucalypts. The arboretum forms a most useful study, and at Tokai, in its midst, has been installed the South African Forest School. There is another forest arboretum further inland at Wolseley, and another quite in the dry-country with a rainfall of only 9in., at Robertson. Here are tested the growth of the various introduced trees under different climatic conditions. At Tokai the rainfall is 40in., at Wolseley 21in., at Robertson 9in. At Robertson such dry-country conditions prevail that only sparsely grown trees can permanently succeed. Here, naturally, in the various trials of trees, are many failures; in arboretum work failures are only a little less instructive than successes.

On the great central tableland of South Africa is another arboretum in connection with the large plantation of softwood and hardwood timbers at Pan. This is at some 6,500 feet elevation.

300.—*Arboretums in Europe, America, and Japan.*

In mid-Europe and in North America, where there is little of the *wealth from planted trees* that exists on the Mediterranean, arboretums are common. I have lately visited and described the two in the forest of Soignes, close to Brussels. There are numerous arboretums in France, particularly one in connection with the Forest School at Nancy. There is a small extra-tropical one at Antibes on the Mediterranean, and not far from there Sir Thomas Hanbury's fine collection of trees at "La Mortola." In my British Association paper I described a 50-year old arboretum at Pena, near Lisbon. Japan has many arboretums, particularly a large one near the capital. Of the American arboretums, the Arnold arboretum near Boston and the Biltmore arboretum are perhaps the best known.

301.—*Arboretums non-existent in Australia, the parks are merely ornamental.*

Those who do not know Australia will hardly credit the assertion that after a white occupation of one hundred years or more the country is still without a single national arboretum. Only in the Botanic Gardens are a few trees seen, and these existing on sufferance at the good-will of the gardeners. Whenever more grass-plots or flowers are required, or whenever the trees start growing well, they are cut down or mutilated; and for so doing you cannot blame the gardener, for gardening and tree-growing have little in common!

There is nowhere in Australia a collection of closely-growing trees imitating forest conditions. Tree-growing in Australia is an unexplored mine of wealth, a mine that has remained unopened for over 100 years!

The only collection of trees worthy of mention in Australia is that in the Botanic Gardens, Melbourne, and this is largely due to the fact that they were originally planted as an arboretum by Baron von Mueller, and many of his trees still remain.

302.—*Sydney's Centennial Park contrasted with the Versailles Park of France.*

The Centennial Park is a splendid open space in nearly the centre of Sydney, and it is almost large enough for a suburban forest. Certainly if one-third of the space were kept open for lawns, flower-beds, and ornamental water, the remaining two-thirds might be devoted to an arboretum, which would be the centre of arboriculture in New South Wales; and, from many points of view, would be the leading feature of the city of Sydney. At present the ideals of management in the Centennial Park seem scarcely suited to latitude 34 degrees!

The Centennial Park is pleasant at morning and evening; during the rest of the day it is glaring and wind-swept. In the bright climate of New South Wales shade and shelter are grateful. Patches of true forest should dot this big area, and an arboretum, with an ever-increasing national and scientific interest should be interspersed about sheltered forest glades, as in the Forest of Soignes, outside Brussels. The ideals for the Centennial Park should be rather those of Versailles, near Paris, than of a London Park.

The bouquets in the Versailles Park are little gems of real forest with the shade as dense and the timber as tall, straight, and clean, as in any of the larger forests of the country. There should be no difficulty in getting these bouquets in the Centennial Park if the ground were reclaimed with the city refuse, as were the sandy wastes of the Cape Flats near Cape Town, and Port Elizabeth, in South Africa.

It is said that each tree now in the Centennial Park (and there are few good ones) has cost about £2 10s. from first to last. This may or may not be true, but isolated trees are always very costly to plant and protect in public places. If the ground were reclaimed with city refuse £10 *or* £12 *an acre* would suffice to plant it with trees which would grow tall and straight in bouquets, like those at Versailles.

The reclamation and planting of sand waste in South Africa, worse than that in the Centennial Park, has cost at the rate of £9 17s. per acre net, including the making of railway sidings and all charges; 7,513 acres have been planted (App. II.).

303.—*An ideal site for a Tasmanian Arboretum.*

In travelling through Australia certain areas suggest themselves at once as if cut out for forest arboretums. One such is the "Gorge," at Launceston, Tasmania. It is close to the town which is the first requisite for educational purposes. It is sheltered and would show a fine tree-growth. It is a spot of singular beauty, but a beauty that would be richly increased if to the present meagre collection of trees were added the splendid trees that in such a favourable climate might be grown there. No other large Australian town could hope to have at its gates a scientifically arranged collection of trees set in such beautiful surroundings.

304.—*The "National Park" near Adelaide.*

South Australia has a site for a good arboretum in the National Park, Mount Lofty. It is sad to think how many persons in Australia, in despair of preserving a rural area intact, have opposed planting areas such as the Adelaide National Park, which have been set apart as "Nature Reserves." Under modern Forestry conditions, every State Forest will be a fire-protected "Nature Reserve" in the truest sense of the word! There seems to be sufficient good ground in the National Park on Mt. Lofty to provide good arboretum-planting ground, though not enough for a suburban forest.

302.—*Sydney's Centennial Park contrasted with the Versailles Park of France.*

The Centennial Park is a splendid open space in nearly the centre of Sydney, and it is almost large enough for a suburban forest. Certainly if one-third of the space were kept open for lawns, flower-beds, and ornamental water, the remaining two-thirds might be devoted to an arboretum, which would be the centre of arboriculture in New South Wales; and, from many points of view, would be the leading feature of the city of Sydney. At present the ideals of management in the Centennial Park seem scarcely suited to latitude 34 degrees!

The Centennial Park is pleasant at morning and evening; during the rest of the day it is glaring and wind-swept. In the bright climate of New South Wales shade and shelter are grateful. Patches of true forest should dot this big area, and an arboretum, with an ever-increasing national and scientific interest should be interspersed about sheltered forest glades, as in the Forest of Soignes, outside Brussels. The ideals for the Centennial Park should be rather those of Versailles, near Paris, than of a London Park.

The bouquets in the Versailles Park are little gems of real forest with the shade as dense and the timber as tall, straight, and clean, as in any of the larger forests of the country. There should be no difficulty in getting these bouquets in the Centennial Park if the ground were reclaimed with the city refuse, as were the sandy wastes of the Cape Flats near Cape Town, and Port Elizabeth, in South Africa.

ERRATA.

Page 155, lines 1 and 3, paragraph 3, and line 5, paragraph 4, for "bouquet" *read* "bosquet." Map facing page 180, for "Santulum cygnoram" *read* "Santalum cygnorum."

are few good
t be true, but
e places. If
uld suffice to
like those at

orse than that
including the
d (App. II.).

303.—*An ideal site for a Tasmanian Arboretum.*

In travelling through Australia certain areas suggest themselves at once as if cut out for forest arboretums. One such is the "Gorge," at Launceston, Tasmania. It is close to the town which is the first requisite for educational purposes. It is sheltered and would show a fine tree-growth. It is a spot of singular beauty, but a beauty that would be richly increased if to the present meagre collection of trees were added the splendid trees that in such a favourable climate might be grown there. No other large Australian town could hope to have at its gates a scientifically arranged collection of trees set in such beautiful surroundings.

304.—*The "National Park" near Adelaide.*

South Australia has a site for a good arboretum in the National Park, Mount Lofty. It is sad to think how many persons in Australia, in despair of preserving a rural area intact, have opposed planting areas such as the Adelaide National Park, which have been set apart as "Nature Reserves." Under modern Forestry conditions, every State Forest will be a fire-protected "Nature Reserve" in the truest sense of the word! There seems to be sufficient good ground in the National Park on Mt. Lofty to provide good arboretum-planting ground, though not enough for a suburban forest.

305.—*Suggestion for an Arboretum at Perth.*

In connection with a suburban forest for Perth, one or perhaps two arboretums should be formed, like those which are here mentioned as having been placed in the suburban forests of Soignes near Brussels. But a good, deep soil and damp situation would have to be chosen with the possibility of some irrigation for such class of trees as require assistance during the long dry Western Australian summer. The rainfall at Perth, 33in., is happily sufficient for the Mediterranean trees and the other really valuable ones, but to show a wider range of trees, such as those from Japan and the southern United States of America, irrigation in summer would be requisite. As mentioned, Perth has the exact Mediterranean climate, and the growth of its Mediterranean trees is the best I have seen in Australia.

306.—*An Arboretum at Canberra, the Commonwealth Capital, must be maintained by irrigation.*

In the unfortunate Canberra business, the country is too dry to carry a good forest and thus to offer any hope of forming a good suburban forest, but it would be possible to provide a smaller area under irrigation, which would serve the purpose of an arboretum as has been done to such a remarkable extent with the artificially watered trees in the Melbourne Botanic Gardens. As mentioned in Victorian Forestry (p. 327), this is the best collection of trees in Australia, but it owes its good tree growth entirely to the steam pump! I have calculated, and the calculation has been kindly checked by the authorities, that the watering now done in the Melbourne Botanic Gardens is equivalent to a rainfall of some 150 inches. This, however, is watering from sprinklers, involving a great waste from evaporation.

CHAPTER III.

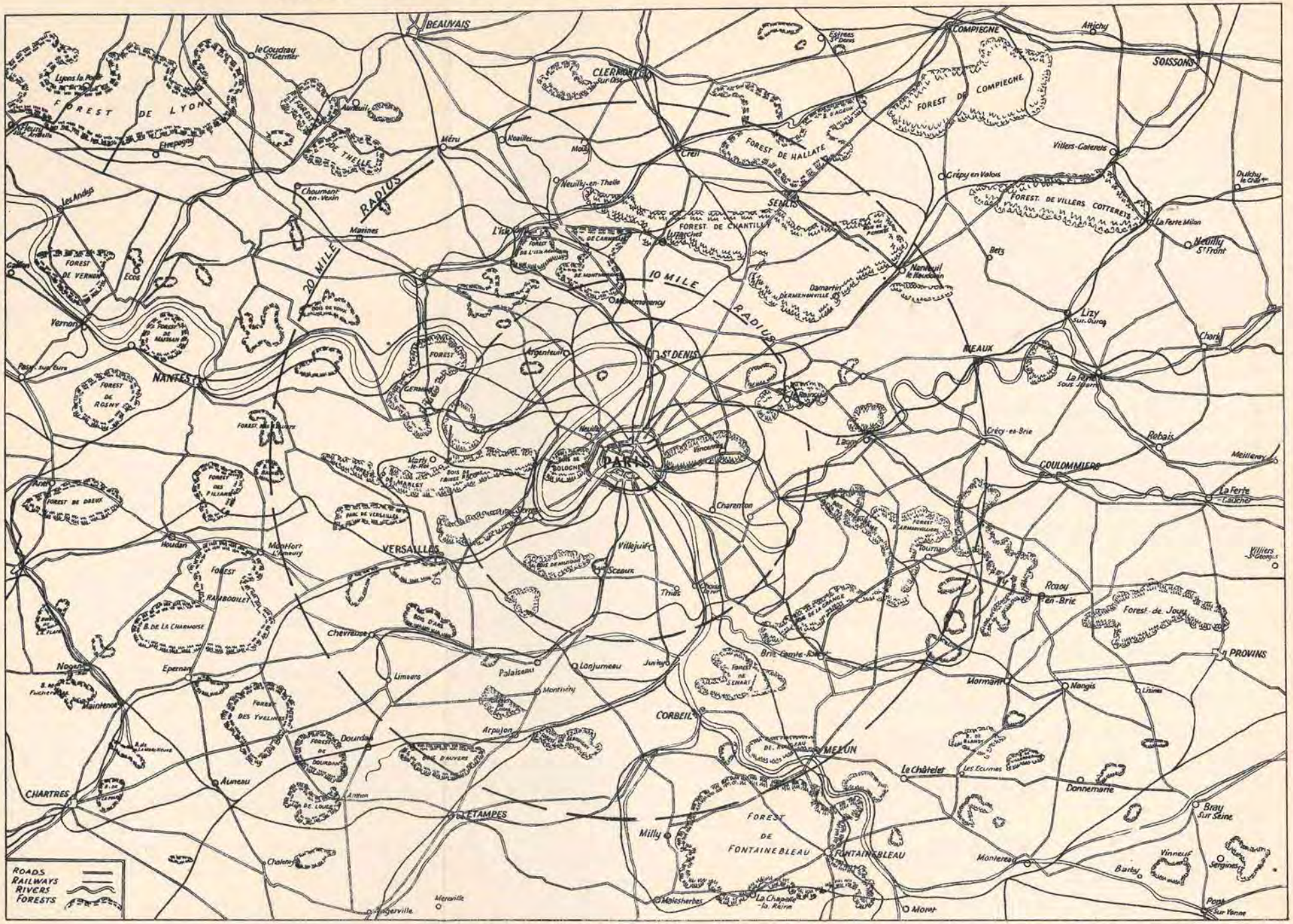
The Educational Value and Utility of Suburban Forests.

307.—*The place of Suburban Forests in Social Life.*

The Suburban Forests of the Continent of Europe have no counterpart in England. To a certain extent their place in the social life of the people is taken by some of the woods of country gentlemen's estates in England being thrown open to visitors for summer visits and picnic parties; but these are small compared to the Suburban Forests of Europe, and they have the disadvantage that the public are admitted on sufferance. Many of them were closed during the recent suffragette outrages.

There is a wide difference between the Suburban Forest of the Continent and the public parks of England: each has its use; but the park is an expensive luxury. Some of the London Parks and open spaces cost up to £500,000 to acquire; and they are expensive to maintain. The Suburban Forest is nothing more than a revenue-producing State Forest. The Suburban Forests of Europe yield about £1 an acre net revenue. Their charm lies in their wildness and freedom. If 'Arry wants to cut his name on a tree he is free to do so, or a boy to bird's nest or a girl to pick flowers! In the forest of Soignes at Brussels there are not even fire-restrictions.

MAP OF SUBURBAN FORESTS OF PARIS



H.J. Pether, Government Lithographer, Perth, W.A.

The Suburban Forests of Europe are State Forests, managed for timber production, but situated near towns, and thus available as pleasure resorts. In the out-door life of the more favourable summer weather on the Continent of Europe, Suburban Forests play a large part in the social life of the people; and their mission, in fostering that love of the forests which characterises the Continental nations of Europe, is very strong. Probably it is the strongest influence in moulding public opinion on the Continent of Europe.

Of these Suburban Forests, the best known and most visited by Englishmen are those near Paris, Brussels, and Berlin. The Berlin Suburban Forest of Grunevald, I have not visited; but the Suburban Forests of Brussels and Paris are well known to me, and it will be useful to add a few notes regarding them.

308.—*The Forests suburban to Paris.*

While travelling in Australia, since the war broke out, I came unexpectedly across a war map which shows, better than any detailed description, the situation and extent of the Paris Suburban Forests. A copy of this map is attached. It will be noted that the two chief forests are those at Compiégne and Fontainebleau. The others are of smaller size and suffered during the siege of Paris in 1870. Fontainebleau and Compiégne are an hour by rail from Paris, but there is a good service of trains, so that they are quite accessible during the long summer days.

Compiégne is the third largest State Forest of France. It is the largest and best known of the State Forests near Paris. It has an area of 36,000 acres (equal to 56.2 square miles). The net revenue is £32,000 per annum, equal to 18s. 7d. per acre. It has two castles, full of art and historical treasures, and is visited by crowds of tourists in summer. Few people go to Paris without seeing the forest of Compiégne.

Fontainebleau is somewhat larger than Compiégne, but rather farther from Paris. It is famous for its Beech and Oak forests, and is a well-known resort of artistic people. Millet, and other celebrities, have lived there.

Fontainebleau, though so little south of Paris, is getting into drier country, and is situated on high-lying dry ground, rendering the forest somewhat liable to fires. In the course of a day spent there, in which I travelled some 30 miles, motoring and walking, I passed seven areas in which there had been burns. The usual precautions are taken, and the fires are not allowed to extend, or to do any general damage. The last bad fire occurred some years ago and under exceptional circumstances, 3,000 acres were burnt over; two regiments of soldiers were called out before this fire was finally extinguished. The forest has since been all restored and little trace of the fire now remains.

309.—*The forest of Soignes at Brussels; its local popularity and educational value to Democracy.*

The typical Suburban Forest, however, of Europe, is the forest of Soignes at Brussels. It is situated at Brussels itself. One steps out of the Avenue Louise and enters the Bois de la Cambre, which is only another name for the ornamental part of the forest, with lawns, flower-beds, and ornamental waters. The English War-maps do not show the forest of Soignes correctly. The compilers evidently did not understand its stretching right up to the *streets* of Brussels. The forest of Soignes, though it adjoins the town of Brussels, is in no sense a park in the English use of the word. It is a forest left entirely in a natural state, famous for its fine timber, and yielding a net revenue of about £1 per acre to the Belgium

Government. Its area is 10,205 acres (nearly 16 square miles). *In area and timber, it is the second-best State Forest of Belgium.* It has Beech and Oak, in which the trees stand so close, and the soil is so clean, that there is no danger of fire. It contains two Government Arboretums, which I have described in a recent publication. I spent five days in the forest of Soignes shortly before leaving for Australia.

Belgian Forestry. An important point to note here is the educational value of this forest. Belgium is a democratic country, and to the man of the working class belongs the chief political influence. Brussels is a large, rapidly-growing manufacturing town. The forest of Soignes is part of the everyday life of the Brussels workman. In the long summer days he will be off at 4 o'clock in the morning with a day's provisions, and spend a long Sunday with his wife and children in the forest. In no country is Forestry more popular than in Belgium. A Government neglecting the national forests like Australian Governments do would not have the remotest chance at the polls whatever its other merits! Twenty-five years ago in Belgium there was but a small area of State Forests, and a slender Forest Department. Every effort is now being made to get under timber the whole of the waste lands of Belgium. Belgium, it should be noted, in spite of its dense population, has a considerable area of poor ground, suitable for Forestry and little else.

The Belgium Forest Department has 750 officials, and provides winter employment for 32,000 men. Communes (rural municipalities) are encouraged to plant trees by having half their costs refunded to them, and free management by the State for 10 years. After that they pay at the rate of 8d. per acre per year for continued State management. This substantial assistance is given for two reasons: (1) To produce timber, and (2) to produce rural employment. There had been large destruction of private forests and consequent loss of rural employment. Here we see popular Forestry in a democratic country.

310.—*Other Suburban Forests in Europe.*

I have visited other Suburban Forests near various towns on the Continent of Europe. There is a good Suburban Forest on which the citizens place great store near the health resort of Aix-la-Chapelle, on the German-Belgian frontier. The Suburban Forest of Wartfield, near Frankfort, which in timber-yield is equal to the best of the Paris Suburban Forests, has a net revenue of £2 per acre.

Nancy has its La Haye forest within a short walk of the University. This I know well; the net revenue there is slightly under £1 per acre.

311.—*Suggested Suburban Forest sites in Australia.*

It is easy to see the part which forests like the Suburban Forests of the Continent of Europe should fill in the social life of Australia, where, apart from a too hot sun, there are so many days in which it is pleasanter out of doors than in. The Suburban Forest supplies the shade and space for recreation. It is quite unnecessary to enlarge this point!

Under Forestry in New South Wales I have mentioned three excellent sites for Suburban Forests near Sydney. Near Melbourne, apart from the rather distant mountain forests, the conditions are not so favourable. But Adelaide, if it is to stop the leak in its finances for imported timber, must have a large area on Mt. Lofty, whether this is called a "suburban" forest or not. Hobart, as soon as Tasmania puts its house in order, will have a Suburban Forest on Mount Wellington. Only a Government of the poorest sort imaginable could have brought about the present position there.

I understand that near Perth there is a considerable area of poor sandy soil, which could be acquired at a moderate figure, and which, while fulfilling the essential requirements of accessibility and depth of soil, would also have the value of an educational and social resort.

It was remarked at the British Association Meeting at Melbourne, that on the plans shown to us of the Federal Capital, at Canberra, no provision had been made for a Suburban Forest. Whether this is an oversight, or intended, on account of the dryness of the climate, was not stated; for the Canberra site, like Melbourne, can only grow good trees with artificial watering. It is extremely unfortunate that this should be so, because quite near the Canberra area is country with a better rainfall, well suited to tree-growing.

312.—*The purchased sites, an easily redeemed outlay. The example of Burnham Beeches, in England.*

The difficulty of acquiring land for Forestry adjacent, or very near, to centres of population may not be so great as appears at first sight. A considerable portion of the expenditure incurred may be recouped thus:—

An area devoted to Forestry immediately becomes the choicest suburban building area of the neighbourhood.

However near the land may be to a city, and however expensive to acquire in consequence, the value of building sites rises in equal proportion. And if a scheme be well managed, it is quite possible that the greater portion of expenditure in acquiring the land may be reimbursed by building-sites. At Compiégne and Fontainebleau, building-sites within and in proximity to the forest have long had a value far beyond ordinary building-sites. Some years ago a public spirited individual gave to the citizens of London a piece of land, on which was situated the remains of one of the ancient English forests, the "Burnham Beeches." It turned out, after a few years, that the land which he had reserved for himself became so raised in value for building-sites as to nearly give back to him the total value of his gift to the nation.

And in laying out an estate for a suburban forest, it is often convenient to include building-sites within the boundaries and adjacent to it, since the best building-sites are those which are high and dry, and the best planting-sites are those which are low-lying and damp. If a few pieces of ornamental water are thrown in, by some inexpensive dams across valleys, they will greatly add to the beauties of the forest and birds and game be attracted; while at the same time the water's edge will afford sites for a choice in planting rare and beautiful trees which will grow nowhere else. This has been done in the Brussels suburban forest. Under "Arboriculture," I have mentioned many trees which, during the long dry summer of Western Australia, can only be grown under such conditions. Of such trees are the Camphor, the Walnut, the Chestnut, the Catalpa, and a great many leaf-shedding trees, as well as the Californian Redwood, probably the most valuable tree in the world. Of course, in a matter of this sort, it is necessary to proceed with quite trustworthy agents. As the land is bought in there must be no suspicion of what it is intended for.

Of the influences which may be counted upon to mould public opinion on Forestry in Australia here enumerated, it is probable that the Suburban forest will be the strongest. It means the forest in its most valuable and beautiful form brought home to the daily life of everyone.

CHAPTER IV.

The Australian Forest League, and the work of kindred societies elsewhere.

313.—*The League's recent birth and Great Mission. Its need of a Journal.*

The Australian Forest League was originated by a resolution of the Conservators' Forest Conference, held at Sydney in November, 1911. It has a separate organisation in each State of the Commonwealth, and has performed a useful service in keeping the forest question before the public. It promises to develop into an organisation of the first importance to the country as focussing outside opinion on Forestry matters, while so much of the opinion and work must necessarily be within Government circles. In France certain societies are formally recognised by the Government as being of public utility, and the leaders of the Society awarded public honours. If ever there was a society that at the present juncture in Australia should have such recognition, it is the Forest League. At the meeting in November at Melbourne (the Governor General presiding), we listened to useful addresses from the delegates of the various Australian States. The New South Wales delegate gave an eloquent address which deserved to be printed and widely circulated. It was not even reported!

The Forest League, after having been enthusiastically founded, should now be carried on with moderation and firmness. There is a danger of its being allowed to lapse, after the first burst of enthusiasm. In one of the States, the Forest League is already described as being moribund, but there are exceptional circumstances in that State.

An improvement towards the usefulness of the society would probably be an adequate yearly subscription, so as to cover the cost of a half-yearly Journal and a general educational propaganda. But time would be required for the educational propaganda to take effect.

314.—*Australian Leagues, to be effective, must first acquire Political Influence.*

For the immediate necessities of the case (there is £10,000 going out of Australia every day for imported timber), the only remedy seems an incursion into the field of politics; and the two political parties in Australia are so evenly balanced now, that this course seems designed to effect practical and immediate relief. Political mismanagement has had so much to do with the present degraded conditions of Forestry in Australia that it would be the barest justice if politics could now be utilised to elevate Forestry in Australia to the level of other civilised countries. If the members of the Forest League, the Timber and Turners' Associations, the Australian Natives' Association, the Million Club and other patriotic associations would combine to extort a "forest pledge" from every Parliamentary candidate, the influence of that pledge would assist the forest industries and improve the forest estates to such an extent, that the path would then be open to the full adoption of modern Forestry methods. The four points in pledge might be: (1) Demarcation and Fire-protection for the forests: (2) All forest revenue (and a forest loan, if necessary) to be devoted to developing the forests, forest industries, saw-milling, etc., with roads, buildings, fire-paths, and "Working-plans"; (3) A compulsory teaching of Forestry (as in most European countries and Japan) in all the State Schools and Universities; (4) Forest management to be independent of politics, like the Railways.

The Forest League occupies but a small place in a great gap in the social economy of Australia, and I hope it will either be greatly extended or supplemented by other forest societies. Though it may voice requests that it is impossible for the Government always to meet, it will foster the public sentiment in favour of Forestry; and I submit that the society should receive Government encouragement and a small grant. In France, as mentioned, such societies receive a formal certificate from the Government to the effect that the Society is of public utility (*reconnu d'utilité publique*). This, at once, gives the society a standing.

315.—*Help which foreign countries get from Forest Leagues or Societies.*

There are several forest societies in France:—*"Société des Amis des Arbres,"* etc.; there is the *"Société Centrale Forestiére de Belgique,"* with an extensive membership, and a useful monthly bulletin. There are six forest societies in England. The Danes have a moorland society doing practical work in planting up large areas of moorland. This society has planted something like 150,000 acres of moorland, the society getting a Government grant of some £20,000 yearly, and free transport for the marl and lime used in the moor planting. In the other European States, and in the United States of America, there are numerous forest societies. In Japan there are some 20 forest societies, with a special law, passed in 1907, for their recognition and governance; every private forest owner is compelled by law to belong to the local forest society in Japan.

316.—*An Australian Text-book required for Australian Forestry.*

Mr. Corbin's useful pamphlet of forest statistics should be in the hands of every member of the Forest League; and possibly issued in the form of a popular pamphlet by the League. The members of the League have enthusiasm, but enthusiasm requires to be backed by hard facts.

In speaking of Victorian Forestry, I have suggested (p. 313) that the attention of the Forest League might be directed to a re-publication in a shortened form, and brought up to date, of the 14th and Final Report of the Victorian Royal Commission, published in 1901. This represents at present nearly the sum total of Australian forest literature, and no doubt the author, Mr. Mackay, the present Conservator of Forests in Victoria, could add to it from his more recent experience, and produce a publication which would be useful, not only to Foresters, but to Statesmen and others who might wish to know in brief, what is the present position of Forestry in Australia.

317.—*Facts to be presented in Text-book.*

Some text-book of this sort is certainly required. I have found, in talking to members of the Forest League, and others who are interested in forestry in Australia, that they were unacquainted with the leading facts which have been mentioned in these pages; such as that £10,000 a day is now going out of Australia for imported wood and forest product, raw or slightly manufactured only. That if Australia were to at once adopt scientific forestry on the lines of South Africa, so as to *grow at home* the timber now *imported*, it would be some 30 years before the forest could be a position to produce that timber, and that, in the meantime, the cost of 100 years' neglect of forestry in the past would represent a sum of £588,500,000 lost to the Commonwealth. That within the last few years, simply owing to wholesale burning and grazing, the common Wattle has been nearly exterminated from the forests; and that in the item of Wattle-bark alone, Australia is losing now, taking imports and exports together, a quarter of a million sterling

every year. Then, there are the facts that two or three Australian Governments, instead of spending money to develop the forests, are actually hoarding the money which has been obtained from the wreck of them, and that one Government, Tasmania, has no "Forestry," no forest revenue, and has destroyed the best part of the accessible forests, showing all the time no inclination to turn to account its remaining forests or develop them for the good of the Commonwealth.

Nor is it realised that the present normal importation of timber is some 50 millions of cubic feet, which means an average steamer, of some 3,400 tons, arriving every day with wood that could be just as well grown in Australia as in America or Europe. That the total area of demarcated forests in Australia, up to date, is 11 million acres, while on the moderate 20 per cent. standard, it requires over 98 million acres to be kept under forests; or, if we only take a 15 per cent. standard, 74 million acres of forest reserves would be required. Even a 15 per cent. standard would mean the production of as much timber as Australia is ever likely to want, together with £4,000,000 to £5,000,000 worth of timber for export. Australia is now making only £1,000,000 a year out of timber exports and might make £3,000,000 or £4,0000,000 a year if the world's hardwood markets were fully filled from Australia, as they might be; if the forests were well-stocked and accessible so as to permit of timber being turned out at a much lower price than it is at present. With all these facts before them, Australian Governments are taking no steps to increase the area of forest reserves, or to start putting the forests in order with roads, resident Foresters, and fire-protection. In all Australia there is, so far, but one administrative forest officer who has had the usual professional training in Forestry, and there is not one working Forester living in and controlling a forest fully organised against fire.

CHAPTER V.

Popular Misconceptions regarding Forestry.

318.—*Error* 1—*That Forestry means "costly" planting.*

There are several popular misconceptions in connection with Forestry which may be mentioned here, because the Forestry of the past in Australia has largely gone astray on these popular misconceptions. The man in the street thinks that Forestry is summed up in the dictum "plant two trees where one grew." But in ordinary Forestry there is little planting. It would be too expensive.

It is true that the forests of Australia are so deficient in softwoods that such will have to be introduced artificially, and I am hopeful that much of this will be done by the self-spreading of Pines and Cypresses in the half-empty fire-swept Eucalypt forest that we see to-day. In South Africa, where there has been mixed planting of Eucalypts, Wattles, Pines, and Cypresses, they come up self-sown, and spread themselves naturally like the "noxious weeds" of Australian legislation —the bramble, the briar, and the gorse. This is one reason why it is advisable to proceed somewhat cautiously with plantations.

Reporting on Victoria's forests in 1895, Mr. B. Ribbentrop, Inspector General of the Forests to the Government of India, said:—

Planting on a large scale is costly, and it will be found, if an accurate ledger is kept of the original outlay and all its incidental expenses, that artificial forest cultivation will repay the money and time spent on it only in very exceptional circumstances.

319.—*Error 2—That hardwoods and slow-growing timbers have most durability and strength.*

It is popularly supposed that the hardest and most slow-grown timbers are the most durable. This is far from being the case. Tropical forests are full of perishable hardwoods, the class of timbers which are the least useful of all timber. All the Cedars are softwoods (the softest of woods as a class), and they are all more or less durable; a good many, such as *Callitris arborea* (Cape Cedar), being very durable. The Red Cedar of Australia (*Cedrela australis*) and the Redwood of California (*Sequoia sempervirens*) are notably durable as softwoods. In Tasmania the Celery-top pine is said to be twice more durable as a railway sleeper than is the best of the hardwoods, and Huon Pine many times as durable. On the other hand, tropical forests (and too often extra-tropic forests also) may be full of a great variety of hardwoods, so hard as to be almost useless, and decaying rapidly when put in the ground. Economically, timbers are grouped into four classes:—

1. *Durable softwoods,* such as the various species of cedars—the Red Cedar of Australia and the "Redwood" of California. These are the most valuable of all timbers.
2. *Perishable softwoods,* such as the common pine wood.
3. *Durable hardwoods,* such as Ironbark, Jarrah, Tallow wood, and the best of Eucalypts.
4. *Perishable hardwoods.*—Tropical forests are generally full of these. Apart from a few valuable timbers such as Ebony they are only of use for firewood.

The tests made by G. A. Julius show that the heavy timber is not uniformly the strongest. Among Western Australian timbers air-dried Karri is the seventh on the list for weight, but it has only three timbers above it for strength as a beam.

320.—*Error 3—That the American "backwoods" typify the ideal "permanent forest."*

The popular conception of the forest amongst Englishmen is the wild forest—the American "backwoods" forest. Most of the timber used in England has come from wild forests in Sweden and in America; but those forests are coming rapidly to an end; and both Sweden and America will then have to get their timber supplies from the much more productive cultivated forest. Of the cultivated forests of continental Europe which have been gradually formed during the last 150 years, the man in the street knows nothing, be he an Englishman or an Australian (p. 110). It is this want of knowledge of the cultivated forests of Europe that has led to the under-valuation and disregard of the forests of Australia. It has not been realised that the wild forests of Australia to-day represents only one-half or one-third the value of the cultivated forest to which they will be gradually raised after having been fire-protected and cut over once or twice.

The benefits of fire-protection are sufficiently obvious, but only the Forester knows the difference between the over-mature, unsound, and ill-grown timber of the wild forests, and the straight young timber of the cultivated ones, the difference between the timber of an even-aged and of an uneven-aged forest. This is not to say that there is not first-rate well-matured timber in the virgin forest; I am speaking in an average sense.

It is apparently the "backwoods" idea that is responsible for a curious anomaly in the official statistics of Australia. In the *Year-book of the Common-*

wealth, page 274, No. 7 of 1914, is given an interesting diagram showing the progress of land settlement in Australia from 1901 to 1912. Here two errors are at once seen: (1) the forest reserves are not included in land *settled*; (2) they are not even classified as "occupied" lands.

1. A sub-head shows land reserved by the Crown for roads, but omits the forest reserves. Under ordinary conditions, the State Forests of a country are the areas which are most settled, and this must shortly be the case in Australia, because the area of the forest reserves is below the requirements of the country: two States, Victoria and South Australia, are now redeeming lost forest areas; in Queensland forest redemption is the outstanding forest question; and other Australian States will have to act energetically to a considerable extent before they obtain their requisite quotum of forest reserves. This, in fact, is the process which is going forward in other countries. Prussia acquired a million acres in some 15 years. The French have a standing credit of a million francs in their Budget for redeeming forest areas and adding them to the State Forest Domain. The United States, in the Apalachian scheme, is spending some £500,000 yearly on buying land to be added to the State Forests. The "cultivated forest" is fully discussed at p. 109.

2. Land occupied by State Forests may be more occupied in the sense of rendering a good return and carrying better population than farm lands. Good forest land may be yielding, whether in Europe or Australia, £5 or more per acre. There are belts of Eucalypt timber in Australia that experienced sawmillers have valued as they stood at £500 per acre (Geeveston, Tasmania), say £5 per acre per year on a 100 years rotation. It is good farm land which gives an average of more than £5 an acre. There is fair farm land within 20 miles of London, England, which is not returning above £1 per acre. It may be owing to the "backwoods" ideas that State Forest land, which may be more productive and actually carrying a larger population than farm land, is classed as unoccupied by the Government Statistician. It is obviously an incorrect classification.

321.—*Error* 4—*That all good land is more profitable under Agricultural settlement than under Forestry.*

We have the same underlying "backwoods" idea when a Minister meets a deputation, urging Forestry, with the rejoinder that he "will never consent to see land that could produce food left as forest." Why not? Man does not live by bread alone! Man requires wood for his industries, and trees for water supplies, beauty, and recreation, as surely as he requires mutton and potatoes!

I have devoted a section to pointing out the difference between the wild and the semi-wild or "cultivated" forest (p. 110). Between the "cultivated" forest and the present fire-swept Australian forest there is a very wide difference. The "cultivated" forest can easily return more than an average agricultural crop—the Australian wheat crop in 1912 was at the rate of £2 5s. 4d. per acre (*Com. Year-book*, 1914). It is easy for Forestry to exceed this. A 200 acrim would mean, at 4d. the cubic foot, say, 150 cubic feet sawable — 150 × 4d. = £2 10s. This, curiously, is the same as the average net yield from timber in the Black Forest of Germany, but in exceptionally good sections of the Black Forest the net yield goes up to just inside of £5 per acre. This comparison is, of course, only just where we can afford to neglect the interest calculation, as in the case of the virgin forest, or the semi-wild cultivated forest with trees of all ages, so that the forest taken as a whole has yearly crops.

Destruction of Forest for Agriculture.

322.—*Error* 5—*That intensively working a forest necessarily destroys it.*

Then, there is the popular idea that to work the forest is to destroy it; an idea probably due to the forest being badly worked, and ravaged by fire. I need hardly point out that the truth is exactly the reverse. Provided that there is a market for the timber, and that it can be thus worked remuneratively, its future, in the hands of a scientific Forester, is assured. Enough has been said under Forest Management (p. 69) to make that quite clear.

The man in the street sees the forest as a thing of beauty, and he sees a section of forest which is in course of working temporarily bereft of its beauty; so he jumps to the conclusion that to work the forest is to destroy it! Of course, in countries where there is no scientific Forestry, working the forest tends to destroy it, but that is the result, not of use, but of abuse.

The best education for the man who believes that working the forest destroys it is to go through the cultivated forests of Europe. A traveller may come to a portion of forest which appears to him to be destroyed, and he may make a remark to this effect. Probably the only answer he will get will be a shrug of the shoulders, and a "Leave that to them"—meaning the Forest officials. There is no more beautiful forest as a whole, in Europe, than the suburban forests of Soignes, outside Brussels, and this is absolutely a cultivated forest which was originally planted. It is, of course, regularly worked for timber.

Not long ago, to a deputation urging more vigorous Forestry, the Minister of Customs replied that extensive working of Australian forests, involving a depletion of supplies, could not be considered. Here there was an entire misconception of the methods of modern Forestry. The more rapidly the wild forest of Australia is worked through, the sooner will it be turned into the cultivated forest, safe from fire and yielding two or three times the timber obtained from the present wild forest! The proof of this lies in the comparative study of the yield of the present wild forests of Australia, and the same forest, in a cultivated form, in South Africa, Southern-Europe, and California.

The deputation of the Forest League reported in the *West Australian* of Perth, 17th June, 1914, stated:—

> The State's export figures as regards hardwood timber were growing, but we did not want to see them grow any more.

Here, again, is the same misconception. If the Western Australian forests are worked on modern lines the export trade should be pushed, in order to utilise the large volume of mature and over-mature timber which now cumbers the forest to the exclusion of more useful growth, and represents a capital returning no interest.

323.—*Error* 6—*That Forestry and Botany are practically the same thing.*

It is a very common notion in Australia that Forestry and botany are the same. There is not much more connection between the two than between zoology and horse-racing; less than there is between mathematics and navigation. Occasionally, amateur lectures on "Forestry" have been given in Australia by botanical Professors, sometimes, not altogether to the advantage of "Forestry."

Of the great bulk of Foresters in civilised countries few have anything more to do with botany than with chemistry, geology, meteorology, or other of the sciences allied to Forestry. The Forester has necessarily to know something of the botany of the few species that come into practical Forestry; vegetable physiology, if that be included in his botany, is more useful. Forest pests, fungoid and

insect, are important studies; but not much of these can be stretched into ordinary botany! At best, ordinary botany is an interesting pursuit for the Forester's leisure hours; on the whole not so useful as photography, or meteorology, in its relation to the habitat of exotic timbers; and certainly not so useful as mycology and study of the forest insect world.

It has been stated, and with considerable truth, that the only assistance Forestry has received from botany in recent years has been the negative one of confusion and disagreement over the botanical names of well-known trees such as the Douglas-pine, the common European Silver-fir, the Californian Redwood, and the apparently hopeless confusion in the nomenclature of the Eucalypts. This has led to Foresters and practical men refusing to abandon accepted names such as Pinus insignis till botanists have been in agreement for a term of years.

The two chief qualifications required in a Forest Officer are administrative ability and skill in making forest "Working-plans." For the latter, the most important study, outside Forestry itself, is not botany but forest meteorology; and, for Australia, the very important study of extra-tropical arboriculture.

Division IV.

ECONOMICS OF AUSTRALIAN FORESTRY.

CHAPTER I.

Exports, Imports, and Home Supplies.

324.—*Costs of Imported Timber.*

The total quantity of timber imported the year before the war was about 50 million cubic feet, costing about 3½ million pounds, or, say, 1s. 4¾d. per cubic foot. This calculation makes allowance for a normal increase during the two previous years of drought (p. 185). It includes the forest products—tan bark, turpentine, and resin, but excludes all furniture. No paper-pulp seems to be imported.

The importation of timber to Australia is a steadily-growing figure. It grew from a total value of £1,894,591 worth in 1908 to £2,863,213 in 1912 (p. 392, *Commonwealth Year Book,* 1914). When war broke out it was about 3½ million pounds; New South Wales and Victoria importing about 1½ million pounds each. There is no chance of this being reduced. Taking the normal now at 3½ million pounds, it may be expected gradually to rise to £5,000,000 or £6,000,000, where, perhaps, it may find its level for some years. It will certainly be well within the mark if we assume an average of £6,000,000 yearly for the next 30 years.

325.—*Estimated cost of future imports.*

It will be useful to inquire what will be the inevitable cost of imported timber, supposing Australia were to take steps at once to produce at home the timber now imported, as has been done in South Africa; 30 years being allowed as a mean period for this timber to mature.

In the following calculation, I take 30 years as the time required for supplies of regrowth hardwood and of planted softwood to mature for most purposes. Rough timber for packing cases will mature in 15 years; but good log timber will take 45 years or 50 years to mature. Within 30 years the present supplies of *workable mature timber in the virgin forest* will be quite exhausted.

We may estimate the rise in timber imports in two ways:—(1) as a function of the population; (2) as a function of the previous years' importations of timber.

As regards (1): taking six millions as the average population during the 30-year period; as the present rate of importation is well under £1 per head of population (3½ millions import for 4,872,000 population), the average importation, as a function of the population, would be well under £5,000,000; or, if we put that into figures, the average population showing increase of one-fifth on the present population, viz. (in round numbers), from five millions to six millions; the present importation being 3½ million pounds, an increase of one-fifth added to this would give an increase of £700,000, thus making up a total import of £4,200,000; but this figure neglects to take account of both the failure of home supplies and of industrial progress. This figure, taken by itself, looks as much too low as the next by itself would be too high.

As regards (2): considering the increase of imported timber during the last few years, the table at page 392 of the *Commonwealth Year Book* for 1914 shows that the timber import increased nearly £1,000,000 during the four prosperous years 1908-12. Thus: Imports, 1908, £1,894,591; and 1912, £2,863,213. During the three years 1909-12 the increase was even more rapid. This figure relates to a period of unusual prosperity, and it would be misleading to take it as a guide for the future.

Allowing, however, for a set-back during the war, and afterwards for average industrial development on the lines of the last 10 or 12 years, I see little chance of the imports averaging, during the next 30 years' period, less than £6,000,000.

326.—*Annual imports of timber per head of population in Australia and other countries.*

Australia, when the war broke out, was importing timber at the rate of 14s. 4½d. per head of population. It will be instructive to compare that with the rate per head of other countries. The assumption of six million pounds as the average timber bill of Australia for the next 30 years is supported by a consideration of what is the import timber bill of other countries.

Statistics show (p. 188) that the present use of timber in Australia is at the rate of 21.45 cubic feet per head, which is less than that of Germany and France. It is far below the figures quoted for the United States of America. The Australian timber is half imported and half Australian production. This figure, with the present industrial development, is likely to rise. The production from the half-ruined forest cannot rise during the next 30 years, so that will leave the increase to be made up by imports.

South Africa, which in agricultural and industrial wealth and in white population is about equal to the average of one of the larger Australian States, has an average timber import of rather over 1¼ million pounds. This is at the rate of about £1 5s. per head of population. It is useful to compare South Africa with Australia, since South Africa has not had the recent industrial development of Australia, and the timber import figure has been steady for some years past. Australia has had a much larger area of home forest to fall back on, but that is a rapidly dwindling area, increasingly burnt over, and with a supply of softwood relatively not much better than South Africa. Australia, too, is a rapidly growing industrial country, which South Africa is not. It has thus wanted more timber than South Africa, and will continue to do so in increasing quantity as the home supply fails.

In England, where there are practically no wooden houses, the average importation now of wood and forest products is at the rate of 19s. 1d. per head; the figures being, at the outbreak of the war, £43,000,000, for a popualtion of 45

millions. To this, for the total consumption of timber, has to be added the home-grown timber from three million acres. The English importation of timber is steadily and rapidly rising. It has grown from about £12,000,000 in 1872. Serious though the present figure is, it attracts comparatively little attention. It has come to be taken as part of the issue in the free trade and protectionist strife. More has been thought of the volume of trade than of home production. There will probably be an awakening after the war; for, outside the money loss, there is "the loss of much rural employment and the pick of the manhood" of the country—the great social question in England at present.

Belgium, when the war broke out, was importing £8,000,000 worth of timber, or at the rate of almost exactly £1 per head. In 1850 Belgium imported only at the rate of 1s. per head. This is the result of industrial development.

Even Germany, with its fine home forests, has had to start timber importing, owing to its great industrial development of recent years. Germany is now the largest timber importing country, after England. There is no avoiding the conclusion that industrial progress and heavy timber requirements go together. The German forests are well stocked, and improving in their timber yield year by year; but Germany, with a population of 65 millions, has not got room at home to grow all the timber it wants. Australia has; and with good forestry, could fill the hardwood markets of the world! When the war broke out Germany was said to be importing timber at the rate of about 7s. per head.

There is a heavy timber demand for building the wooden houses that are such a conspicuous feature of Brisbane and the smaller towns of the south; thus leaving 14s. 4½d. per head, the present Australian consumption of imported timber, a rather low figure compared to the English standard. I have shown (p. 189) that the present Australian consumption of timber is almost equally divided between home-grown and imported.

327.—*Australia's timber imports for next* 30 *years,* £6,000,000 *a year.*

No doubt, to some extent, the bulk of the imported timber will be influenced by the tariff. The present tariff for a protectionist country is remarkably low, induced, no doubt, by ignorance of the *capabilities of* Australian forests, and the unfortunate predominant town interests as against rural, in politics. In South Africa, the position is reversed. The predominant interest is rural, and with this has gone better Forestry. It is to be feared the predominant town influence in Australia will, for many years, be on the side of increased imports of timber.

On these grounds it seems impossible, as an average for the next 30 years, to value the Australian import at less than £6,000,000 yearly. The present figure must go on rapidly rising in a young country developing industrially. And it will be 20 years before there can be any appreciable relief from softwood plantations, and 30 or 40 years before there can be any *adequate* production of good softwood timber. This, too, is supposing that Australia were to start away at once, and put down a million pounds a year for scientific forestry. But Australia will not do this. There will necessarily be delays. Public opinion has to be formed. In Tasmania, the most backward State, the first step has not been taken in scientific forestry, and most of the accessible forest there, that could be worked economically, is destroyed or alienated. *It is certainly well within the mark if we assume* 30 *years* before Australia can obtain any appreciable reduction of the £6,000,000, that will soon be going out of the country yearly for imported timber.

This is a very serious figure; £6,000,000 yearly equals about three-fifths the present charges (£9,909,118 on 30th June, 1913) on the Australian public debt—

Federal and State. It calls for the earnest consideration of every patriotic Australian.

328.—*The National Debt equalled by the unavoidable timber bill.*

Or, looked at in another way, supposing Australia *were* to start modern forestry at once in all the States, as South Africa did after the Boer war, before the bill for imported timber could be finally extinguished this bill will have reached a figure in excess of the present national debt of Australia, State and Federal; since six millions yearly for 30 years, with interest at 4 per cent., will amount to 336½ millions. On 30th June, 1913, the Public Debt stood at—State, £294,472,486, and Commonwealth £7,430,949; total, £301,903,435.

I have taken 1,000,000 as the mean increase of population during the 30-year period, taking 15 years as the mean period; and the present population to 1st January, 1914, being 4,872,059 (*Commonwealth Year Book*, 1914), the average population for the 30 year period becomes six millions.

The six millions a year for imported timber may be reduced by good forestry and gradually extinguished in between 30 or 40 years. Whether reduced by good forestry as in South Africa, or increased by bad forestry, as in Australia, it is a charge which there is no means now for Australia to escape for the next 30 years.

As regards the average value per cubic foot of the imported timber: in 1912, the last year for which full official returns are published, Australia imported 368,954,356 super. feet (= 30,746,196 cubic feet) of logs and undressed timber valued at £2,161,605 (Official *Year Book*, 1914), which thus had an average import value of 1s. 5½d. the cubic foot. The average value for the three years, 1911-13, was quoted to me in a letter by the Commonwealth Statist at 1s. 1d. per cubic foot. Taking the average timber consumption at £2 per head (my estimate) and the quantity at 21 cubuc feet, the average present retail price works out at 1/10¾d. per cubic foot. It is possible that the era of cheap wooden houses may come rapidly to an end with the increased dearness of timber and that the mean consumption during the 30 years may be under the present figure of 21 cubic feet (= 252 super. feet), but, on the other hand, industrial development will tend to raise it.

329.—*Factors affected by retail price of timber.*

There is no doubt that, besides the bill for imported timber, Australia has to face also a heavy loss in export timber during the next 30 years. Here it is less easy to foresee the exact loss. I say again 30 years, because it takes an average time of from 30 to 50 years for Eucalypts to mature; and it will be perhaps some 20 years before the present supplies of export hardwood in the forest come practically to an end. What the loss in export timber may be can be approximately estimated thus:—The largest item of export is £500,000 worth of timber, mostly sleepers, going yearly to India and New Zealand. Both of these countries have supplies of their own. It is mainly now a question of forestry whether they send sleepers to Australia or Australia to them; and, for at least 30 years, Australia must suffer from the bad forestry of the last 100 years.

330.—*Losses of Export Markets; former customers become competitors.*

From South Africa we have to consider the loss of what might be made in exporting hardwood for sleepers and girders, before the forests now being formed there can come into bearing. The railway system of South Africa is now an important one, extending over some 30deg. of latitude. One can travel from Cape

Town to Katanga, or nearly to the Equator, by rail. The substitution of Karri for Jarrah sleepers injured the sleeper export to South Africa for some years, but in 1912, £270,000 worth of timber went to South Africa. The extensive railway system of that country requires about £250,000 worth yearly of sleepers for renewals alone.

Then there is the Argentine and Uruguay, in South America, where systematic forestry is barely now beginning; the first, the richest country in the southern hemisphere, with railways across its great treeless plains. They get most of their softwoods from North America; their hardwood for sleepers should come more economically from Australia than the distant Quebracho forests, but, so far, Australia has sent only small quantities of hardwoods, thus: £73,000 in 1908, and £16,000 in 1912.

331.—*Europe's unlimited market for Cheap Hardwood.*

Lastly, with a market that can never be overstocked if only hardwood can be got in cheaply enough, there is Europe, where there is pretty certain to be an increasing demand for hardwood, replacing oak, which can no longer be grown at a profit, as against softwoods. England alone is now importing hardwood to the extent of £4,000,000 yearly, and of this only an insignificant part comes from Australia. The poor forestry of Australia seems already to have seriously reduced the export of its hardwoods to Europe. In 1908 (including Egypt) there was an export of £248,402 worth, but by 1912 (the last year of published returns) the export to Europe had shrunk to £116,860, or by almost exactly one-half. It is just a question of economical working, and so little has been done to open up the Australian forests with roads and railways.

332.—*Australia's annual exporting power limited to half-a-million sterling.*

Taking all these facts into consideration, it seems difficult to value the *possible* export trade in hardwood from Australia at less than £3,000,000 yearly. How much of that £3,000,000 will be captured will depend, to some extent, on the policy pursued. If the forests are properly opened up to saw-millers and protected from fires by organisation and road-making, if the accessible forests are at once demarcated and extended by redemption and planting, it is probable that the present £1,000,000 obtained from the export of timber may be maintained at an average of about £500,000 for 30 years, till the improved regrowth forest comes to cutting age. That would leave an average net yearly loss of £2,500,000 for the next 30 years, or, with interest at 4 per cent., £112,000,000. It must be remembered that with the failure of home supplies, there may be very little timber left for export.

These partially captured markets are, of course, no new thing to timber-business men in Australia; but the cheaper working, and consequently lower prices for Australian hardwoods that would come with modern Forestry methods, are apparently not known to them. To see it they would have to study timber-working and transport in countries where Forestry is more advanced than Australia.

333.—*Tan bark export industry; continuous shrinkage of home supplies.*

The tan-bark export is capable of great expansion. In recent years it has shrunk with the shrinkage of home supplies from bad forestry. It is shown (p. 185) that, taking imports and exports together, Australia is now losing £250,000 yearly over Wattle-bark. At present large supplies of Wattle-bark are being burnt, while the value of the burnt bark for export and home use would repay, many times over, the cost of fire-protection. Last summer Victoria burnt a Wattle-bark plantation.

334.—*The sources of supply in the existing forests.*

Forestry or no Forestry in Australia, there will for long be certain supplies of timber from forests that do not easily burn, such as the Karri forest of Western Australia, and the dense "brush" forests of New South Wales and Queensland; also a good deal of timber, now left as being immature and below the cutting standard sizes, will grow in spite of the fires, as the timber before it has grown with the milder fires of the blacks. There is also a larger area of unworked, inaccessible forest which has only been picked over, and will become accessible with forest organisation and the development of the country generally. It is thus seen that £500,000 seems a fair average figure to take for exports during the next 30 years.

335.—*The crux of an export trade is the area of accessible good forest.*

The crux of the matter as regards foreign markets is the area available of well-stocked *accessible* forest. Want of forest demarcation in the past has lost the best of this; but while redemption will restore some and the progress of development will render some others accessible, a policy of population and progress for the forests will do more.

CHAPTER II.

Primary Values of Forest Products.

336.—*Value of home timbers at Mill and in Forest.*

The bill for imported timber will be bad enough, but this is not the worst! The neglect of forestry in Australia (during the last 100 years), is going to hit the country in another way. There will be failure in home supplies of timber.

Australia, at present, uses yearly, slightly over £5,000,000 worth of timber as raw material (*Official Year Book,* 1914, page 472), which is slightly more than doubled in value by the various manufacturing processes. The "Year Book" gives, on page 473, "Value of raw material worked in factories in the Commonwealth, 1912," "Saw-mills," as £5,085,492, and the value of this, manufactured, at £10,281,284. Of this timber, we have to deduct, perhaps, half a million worth for the value of imported timber worked in Australian sawmills, leaving 4½ million pounds as *the value of native Australian timber worked in the saw-mills of Australia.* The value of undressed timber imported in 1912 was £2,061,666 (*Commonwealth Year Book,*" page 392), of which perhaps one-quarter went to the mills. It is unfortunate that exact information as to the proportion of home and foreign timber worked in the saw-mills is not available. Probably, the deduction of half-a-million pounds' worth is an outside value, since most of the imported timber goes direct to the house-builder. It seems fairly safe to assume that at least 4½ million pounds' worth of Australian timber is worked in the mills yearly.

To revert again to the figure £5,085,492, it is evident that it is made up of three values. (1) The value of imported timber converted at the mills. (2) The value in the forest of that part of the home timber which is brought to the mills. (3) The value of work put on the home timber in cutting and bringing it to the mills. So that this figure of £5,000,000, as the value of the raw material at the timber mills, does not help one to get at the present value of the home timber cut in the forest.

337.—*Misleading comparisons of official forestry values.*

Indeed, the primary value of Australian home timber in the forest is not easy to get at The State Forestry Departments have a total "Revenue" of £254,586, but this is only an indication of the value of the total quantity of timber and produce worked in Australian forests, since much of the timber felled does not come from Government forests; and in one State (Tasmania), there is no Forest Department and only a nominal forest revenue. In Queensland, too, if I remember correctly, the amount of timber worked, comes about half from Government and half from private forests. We may, however, put an average value on the timber, scheduled as raw material at the mills, to get at the value of this timber when cut in the forest.

An examination of the figures given in the official *Year Book*, No. 7 of 1914 (p. 390), gives the total quantity of local timber sawn or hewn in the Commonwealth during 1912, as 667,554,000 super. feet (= 55,629,500 cub. ft.). These figures, it is stated, were furnished by the various Forestry Departments. It is unfortunate, for more reasons than one, that the Forestry Departments have not given the value of the timber as it stands in the forest, for that is the important figure for the Forest Departments, as representing the national forestry of Australia. Thus, owing to good management in Queensland, and chaotic management in Tasmania, the same timber in Queensland seems to be rated at five or six times its value in Tasmania. The *Commonwealth Year Book*, it is true, mentions returns from Tasmania and South Australia, and some fragmentary estimates from the Forest Departments of other States; but more information is required to extract any statistical value from these.

338.—*Primary valuations by the "Metric tickey" standard or by politically-influenced "Royalties."*

However, one may get an idea of the forest value of the timber by taking average figures from other countries; 2.4d. (= £0.01, sometimes called the "metric tickey") is a convenient figure for the value of timber standing in the forest, per cubic foot of *sawable timber*. For general estimates I have frequently used it. The average value of timber as it stands in the South African forest is a good deal higher. It was 4d. in 1912 and 4½d. in 1913, much of the timber being sold by auction. Royalties in Australia are generally, but not always, decidedly lower. The present average Royalty on Queensland timber is stated to be 2d. per cubic foot.

Australian royalties generally, as I have shown (pp. 93 and 182) are abnormally low for various reasons. When shiftless Governments have been reproached with doing nothing for the national forests, they have thrown a sop in the way of reduced royalties to the millers! (This was reported to have been done by the "Minister in charge of Forests" a few days ago in Melbourne.) It is not only in Australia that this has occurred, nor is, of course, forestry peculiar in the evils following political interference. The fact must be referred to here in connection with the low timber royalties in some of the Australian States.

There are reasons why the Australian timber royalties should legitimately be low, pending better forestry and better timber At present, working the unsound, unwieldy, and often scattered, over-mature timber, and the absence of Government help in road-making, are serious drawbacks; so that 2.4d. per cubic foot may perhaps be taken as an average normal value for the next 30 years. I see *Insignis* pine has been sold standing, from plantations in New Zealand, at 2½d. the cubic foot.

Thus 667,554,000 super. ft. (= 55,629,500 cub. ft.) at an average value of 2.4d., may be taken as having a value of £556,295. But this figure represents the sawn or hewn cubic content of the timber in the log. To convert this to the gross log cubic content of the timber as it stands (and this is what the "metric tickey" rate refers to), we must multiply by about two; so that the forest value of local timber sawn or hewn in the Commonwealth during 1912, valuing it at 2.4d. per cubic foot, as it stands in the forest, would have a total value of £533,243 × 2, say, £1,000,000, in round numbers.

339.—*Waste of forest timber indicated by "Sawn Timber" Statistics.*

It might be objected, that in taking the *sawn* timber as half the *sawable* timber, half is too large, for it must be remembered that the rates for timber in the forest are rates for sawable timber, not the mere outside measurement of often hollow logs. But one-half, or near it, is the usual experience of most saw-millers, and it is the official rate mentioned in the Western Australian Forest Regulations. Bad Forestry in Australia has undoubtedly had, as one of its results, the waste of timber.

American forest statistics give a curious confirmation of the "metric tickey" assumed value for the "sawable" timber of Australian forests. This would give a value of £1,000,000 for the timber felled during 1912, while the value of the same timber as it leaves the saw-mills is returned at £5,000,000 (in round numbers), thus giving the standing timber in the forest an all-round value of one-fifth the value of the same timber as it leaves the mills. American statistics, as I have mentioned elsewhere, rate the timber in the forest at one-fifth the value of the timber as it leaves the mills.

340.—*Primary value in the forest of trees producing* 667,554,000 *super. feet of sawn timber, equals* £2,000,000.

There remains the value of mining timber, poles, logs, piles, split palings, firewood, tan-bark, etc., not included in the Government Statistician's figure of "Timber sawn or hewn, 667,554,000 super. ft.," to which, perhaps, may be assigned a very approximate, but certainly inside, value of another £1,000,000; bringing up to some £2,000,000 *yearly, the present primary value in the forest of Australian forest production.* It is worth noting that in Victoria, during 1913-14, the sawn timber, and all other forest products, had a worked value approximately equal. At page 390 the Commonwealth Statistician states, "No satisfactory estimates of the total value of forest production are available. Large returns are credited to firewood, but these are subject to a wide range of uncertainty."

341.—*Home trade has lost the stimulation derived from cheap abundant raw material.*

Thus, to resume, we have somewhere about two million pounds as the forest value of the forest products of Australian forests; 4½ million pounds as the value of Australian forest produce as it gets *to* the factories; some 9½ million pounds as the value of the forest produce as it *leaves* the factories.

Here is a tale of industrial progress, founded on a cheap and abundant raw material! How far the total or partial exhaustion of the raw material is going to contract the industries is difficult to foretell, much less to express as a money value. There is no gainsaying the fact that an abundant and cheap raw material is the most powerful stimulus to industrial progress. Thus, Australia had a cheap and abundant supply of tan bark, which has been lost through bad forestry. While it lasted, it stimulated the early starting of tanneries. Australia had no abundance

of softwood for paper-pulp, and it has never had a paper-pulp and paper-making industry. Australia to-day is paying £3,116,215 yearly for imported paper (Off. "Year Book," No. 7, pages 539 and 561). Of the paper imported to Australia nearly three-quarters comes from forest countries, Sweden, Canada, and United States of America. The import of paper from England, a non-forest country, is rapidly declining. England has to import practically all its paper-pulp.

The curtailment of the supplies of cheap Wattle-bark has already affected the tanning industry, which has been almost stationary during the last few years. Thus, though the value of the machinery has increased, the number of tanneries has fallen from 303 in 1908 to 294 in 1912.

That there will be a curtailment of forest supplies, instead of the improvement demanded by expanding industries, is certain.

342.—*Exports of certain timbers now prohibited on account of scarcity.*

The native forest is now not one-third stocked; it has been ravaged by the fires of the blacks from time immemorial, and recently by the more severe fires of the whites. It is showing signs of exhaustion at every point. In the one all-forest Australian State, Tasmania, reckless working has destroyed all the easily accessible timber. Costly tramways are required to get at what is left, and the price of timber there has doubled during the last few years. The State of Tasmania is losing some £100,000 a year forest revenue, and what is worse, losing its valuable forests. This £100,000 is now made up to it by the special Commonwealth grant of £90,000. Should this support to misgovernment be continued, may well be a question; since the criminal recklessness of the Tasmanian Government is a menace to the whole of Australia? It is unfortunate that in the Act of Union some clause requiring ordinary care of the forests was not inserted. In India, the British Residents at the Courts of the Native States, keep a watchful eye on the general forest policy of the native States. A State so recklessly governed as Tasmania should be compelled, in its own best interests, to reform.

Even in better-governed States like Victoria the forests are not yet organised against fire, and the supplies from the forest are dwindling. Victoria has had to stop the export of Ironbark to keep sleepers for its own railways, while "Redwood" (*Euc. rostrata* and *Euc. tereticornis*) has been recklessly destroyed and is getting nearly as scarce. The Victorian Government is now actually replanting hardwoods!

New South Wales has been robbing and burning its forests for over 100 years. It is doing practically nothing to stop the forests' destruction, and hugs half-a-million pounds wrung from the ruin of its forests! The Conservator of Forests estimates that with the present rate of working, all the hardwood will be done in 35 years, and the softwoods in 15 years. Sleepers have been largely exported to South Africa, India, etc., now they can hardly get enough sleepers for their own railways. The price of sleepers has nearly doubled in five years, while the price of labour has not risen over 30 per cent.

Queensland has been estimated to have destroyed more timber than it has got left; and it is doing nothing to fire-protect the natural reproduction of timber in the considerable area of national forest that is still left. It has scarcely the beginning of an efficient Forest Department, or of an adequate forest expenditure.

Western Australia, when the war broke out, was exporting over one million pounds' worth of timber, and using up another quarter of a million pounds' worth of timber locally. Said Mr. Peter O'Loghlen, M.L.A., Vice-President of the Forest League of Western Australia to the Minister in charge of Forests, at a public reception of the League's deputation, 1914 (and the statement was not denied by the

Minister), "At the present rate of forest denudation the timber industry in 20 years would be of small importance"! Western Australia has prohibited the export of Wandoo and Tuart, its two best timbers after Karri and Jarrah. Its Mallet Bark and Sandal are nearly done. It has no softwood in the forests, and is paying £120,000 a year for imported softwood!

South Australia, relative to its population, has now the best Forestry in Australia; but, before beginning serious "Forestry," it had alienated practically all the accessible forests; so that it has now to import nearly the whole of its hardwoods and softwoods. South Australia has paid nearly four million pounds sterling for imported timber since 1905! In proportion to its area, its natural forest wealth was originally the lowest in Australia, as Tasmania's was the highest.

It is impossible to avoid the conclusion that during the next 30 years there will be a stoppage or considerable shrinkage of house timber supplies in all the Australian States. Both in Australia and New Zealand the average cost of native timber has about doubled during the last six or seven years.

CHAPTER III.

The Lessons of the Past.

343.—*Summary of the losses due to a Century of bad Forestry.*

If we take the primary value to Australian industries of its forests at £2,000,000, and allow the loss of half that with the shrinkage of forest production during the next 30 years; and if, further, we rate at £1,000,000 yearly the indirect loss to Australian industries through the forests going partially out of production during the next 30 years, we have £2,000,000 for 30 years, equal to £60,000,000, or, with 4 per cent. interest, equal to £112,000,000. This figure is merely an estimate, but it is a low estimate, likely to be exceeded in reality; the estimate of timber working at Dona Buang (p. 206), valued the indirect loss at 22 times the timber royalty! The million here estimated is little more than a suggestion of the much greater sum really represented by indirect losses.

Loss amounts to £588,500,000.—With these data, we can estimate fairly approximately the loss which the bad Forestry in Australia during the last 100 years must inevitably cost Australia during the next 30 years:—

1. Cost of imported timber at average of £6,000,000 yearly for 30 years, with interest at 4 per cent. as above ..	£336,500,000
2. Loss of export trade owing to bad Forestry, say £2,500,000 yearly for 30 years, with interest as above at 4 per cent.	£140,000,000
3. Shrinkage of production from Australian forests, for home use, plus £1,000,000 indirect losses, at average of £2,000,000 for 30 years, with interest	£112,000,000
	£588,500,000

If we take the present day value of the figure £588,500,000, discounted at 4 per cent., it is £243,333,000. That is more than the war can cost Australia at the most outside computation.

It must be remembered that of these three figures (1) is a close estimate of a certain loss; (2) and (3) are only approximate estimations of losses, while there is a certain amount of over-lapping between (1) and (3). I have preferred to state the whole three items as rather below, than above, what is likely to occur, though I have faith in the rapid development of Australia; and that is the peg on which these items hang. If development be slow, they will be too high; if rapid, too low. In any case, the figures call for very earnest attention.

They are somewhere near the amount of the whole British National Debt when the present great war broke out, viz., £700,000,000. They are nearly double the total public debt of Australia, State and Federal, a year before the war began (£302,000,000). They exceed, by a good deal, the total value of all the gold won from Australian soil, which up to 1913, the date of the British Association statistics, was £550,000,000.

The calculation assumes that Forestry in Australia will be now put on the same footing as Forestry in South Africa. It is easy to infer what may be the cost of not doing so!

344.—*Further losses due to the Retardation of Settlement and Population through bad Forestry.*

The above figures are so framed as to represent purely the loss from bad Forestry. There is absolutely no set-off on the score of forest necessarily destroyed for settlement. In fact, as I have elsewhere pointed out, if the forests had been demarcated and organised, with roads and fire-protection, settlement would have been advanced in more ways than one. And all the cost of demarcating, organising, and fire-protecting the forests would have been repaid many, many times over, since it could not have amounted to more than a small part of the loss now being suffered for the want of it. This £588,000,000 is simply the penalty to be necessarily paid by Australia, during the next 30 years, for the neglect of modern Forestry science during the past 100 years; and, naturally, every year that Australia delays putting its forests in order, the £588,000,000 will be increasing at compound interest. Looking at the matter as one may, there is no avoiding this conclusion.

It is no use crying over spilt milk; but by the side of the loss of £588,500,000 to be faced during the next 30 years, we may glance briefly at the losses in the past. This loss falls under two heads, (1) population, (2) lost export of timber. Instead of demarcating out the best of the forest it has been burnt. The employment in working the forest, much of the employment in working the timber, the timber for export and the national forest itself have passed away in smoke.

It has been seen that in Europe every 942 acres of forest supports one labourer, apart from the men employed in timber working. If the best of the accessible forest had been demarcated out, it would have supported more men than this on account of the increased cost of fire-protection, probably about 800 acres per man. And then if the timber had been sent to Europe instead of being burnt as it has been there would be greatly increased work for the timber men. No doubt, too, some of this labour would have settled on the ground as the attractive country about the demarcated forests was opened up with roads and railways, together with Government work, and Government grazing for the small man.

This forest population, which in Europe is the pick of the manhood of the country, has been entirely lost in Australia, while the present timber-working population has been much reduced on account of the burning and waste of the timber.

345.—*The idle capital represented by virgin forest.*

Among the most notable of the losses during the last 100 years of bad Forestry is that of the idle capital of the virgin forest. I may again quote the words of the greatest American Forester of our time, Mr. G. Pinchot, for long the head of the Forest Department of the United States of America:—

The virgin forest is an idle capital. On any considerable tract, the growth is about equalled by the loss through windfall and decay.

If this fact of the great idle capital had been realised, and the forests worked systematically during the past 100 years, it is easy to see how great would have been the gain. Instead of destroying the accessible forest by fire and irregular working, the whole of the forest would have been worked through systematically, as is being now done in South Africa. In the above calculation I have made no attempt to estimate this loss of interest on a great capital lying dead. There are no data whatever for taking it! We might perhaps say, in a general way, that it would have covered the cost of opening the forest with roads, leaving the timber worked as clear profit; for there is no doubt this timber, worked so much more economically than at present, would have found an easy market in Europe.

In 1912 England and Germany imported some £7,000,000 worth of hardwood, of which only £97,334 came from Australia, and the latter figure is falling rapidly. This is an indication of what Australia has lost during the last 100 years through supineness in not opening up, working, and improving "the finest hardwood forests on the globe."

Amongst the Australian Governments, only that of Western Australia has at all realised the position. It has made a railway into the heart of the Karri forest, and it has established three well-equipped saw-mills. In the energetic working of the forests, Western Australia stands easily at the head of all the Australian States (p.)

There are various indirect losses: (1) the loss of public credit and borrowing power proportionately with the National forests destroyed; (2) the loss of water supplies, though here indeed there is a debit and credit side; (3) the loss of the general beauty and attractiveness of the land. There is only one side to this aspect of the forest question. Altogether the loss in the past must have been considerable, though on account of the smallness of the population and the interest involved, it could have come nowhere near the loss now to be fixed.

346.—*Urgent need of the true facts being made widely known, and forest economics set forth in official publications.*

The figures supporting the estimate of £588,500,000 are sufficiently important to merit careful consideration and criticism. They should be checked, and the public advised of their condition, year by year, as is done so admirably with other figures of public interest in the Commonwealth *Year-book*. A curious omission in the Official Year-book is that of the importation of timber to the various Australian States. We are told where the imported timber comes from, which, after all, does not much matter; but when we come to the really important figure, the penalty being paid by each Australian State to-day, for "the sins of the fathers," only the Commonwealth totals are given. Necessarily, each State's timber bill is a vital matter to it. It is the penalty being paid for the errors of the past. It is the base of the future forest economy of each State. It is referred to in writings and speeches on the Forestry question, and sometimes a State with a moderate timber bill is painted blacker than it really is! Some of the States refer to the

point in their yearly "Forest Reports," New South Wales and Western Australia for instance; South Australia has a special official publication on the subject by H. H. Corbin, B.Sc., 1913.

It is a strange omission in a publication with the scientific value of the Commonwealth *Year-book,* that the "timber bill" is not treated in more detail. My calculation, put together by a travelling forester from the published records, does not claim to be more than a contribution to the subject.

Forest economics have not been studied in Australia any more than in England. In England hitherto this has not, alas, much mattered! A nation of Quakers would need no soldiers! A nation with little of forestry has little need of Forest Economics. England, up to the war, was in an anomalous position—no State Forestry; £43,000,000 paid yearly for imported timber, and the bulk of the people wedded to out-of-date free-trade maxims handing over to the foreigner employments vital to it as a nation.

In other countries, not in this anomalous condition, Forest Economy is studied and *taught.* There are chairs of forest economy at Universities in Europe, America, and Japan. Australia should have at least one such. And it would be fitting that that should be in Victoria, which has long been at the head of Australian Forestry. In the early years of this century, Victoria was spending as much on Forestry as all the other Australian States put together. To-day, Victoria has by far the highest forest expenditure, and, except South Australia, it is the only State that is doing anything in practical constructive Forestry.

It is worth noting that if only the cost of one year's timber importation were applied to planting suitable ground with the proper trees, there would be enough—when the timber became mature—to replace the whole of the timber now being imported.

CHAPTER IV.

Statistical Abstracts to 1913.

FOREST RESERVES AND FOREST WORKING.

Forest Reserves. Misleading Official Figures.

The Commonwealth Statistician, in the various *Official Year-books,* credits Western Australia with 12 million acres of forest "Specially reserved for timber." It is really about one million. See also Ministerial reply to Deputation Forest League, July, 1914. Similarly, the other figures quoted in the Commonwealth *Year-books* have little real significance. New South Wales has recently declared a reserve of five millions; Victoria has four million acres of forest reserves finally dedicated under the Forest Act, besides some two million acres of timber reserves, and forest demarcation is being actively prosecuted. It is only in Victoria that there is really satisfactory forest demarcation. Queensland is in about the worst position of any State as regards forest demarcation. It has only about one million acres of forest reserves, while on the 20 per cent. standard and taking into consideration only the fertile part of the country fitted to carry a large population, it should have 43,000,000 acres.

Gross Forest Areas (1912.)

	acres.
Queensland	40,000,000
Western Australia	20,400,000
New South Wales	15,000,000
Victoria	11,000,000
Tasmania	11,000,000

These forest-area figures are mostly rough estimates only; I quote them for what they are worth.

Excepting Victoria and South Australia, the forest maps have yet to be made.*

The actual area of Forest Reserves in 1915 is about as follows:—

	acres.
New South Wales	5,000,000
Victoria	4,000,000
Queensland	1,000,000
Western Australia	1,000,000
South Australia	154,232
Tasmania	*Nil*
Total demarcated forest	11,154,232 acres.

The security of tenure of these reserves is nowhere complete. It is best in South Australia and Victoria, poor in Queensland, and perhaps worse in New South Wales. South Australia has only a small area of State Forests, and that little not well placed.

On a 20 per cent. standard (the European standard being 25 per cent.) the area of Forest Reserves required for Extra-tropical Australia is 98,000,000 acres. This area only takes account of fertile Extra-tropical Australia, viz., the area likely to carry a large population (p. 12). On a 15 per cent. standard, which would be a low one, and leave perhaps little timber for export, Extra-tropical Australia requires 74,000,000 acres (p. 13).

Forest Field Staffs (1912.)

New South Wales	90 men.
Victoria	68 „
Western Australia	32 „
South Australia	26 „
Queensland	9 „
Tasmania	1 man.

Forest Expenditure, 1900-1 *to* 1912-13 (*to nearest* £1,000).

	1900–1.	1906–7.	1910–11.	1912–13.	
	£	£	£	£	
New South Wales	5,000	20,000	27,000	42,000	Nearly all in salaries.
Victoria	19,000	21,000	46,000	57,000	Salaries and "works."
Queensland	4,000	7,000	8,000	5,000	All salaries, practically.
South Australia	7,000	7,000	21,000	23,000	$\frac{1}{23}$ in "works"; *very good.*
Western Australia	3,000	6,000	9,000	10,000	Nearly all in salaries.
Tasmania	Expenditure not		rising to	£1,000	All in salaries.
Grand Total for the Commonwealth	38,000	61,000	111,000	137,000	

**Note.*—The map showing the Forest Reserves of Western Australia awaits the completion of the classification of the timber regions. When that is completed the demarcation and final reservation of those areas which will be dedicated for all time to Forestry will be effected.—[C.E.L.-P.]

SKETCH MAP
OF
SOUTH WEST PORTION
OF
WESTERN AUSTRALIA
Showing Approximate Position of
MAIN FOREST REGIONS

REFERENCE

Jarrah	Eucalyptus marginata	
Karri	E · diversicolor	
Tuart	E gomphocephala	
Red Gum	E calophylla	(Interspersed among above three classes)
Black butt	E patens	{Occurs in rich bottoms among above but not ranging so widely as Red Gum}
Wandoo (or White Gum)	E redunca	
York Gum	E. loxophleba	
Mallet	E. occidentalis	
Salmon Gum	E salmonophloia	
Gimletwood	E. salubris	
Jam	Acacia acuminata	
Sandalwood	Santulum cygnoram	

Broadly interspersed over the whole area & providing timber used for other special purposes:
Viz: Wandoo for Railway plant:
Mallet bark for tanning industry
Jam for fencing &c
Sandalwood for export.

Concessions Leases & Permits
State & Private Sawmills
Timber Shipping Ports
Railways in operation
National Parks, Fauna & Flora Reserves

Note: A large part of the Eastern Goldfields is wooded with Salmon Gum, Gimletwood & other Eucalypts, which are there used for Mining Timbers & Firewood.

Scale of Miles
10 5 0 10 20 30 40 50

S.39.

H.J. Pether, Government Lithographer, Perth, W.A.

The expenditure is instructive as showing some progress in Forestry in all the Australian States, except Tasmania. The greatest increase, it will be noticed, is in New South Wales, but South Australia, West Australia, and Victoria have all trebled their forest expenditure in the last twelve years. South Australia and Victoria shows the largest increase in effective expenditure—salaries and "works."

In 1900, it will be observed, the forest expenditure of Victoria was equal to all the rest of the Australian States put together.

Revenues of State Forest Departments (*to nearest* £1,000).

——	1900–1.	1906–7.	1910–11.	1912–13.
	£	£	£	£
New South Wales	14,000	51,000	88,000	96,000
Victoria	15,000	25,000	44,000	51,000
Queensland	8,000	15,000	40,000	*63,000
South Australia	3,000	3,000	4,000	6,000
Western Australia	18,000	23,000	24,000	34,000
Tasmania	2,000	4,000	4,000	4,000
Grand Total for the Commonwealth ..	60,000	121,000	204,000	254,000

* Queensland is really larger, since Railway timber is omitted.

In spite of its large forest area, and its 122 saw-mills, valued at £238,235, Tasmania has a lower forest revenue than South Australia; and (though working on an average rather less timber than Victoria) a forest revenue of only one-thirteenth of Victoria.

The total Australian forest revenue is almost double the expenditure; in South Africa the expenditure is three times the revenue. In Australia the expenditure should be from four to six times the revenue till the State Forests are demarcated, surveyed, organised and protected against fire. Then there would be a handsome return for the expenditure. At present, often the best that can be said is, that without the expenditure there would be no revenue.

With Australian Forestry in the "constructive" stage in all the Australian States, South Australia is the only State with sound forest finance. The expenditure is nearly four times the revenue, and when one analyses that expenditure it is seen that little more than one-sixth is spent in salaries.

Timber Worked in each State.

To nearest million feet super. (12ft. super. equals 1 cub. ft).

——	1901.	1906.	1910.	1912.	1913.
	million ft.	million ft.	million ft.	million ft.	million ft.
New South Wales	97	119	139	163	165
Victoria	46	51	51	60	82
Queensland	140	83	116	164	157
South Australia	0	0	0	0	*0
Western Australia	122	136	174	218	219
Tasmania	46	39	55	63	61
Commonwealth	451	428	535	668	684

* South Australia, 1913: Timber worked 100,667 super ft., and, similarly, the other years being below the million feet are not shown here.

Table showing the Average Timber Worked in the Forests of each Australian State, and the net Forest Revenues; Mean of Five Years, 1908-13 (*compiled from Commonwealth Year-book,* 1913).

State.	Timber worked, (Sawn hewn, or split.)	Forest Expenditure.	Gross Forest Revenue.	Net Forest Revenue.	Remarks.
	super. ft.	£	£	£	
Victoria	53,720,400	39,866	43,756	3,890	Expenditure largely on works.
New South Wales	140,205,800	29,587	80,523	50,936	
Queensland ..	125,662,600	5,200	44,806	39,606	
South Australia ..	257,300	18,740	4,144	*Nil*	Nearly all expenditure on works.
Western Australia	184,185,800	9,356	28,456	19,100	Largest quantity of timber worked, but a poor third in gross forest revenue and no works.
Tasmania	54,721,400	2,972	4,058	1,086	No Forest Department and little forest revenue, while timber worked is one million feet more than Victoria.
Commonwealth	558,753,300	105,721	205,743	114,618	
= cubic feet	46,562,775				

Western Australian enterprise heads the above list in successfully working off the supplies of over-mature timber. Victoria is first in good timber working and good Forestry. The quantity of timber worked in South Australia is unfortunately very small; otherwise this is the only State which figures well in this statement as regards forest expenditure. A better expenditure has been promised by the State Premier for Victoria. This statement shows clearly the bad positions of Western Australia and Tasmania, which, with large quantities of timber cut, have comparatively little forest revenue (presumably owing to the timber grants), and show no forest improvement.

Forest Revenue obtained by the State against the Timber worked in each State. 1912.

—	Timber hewn and sawn in feet, super. (*Commonwealth Year Book,* 1914).	Forest Revenue (*Commonwealth Year Book,* 1914).	Amount received by the State per 100 feet super.	Amount received by the State per cubic foot.
		£	s. d.	d.
Victoria	60,000 000	51,146	1 8¼	2·45
New South Wales ..	162,604,000	96,145	1 2	1·70
Queensland	163,828,000	63,467	0 9½	1·11
Western Australia	217,696,000	33,805	0 3¾	0·44
Tasmania	63,243 0 0	4,414	0 1·67	0·20
	667,371,000	248,977	0 8·08	1·074
Commonwealth, including South Australia	667,554,000	254,586	0 9·15	1·08

This calculation assumes that the bulk of the revenue comes from timber. South Australia is omitted from this calculation, because the larger part of its revenue is not received from timber. The figures, in any case, only have a relative value, since much of the timber worked comes from private forest; but as this was mostly given away, a certain comparative value still attaches to the figures. Thus, the low figure from Queensland is due to the quantity of timber cut in private forest, and reflects the discreditable past history of Forestry in Queensland. The actual present timber dues in Queensland are said to be the best in Australia. Similarly, the unfortunate timber grants in Western Australia and Tasmania have sent down the figures from those States, while in Tasmania there is practically no Forest Department, and little forest revenue.

The remarkable point about these figures is that, as they stand, they reflect exactly the present-day efficiency of the Forest Departments in each State. And that is, after all, what one would generally expect, since sources of forest revenue which are lost or destroyed in such a State as Tasmania become productive in Victoria.

The Commonwealth figure, 9.15d. per cubic foot, merits particular notice. A considerable portion of the forest revenue is derived from tan-bark, grazing, and other sources of forest revenue. Thus in 1913-14 Victoria, out of a total forest revenue of £64,493, had only £28,610 from timber hewn and sawn, including piles, viz., a good deal short of one-half. Allowing for this, we may perhaps average the mean Australia forest-timber-royalty at about 6d. per 100 super. ft. of sawn timber, or 0.72d. per cubic foot, equal to 2.88 farthings. This is close to one-fourth of the "metric tickey" standard which I have assumed (p. 92), and is a close approximation to the result arrived at there, taking different figures and viewing the subject from another standpoint. Thus the "metric tickey" equals 2.4d. And 0.72 x 4 equals 2.88d. The conclusion arrived at in the calculation (p. 93) is that Australia is now getting about one-quarter of its forest revenue on the "metric tickey" standard. For the general discussion of Australian timber royalties, see page 92; also page 173.

ARBORICULTURE AND FOREST NURSERIES (1912).

Area of Forest Plantations (to nearest 1,000 *acres).*

	acres.
Victoria	19,000
South Australia	10,000
Western Australia	only 700
Queensland	only 310
New South Wales	only 195
Tasmania	*Nil*

Expenditure on Plantations and Nurseries (to nearest £1,000).

	£
South Australia	19,000
Victoria	11,000
New South Wales	4,000
Western Australia	1,000
Tasmania	250
Queensland	*Nil*
Total	£35,250

Yearly Distribution of Trees to the Public (*to nearest* 1,000).

	No.
South Australia	280,000
New South Wales	70,000
Western Australia	68,000
Victoria	40,000
Tasmania	5,000
Total	463,000

Queensland has no forest nursery, but makes a small issue of trees through another Department.

EXPORTS AND IMPORTS.

Export of Timber to Countries outside Australia.

During the year 1912 the exports of timber amounted to 119,401,434 feet super. (equal to 9,950,119 cub. ft.), valued at £858,357; the previous year being £1,016,510, and the three previous years nearly the same.

Forest Imports.

Under Table "Value of goods entered for consumption in the Commonwealth," (page 568, *Com. Year-book,* 1913) we have "Wood and Wicker," raw and manufactured, £3,514,377. This paid an *ad valorem* duty averaging about 15 per cent. The total value of timber imported between 1901 and 1910, as declared at the Customs, was £14,500,000 (Corbin).

To the Commonwealth Statistician, Mr. G. H. Knibbs, I am indebted, amongst other information, for particulars of imports to the close of the year 1913, under Class 18, "Wood and Wicker, raw and manufactured." Under this head is classified the timber in logs, sawn, or more or less slightly manufactured, imported into the Commonwealth of Australia. For 1913 this amounted to £3,164,122, while furniture of wood or wicker work comes to £409,631, the wicker work only £39,661 out of the whole. To complete the figure for raw and slightly manufactured timber and forest products, the second of the two tables hereunder, we have to make certain allowances to get rid of the disturbing effect of nearly two years' drought prior to the outbreak of war.

Imports of Logs and Slightly Worked Timber in recent Years.

1901.	1905.	1906.	1907.
£ 1,159,215	£ 1,015,000	£ 1,264,730	£ 1,553,000
1909.	**1910.**	**1911.**	**1912.**
£ 1,574,146	£ 2,008,932	£ 2,660,008	£ 2,728,592

Imports of Timber, Raw or Slightly Worked, and Forest Produce, 1913.

	£
Timber sawn or partially planed	2,327,893
Timber dressed in boards, mouldings, etc.	613,610
Manufactured timber in handles, wooden doors, mouldings, etc.	222,619
Total, Timber	£3,164,122
Turpentine, Resin (approximately) £60,000	
Tan-bark £80,000	
	140,000
	3,304,122
Add 10 per cent. for effect of drought	330,412
Normal importation at outbreak of war	£3,634,534

Some of the minor items being estimated, it will be safer to take this figure, in round numbers, at £3,500,000. It represents the normal importation of timber and forest produce, making allowance for the drought, up to the outbreak of war.

Paper-pulp, usually so large an item of forest produce, is imported at present into Australia only to a very small extent, if at all. Large paper-mills may be started at a time with the prospect of local supplies of softwood for paper pulp. Queensland has a small pulping plant designed to utilise softwood waste from the forest timber. There is an import to Australia of £3,004,054 for paper and stationery. All the paper-pulp, and most of the paper, could be produced easily in Australia as soon as there is a good supply of softwood in the forests.

And the same remark applies to Turpentine and Resin. I have referred at page 289 to the Coorong, the huge area of sand on the Victorian-South Australia border, waiting to be planted with Cluster-pine. The turpentine and resin industries support a large population in the South-West of France. Turpentine, resin, and varnishes made with them are now being imported to the extent of some £30,000 yearly to Australia. Turpentine and resin will continue to be imported for just so long as the planting of Cluster-pine (*Pinus pinaster*) is postponed. I have referred to that elsewhere (p. 81).

Tan-bark.

Tan-bark is a rapidly rising importation, and a rapidly falling exportation. In 1912, £50,920 worth of tan bark was imported (*Commonwealth Year-book,* 1914). And shortly before the outbreak of war the import was stated at £90,000 worth; the tanners asking for the duty to be taken off, as it was impossible to obtain sufficient tan-bark in Australia.

The loss of the tan-bark industry is the direct result of bad Forestry. Abundant as the Black Wattle is, and, to a less extent, the Pycnantha Wattle and some other Wattles are, in the forests of South-Eastern Australia, a century's burning has nearly destroyed them (p. 111). The Black Wattle is specially sensitive to fire. The loss of the Wattle industry is shown by the following figures from the *Commonwealth Year-book,* 1914.—

Decline in Tan-bark Exports.

1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.
£	£	£	£	£	£	£	£	£	£	£	£
48,514	54,607	61,013	93,927	189,609	162,453	132,186	102,410	91,945	119,254	104,646	72,128

Increase in Tan-bark Imports.

1907.	1908.	1909.	1910.	1911.	1912.	1914.
£	£	£	£	£	£	£
156	16,289	12,774	5,461	31,253	50,920	80,000

It will be observed that in recent years, the Wattle-bark export reached its maximum in 1905.

As with timber, it is scarcely necessary to consider the balance of these tan-bark exports and imports. All the import is sheer loss, owing to bad forestry; all the decline in export is the same.

Wattle-bark was one of the first forest exports from Australia. The London Custom House returns, for the year 1832, mention an export of 328 tons of "Mimosa" bark from Tasmania, and the years before and after were about the same. It is curious, too, that as far back as 1832, 44 casks of tan extract were shipped from Tasmania to London. In 1905, there was an export of £189,609. By 1912 this had shrunk to £72,128, or a loss in seven years of £117,481 in the tan-bark exports. In 1907 there was a trifling importation of £156 worth. By 1912 this had risen to £50,920, and in 1914 (as stated) to £80,000. Or a Forestry loss of some £80,000 in imports; plus some £150,000 loss on exports. Or a total loss, when the war broke out, of some £230,000. This figure is approximate, as the published returns do not extend beyond 1912. Up to 1912, the loss on exports (viz., the fall since 1905) was £117,481, while the import for the year 1912 was £50,920. Thus the total loss up to 1912 was £168,401.

Subsidiary Wood Industries.

There are, besides, various importations in which wood is the chief or only raw material; imports of which the value is mainly that of the labour and transport of them; but which, in most countries, have their origin in an abundance of the raw material. Of such, besides paper-pulp, it will be sufficient to mention Furniture (wooden), which, in 1912, had an import value of £354,257; Kerosene (paraffine), which is not separately mentioned in the *Commonwealth Year-book*, and runs into something near £2,000,000 yearly, must also be mentioned here. The forest interest in this is the growing use of Kerosene for fuel, displacing firewood in cooking stoves, the firewood which, with better Forestry in Australia, would be very much cheaper than it is. At present, the chief item in the cost of firewood at all the larger and older towns of Australia is the carriage from the forest. And this has come about gradually with the destruction of the accessible forest. Kerosene has also taken the place of charcoal in first-class cooking, so that better Forestry will mean for Australia some reduction in the Kerosene bill. In the future, as coal gets deeper and labour more costly, and the cultivated forest more accessible, the field for hardwood fuel, whether in the form of waste wood, charcoal, or charcoal briquettes seems assured. An important feature in the use of wood fuel is that as towns grow it becomes more and more necessary to attend to the atmosphere, to replace coal by other fuels of which, as in Paris, the most important are firewood and charcoal.

Furniture and paper are serious items. Together they represent some £3,333,000 lost yearly to Australia in production, mainly through the poor quality of Australian Forestry. It is probable that softwoods could be planted, or caused

to spread naturally in fire-protected forests, so as to produce paper-pulp at a price lower than it can be imported for. There is little chance of paper-pulp ever being produced from hardwoods.

The following figures, explanatory of the above, will be found in the *British Association Commonwealth Hand-book,* 1914.

Growth of the Timber Imports.

Wood and furniture, etc., 1912—£3, 565,000. Eleven years ago this figure was £1,814,000, or an increase in eleven years of 96 per cent.

The export of Australian wood is entered for 1912 at £908,000, having increased in the last 11 years from £666. (*Ibid.,* page 494.)

At page 490, it is stated that in the Commonwealth of Australia there is a total of 1,494 saw-mills, valued at £3,675,000; employing 26,785 men, and paying in wages £2,749,000 yearly; while the total output of the saw-mills is estimated at £8,536,000. And it is worth noting that in the list of 25 of the biggest Australian manufacturing industries, saw-milling is the third most important; the first being Smelting-works, the second Butter and Cheese-making, and the third Saw-mills.

Among Wood industries, we have coach, wagon, and furniture making, with a total of 1,194 factories, employing 14,948 men, receiving in wages £1,333,000, with an output valued at £3,440,000. (*Ibid.,* p. 490.)

Bulk of the Imported and Australian Timber in Cubic Feet.

The Commonwealth statistics under Forestry are not as well shown as those of some countries. There is a perfectly indefensible practice of grouping production under "Forestry and Fisheries" (*Commonwealth Year-book,* No. 7, p. 1053, etc.; *Brit. Ass. Hand-book,* p. 592, etc.). The only connections between the two being that they both begin with an "f"! The practice may have been a relic of Downing Street days, where forests-and-fisheries have been pigeon-holed together without much inconvenience, because the pigeon-hole represented important fisheries and no forestry!

Thus, the quantity of timber and forest products imported to Australia, a most important social qestion, can only be gathered approximately from the tables at pages 390 and 391 of the *Commonwealth Year-book* (No. 7 of 1914) as being somewhere about 500,000,000 super. feet (dressed and undressed timber, logs, and veneers) for the year 1912. (This is the interpretation put upon it by Mr. A. H. Ashbolt, President of the Hobart Chamber of Commerce in the *Brit. Ass. Hand-book of Tasmania,* p. 193.) Thus at page 391 of the *Commonwealth Year-book* we have the total for logs, dressed and undressed timber, and veneers; but for all the remaining items, the cubic contents are not given. It would not be difficult to give these approximately. Thus, in 1912 there were imported 2,000,000 pickets, 1,250,000 shingles, 2,000,000 staves, 30,000,000 laths, 12,000 doors, etc. The Commonwealth Statist has kindly supplied me with the following scale, applicable when one knows the number of lineal feet:—

Architraves, Mouldings, and Skirtings ..	24	lin. ft.	=	1 cub. foot.
Laths	85	„	=	„
Pickets	10	„	=	„
Staves	5	„	=	„
Palings	8	„	=	„
Shingles	22	„	=	„

What bulk of timber the importation for 1912 represented we are left to guess. I agree with Mr. Ashbolt that approximately it will be near 500,000,000 super. feet. This equals, in round numbers, 42,000,000 cubic feet.

I am indebted to the courtesy of the Commonwealth Statistician for the corrected import figure for the calendar year 1913, which was £3,573,753; practically no increase on the figure (£3,565,445) of 1912. But the drought rendered the figure for 1913 abnormal. I prefer to eliminate this abnormality by taking the figure for 1912, and adding the average increase during the previous five years. I therefore add 20 per cent. to 500,000,000 super. feet as representing the increase for 1913 if there had been no drought, and take, in round numbers, 600,000,000 super. feet (equal to 50,000,000 cubic feet) as the normal importation of timber to Australia for the year 1913, the last complete year before the war broke out in August, 1914.

BALANCE OF TRADING IN TIMBER IS AGAINST AUSTRALIA.

Australian Timber—Home Use and Export.

Home production of Timber.—For the home production and export of timber we get complete figures in the *Commonwealth Year-book*, No. 7 of 1914, p. 390. In 1912 the total of timber (hewn and sawn) produced in the Commonwealth was 667,554,000 feet super. Adding 20 per cent. as above for increase for the next year, we get 801,064,800 feet super., say in round numbers 67,000,000 cubic feet.

Export of Timber.—Practically all the timber exported from Australia is home production, and practically all the timber imported *could be produced in the country.* It is not necessary, therefore, to concern ourselves with the tables showing the balance of imports and exports given at pages 392 and 393 of the *Commonwealth Year-book*, No. 7 of 1914. All the timber imported is loss to Australian production; all the timber exported is gain. Thus, the gross export of timber for 1912 was (p. 392) 122,291,086 feet super., equal to 10,190,924 cubic feet. This was the total for timber "dressed, undressed, and in the log." There is little else. This represents practically all the timber exported. But in 1912 there was an unusually small export. The exports for 1911, which are about equal to the average of the five years 1908-12 were (for logs, dressed and undressed timber) 150,586,481 feet super., equal to 12,548,873 cubic feet. I, therefore, take the figure for 1911, but as the export figures for the previous years show no increase, I add nothing to it.

Home Use of Timber.—Deducting the exported timber from the "production" of timber, we have a balance of 54,500,000 cubic feet of home-produced timber used up in Australia. If, to this, we add the 50,000,000 cubic feet imported, that will give 104,500,000 cubic feet as the total quantity of timber (apart from firewood) used in Australia. Or, at the rate of 104,500,000 divided by 4,872,000 equals 21.45 cubic feet per head of population. The population figure is that estimated to 31st December, 1914 (*ibid.*, p. 1064). Of this figure, practically one-half, 500/545 or .92 per cent., represents imported timber.

This figure, 21.45 cubic feet per inhabitant, is somewhat low for a country with so many wooden houses. It must rise rapidly as the industrial development of Australia proceeds. It may be compared with the corresponding figures of 37 cubic feet for Germany, 25 cubic feet for France, and 19.53 cubic feet for South Africa per white inhabitant. There is little industrial development in South Africa, apart from the Goldfields, and a little at the Diamond-fields, together with some sugar, and matches, and tanneries at the ports. But, on the other hand, there are some 4,500,000 of coloured and black people to be allowed for, though the great majority of these live in huts of Wattle and daub, and use no timber; while the house of the poorer class of Boer (as indeed of the peasants in the South of Europe) in treeless parts of the country has wood only in the doors and windows.

Summarising the above figures we have:—

Timber Used in Australia.

	Million cub. ft.
Home timber production, estimated for 1913	67
Export for 1911 (as 1912 was abnormally low)	12½
Balance of home production, used in Australia	54½
Imports (estimated) for 1913	50
Total timber being used yearly in Australia when the war broke out	104½

Consumption of timber per inhabitant before the drought and war, 21.45 cubic feet per head.

MAGNITUDE OF THE AUSTRALIAN FIGURES EXPRESSING IMPORTS OF FOREST PRODUCE.

A 3,400 ton Steamer arriving daily.—It is quite impossible to realise the "bulk" of 50,000,000 cubic feet! It is 5,000,000 times the ordinary passenger allowance of 10 cubic feet on board ship! If we suppose the timber to be brought out in ships, having a mean *carrying capacity of 3,424 tons, it would require one such ship to arrive every day in Australia, fully loaded,* to bring out 50,000,000 cubic feet a year. The mean importation for the next 30 years, I have estimated (p. 167) to be nearly double this: say a big steamer of 6,000 tons to arrive daily.

The waste in doing this for 30 years (*or longer, unless there is an immediate change in forest policy*) seems almost incredible. Yet this is what Australia is now committed to as the penalty for 100 years of unscientific Forestry! The actual money loss I have estimated (p. 176) at £588,500,000.

THE NEEDED STIMULUS MUST ORIGINATE IN FEDERAL CONTROL.

The furniture import bill of over £330,000 yearly calls for attention. With the splendid hardwood forests—the world's champion hardwood forests in a temperate climate; there should never be a stick of furniture allowed to be imported into Australia! The "Tasmanian Oak," as I have mentioned (p. 334), is every whit as good as European Oak. Similar light-weight Eucalypt timbers occur throughout Australia, the Blackbutt (*Euc. patens*) in Western Australia for instance.

From a purely Australian national point of view, the right course is as clear as daylight. *The Federal Government should take over the mismanaged forests of Tasmania,* and impose such a duty on imported timber as to exclude imported furniture from Australia. The cost of restoring the wrecked forests of Tasmania would not exceed £1,000,000 yearly for the few years required for it. And as soon as the forests were opened up with roads, and put into working order, a large part of the present yearly furniture bill would tend to disappear, due to the abundance of cheap Blackwood, Tasmanian Oak, and Beech that would be produced. Perhaps, also, we might look for the establishment of a local forest industry like the chair-industry of Princes Risboro, which is within an hour of London but is a real rural industry. If they can make a first-rate Beech-wood chair for 2s. 6d. in the Chiltern forests of Beech timber in England, they could make an equally good 3s. chair in the Blackwood, Oak, and Beech forests of Tasmania. And, in a few years, the restored forests would be giving bountiful returns; they and the enlarged furniture factories supporting a new population. At present the furniture and billiard-table factories of Australia use £858,387 worth of timber yearly and have an out-turn worth £2,008,679.

Division V.

FACTORS INFLUENCING AUSTRALIA'S TRADE IN TIMBER AND FOREST-PRODUCTS.

CHAPTER I.

Tariff Influences.

347.—*Difficulty of applying a Tariff on Raw Products.*

To a deputation of Saw-millers Mr. Tudor, the Minister for Trade and Customs, replied on 14th April, 1915:—

"The timber duties were difficult to deal with, and he would welcome assistance."

The difficulty with regard to the timber tariff is this: It is raw material and as such, apart from the special Forestry question of Australia, should be allowed to come in duty free. We see that countries which do not share the free-trade and no State Forestry fallacies of England, admit all raw material duty free, or with but a slender duty on timber. This is the case with Germany, Belgium, France, Italy, and other European countries.

Then there is the consideration that the supply of softwoods in Australian forests is limited, and for many employments softwood is superior to hardwood. Only Queensland has any noticeable supply of softwood; the New South Wales supply is small and it is estimated will be entirely exhausted in 15 years; Tasmania has practically destroyed all it had. Thus, apart from "The Forestry Question," imported timber, in the raw state, should be allowed to come into Australia free.

348.—*Forest interests should be paramount in a Protectionist Country.*

But when we consider the forest question in Australia it is apparent, at once, that this position is reversed; that Australian forests, after 100 years of burning and bad treatment, are in a perilous condition, and that if anything in Australia needs protection it is the forests! In order to stimulate the forest industry and render remunerative the working and restoration of the forests, it is imperative that there should be a heavy tariff against the imported timber. The reasons for this may be stated thus:—

The idle capital of the virgin forest (pp. 178 and 109). All the decaying overmature timber left unworked in the forests of Australia represents a capital, not only returning no interest, but going to decay. (See Pinchot's dictum, p. 178.)

The scientific working of Australian forests is to-day entirely in its infancy; only one State, South Australia, has made much progress, and even in Victoria scientific Forestry has hardly yet begun. If the imported timber is allowed to come in and stifle this good work in its infancy the future of all Australian scientific Forestry will be seriously imperilled. It is the duty of Australian Governments to look on a heavy temporary forest expenditure now as a good investment; that is the legitimate view to take of the matter. But it is certain that Australian Governments will be influenced in their forest expenditure by a consideration of what the forests are yielding. If, for want of protection, the capital represented by Australian forests remains idle and revenue from Australian forests fails, the introduction of scientific Forestry may be postponed; and this too, at the present most critical time in the history of Forestry in Australia! As a young country, Australia has properly done much to protect its budding industries generally, but to protect one of its greatest rural industries, its Forestry and timber-working, it has done little beyond putting a slight duty on imported timber.

The saw-millers and other timber workers in Australian forests, owing to the neglect of Forestry and the failure to open up the forests, have been working at a disadvantage for many years, and must work at a disadvantage for some years longer. They have, as pointed out, to work timber that is over-mature, hollow and unsound, and a forest which, on an average, is scarcely one-third stocked, thus adding greatly to the cost of getting the timber out. It is only fair to their important native industry that they should be protected. And it must be remembered that they are working in competition with countries where the scale of wages is lower and against timber rates which are unduly lowered owing to the fact that in the Northern Hemisphere there are still large areas of forest which, as regards the requirements of the countries, are *surplus* forests and from which the timber is given away. Australia has no surplus forest now.

349.—*An Australian Timber-famine approaching and inevitable.*

Authorities differ as to the severity of the timber famine that is approaching, but all writers on forest economics agree in this, that *something approaching a timber famine is inevitable* in a few years. Unless the present timber industry of Australia is protected, and with it Forestry and the forests of Australia, the latter will not be in a position to supply timber when the surplus timber from abroad begins to fail. The forests of Australia will continue to be destroyed by alienation, burning, and unregulated grazing, and when the timber scarcity arrives Australia will be left without its own forests, and have to pay famine prices for the imported timber.

350.—*Low Tariff tends to create a fashion for the use of imported timbers in Buildings and Furniture.*

One of the results of the present negative or very low tariff is that for the parts of woodwork in house building, where the native Australian hardwood is superior, it has been ousted by imported timber. Thus, in the joists, beams, and rafters of a house hardwood timber is stronger and less liable to burn than softwood. There is a minimum of work on these timbers so that, taking the woods on their merits, these parts in house-buildings should be hardwood; but in practice we find that very commonly softwoods are used. I have mentioned the case of the Government buildings in Hobart now being constructed with the joists and beams of imported timber. 70 per cent. of the framework of most of the wooden houses is said to be now American Oregon.

Again, for flooring boards, if properly seasoned, hardwoods are superior to softwood, but here again softwood is frequently used to the exclusion of the superior hardwood boards of Australia. In Europe a properly laid hardwood floor is a very superior and very costly flooring. The common practice in Australia is to lay it badly, or replace it by a softwood floor of imported material!

In furniture, as mentioned (p. 186) the case is even stronger. Australian hardwood is fully as ornamental, but slightly heavier and considerably stronger than European hardwood, Oak for instance; yet, under the present duties, the value of imported furniture reached, in 1912, the serious figure of £354,257.

351.—*Present Australian tariff the main cause of the drain on the country for imported timber.*

At present, while the forest question in Australia demands the fullest possible protection for the native forests in their working, we have the unfortunate position that the imported timber is admitted nearly duty free. Timber in the log comes in quite free, while sawn timber in sizes of 12in. x 6in. and over, pay a duty of only 6d. per 100 ft. super., or not 1d. per cubic foot. Considering that the forest industry of Australia is at present in its infancy and that £10,000 a day is being sent out of the country for imported timber, this slender protection afforded to the struggling young Forestry industry of Australia is astonishing. It is in great part this want of protection that is causing the drain on the country for imported timber to advance by leaps and bounds. In 1909 Australia imported 22 million cubic feet of timber by measure in addition to 21 million "pieces of timber," the whole valued at a little over £1,500,000. By 1911 these figures had mounted to 36 million cubic feet and 38 million pieces, valued at £2,750,000. (*Commonwealth Year Book,* 1914.)

352.—*The Wattle-bark industry can be retrieved—Tariff is absolutely necessary.*

The position with regard to Wattle bark is not quite the same as timber. If the forests were organised and fire-protected now there would, as a result, be an improved supply of Wattle bark from the forests in two or three years. But, in the meantime, it is necessary to keep the tanners supplied with tan bark at a fair price; they say they were 500 tons short in 1914. And a difficulty will arise if some States commence conserving their Wattle supplies at once and others do not. There is a stronger case for protecting the first States than the second.

At present, as has been pointed out under "Forest Statistics" (p. 185), Australia is losing, over imports and exports, about £250,000 yearly on tan bark, so that some strong inducement should be held out to the better-governed and more enterprising States to retrieve the position. And with Wattle bark the position *can be retrieved in quite a few years.* The effect of organisation and fire-protection would be to help the position somewhat in two or three years, and to bring forth quite a new supply of Wattle-bark in from eight to ten years.

At present there is a duty of 30s. per ton on Wattle-bark, in place of which the Tariff Commission recommended a bounty of £1 per ton on Australian-grown Wattle-bark used in Australia. On the whole, this seems the wiser course, though in a way it opens the door to competition from South Africa; but if that door were *closed,* the time would arrive sooner, and then it would be more profitable for Natal to grow cereals instead of Wattle bark on its fields of good soil.

If it were possible, the correct course would be to give a higher bounty to such a State as Victoria, which may be expected to stop burning and grazing the Wattles (Wattles are very easily destroyed by grazing) at an early date, and no bounty to such a State as Tasmania, which at present in Forestry is the black

sheep among the Australian States. There seems no reason why Tasmania, when it destroys say, 100 tons of Wattle by burning and grazing, should be given a premium for the one ton plucked from the fire; nor why a premium should be given for plantation Wattle-bark anywhere while Wattles are being burnt and destroyed wholesale, simply because the forests are not yet organised and the Wattle regrowth protected from fire and grazing.

CHAPTER II.

Political Influences.

353.—*Evil Influence of Politics on Forestry manifest throughout all Australia.*

In every State of Australia—except perhaps South Australia—and in nearly every phase of Australian Forestry, I have been brought face to face with the evils resulting from political interference in the details of forest management. In some of the States the Minister has the good sense to abstain from interference in the details, but a system which permits such abuses as have occurred is obviously at fault.

Everyone has heard of the evil of political management in Railway matters. That seems to be recognised in every country where there are Government Railways, and the weak argument has been used against Government Railways in England that they might get under political control. On the Continent of Europe, all the Railways are State-owned, or tending towards State management. They are better, or tending to become better than English Railways. In Australia, and in South Africa, the evil of political interference in Railway management has been met by the appointment of Commissioners, who are responsible for all details of Railway-management. There are three Railway Commissioners in the two large States of Victoria and New South Wales, and one Commissioner in each of the smaller States.

The Minister for Railways simply protects legislation, and represents the Railway Department in Parliament. He has no authority to directly interfere in the management, though the Ministry as a body, and he, as the executive representative of Parliament, can veto a Commissioner's policy.—(*Brit. Asso. Hand-book.*)

The system is, I understand, in the main successful, though one hears complaints of want of independence on the part of the Commissioners in some of the smaller States. In South Africa there is a "Comptroller and Auditor-General" who reports to Parliament, and is entirely free from the control of the Ministry of the day.

354.—*Political Mistakes cannot be recalled in a work framed to run continuously. Some Australian examples.*

Whatever the evils of political interference in Railway management, those in Forest management are necessarily worse, since a mistake in a detail of forest management may run for a century—roughly the life of a tree or a forest unit—before it can be rectified.

Australian timber royalties are abnormally low. The lowness is not only a matter of money, it leads to waste in timber-working. It should be a matter of *policy* to raise them (p. 96). A few days ago the Minister for Forests, Victoria, told a deputation of sawmillers that he would lower, or abolish altogether, the timber royalties! I have known forest-rights given away heedlessly by a Minister on tour, which had to be redeemed in after years at a considerable expenditure of public money.

Fourteen years ago the Victorian Royal Commission reported in these words regarding the political control of the forests:—

> The experience of many years has shown that it is most inadvisable to leave the forests under the direct control of a Minister of the Crown, holding office for an uncertain period, and being subjected by the electors to persistent applications to grant concessions, reduce rates and charges, reduce or abolish reserves, and grant local privileges in the matter of grazing rights, or any other exceptional privileges which too frequently involve grave injury to forest interests and, therefore, to the community at large . . . . . One of the most obvious defects of the present system of control is the radical alteration in forest policy caused by frequent changes of Governments. One Minister may have an intelligent appreciation of the influence of forests on climate and agriculture, and of the benefits arising from proper conservation, and another be willing to reduce or abolish valuable reserves when the whim seizes him, or when he desires to satisfy local clamour.

This states clearly the position. The extraordinary point is that, after thirteen years, the abuse of political control which is here indicated so clearly, still continues; and, to judge by the criticisms in the Press, in an aggravated form. The Minister who has the ill-fortune to direct Forestry in Victoria to-day (March, 1915) seems to be not only peculiarly unfitted for the task of forest administration, but to be peculiarly unable to refrain from interfering. Whatever the answers to the following criticisms, there is no excuse for the issue of the double-barrelled forest Blue-book in Victoria—edited half by the forest manager and half by the forest "meddler"!

Says the *Age* newspaper of May 10th last:—

> The evil of political control has been repeatedly pointed out in the public Press of Victoria. All parties are agreed that the management of the forests is sadly ineffectve; everybody admits that our timbers are splendid material for building, furniture-making, and other purposes. There is fine scope for a great and profitable industry . . . . . Why is it, then, that while Governments can be induced to promise almost anything, they cannot be cajoled into effective action? Is it that the importing interests are too powerful Is the Forestry administration hopelessly barren of the requisite skill and knowledge, or is it that the great forest areas, being quite free from population, cannot exert any political pressure? . . . . . The real cause of the waste and the loss is to be found in the helpless system of political control.

Political control has produced disastrous consequences in various countries, but there are peculiarities in the present position of politics in Australia that render political interference peculiarly hurtful. In South Africa the country interest, as opposed to town interest, is predominant. In Australia, the chief political influence is not in favour of Forestry or (except perhaps in South Australia and in Western Australia) of forest enterprise. In Australia, in nine cases out of ten, the Minister in charge of Forestry is a town-man, who knows no more of Forestry and is as much fitted to control Forestry as he would be if in charge of a German Zeppelin. Such a Minister who would not dream of directing the Postmaster General to sell a 1d. stamp for ½d., has no scruple about giving away timber worth, say, £1 for 2s. As a town man he looks on the postage stamp as a sacred thing, but he regards trees and forests mainly as things to be got rid of to make room for what he considers settlement and the development of the country. The bush-worker pockets his 18s. and says nothing; you cannot blame him. The Minister is popular and popularity is the first essential in a Minister, can you blame him? It is the system which is at fault, a system which places absolutely the wrong man at the head of the forest administration. It is this system that I have shown (p. 176) is going to cost the country some £588,000,000 in the next 30 years.

While encamped in a Queensland forest that it was proposed to alienate—absolutely against the interests of the State—I had an interview with a Queensland statesman who candidly admitted to me the wrongfulness of the present system. It was patent to everyone that this forest should not, in the interests of the country,

be alienated; but the local member was the servant of his constituency, and the Government existed on the votes of himself and others. A local member would be compelled, against his convictions, to procure the alienation of the forest. Here again no individual was to blame. It was the system that was at fault. As long as it is possible to purchase votes by the sacrifices of a slice of the public domain, it is useless to expect that the scandals of forest alienation in Australia will cease.

It must be remembered that what appears to the amateur Forest Minister as trifling forest concessions are often serious lapses of fundamental forest policy. Rights may be lightly given away, which, in after years, have to be bought back at great expense. And, worst of all, there is the old story of local greed *versus* public interests, resulting in the forest itself being given away and lost to the State.

Said the *Age* newspaper of the 22nd August, 1914:—

It has been shown by many authorities, times almost without number, that the hope of Victorian Forestry lies in the creation of a capable Forest Department, *free from the political influence that has kept it futile for a generation.* In all countries where there is effective forest management the forests are under the control of highly-trained Foresters, who owe no allegiance to particular political parties, and are not beholden to the vote-seeking local member.

The first step to be taken in Victoria is to create an expert responsible Forestry Department, where the political meddler will be powerless to work mischief.

And, again, if anything worth while is to be done, the new Forests Bill must, in the first place, create an independent Forestry Department, free from political influence, and managed by skilled men, with an authorative expert at the head.

355.—*Demoralising Effect on Department and Staff of Political Interference.*

Jobbery, or divided control in the management, must necessarily react on the Forest Department itself. It has happened more than once that a capable Conservator, filled with the sense of the iniquities of the position, may apply the homœpathic remedy of writing and agitating in the Press. This is absolutely wrong. The Conservator's time is diverted, while the want of discipline on his part breeds want of discipline in his staff. Or, the Conservator may adopt a fatalistic attitude, draw his pay and do nothing, since it is nearly impossible for any honest endeavour on his part to result in good for the public service.

356.—*Advantages of a Federal Control exemplified by Indian Forestry.*

Perhaps before long it may come to be recognised that the soundest and most economical administration will be the formation of a Federal Forest Service as in the United States of America, but without the dual Federal and State Administration of the United States. This would, at a stroke, free the national forests from the noxious influence of parochial management, and leave the local staff free to carry out a continuous and effective forest policy, guided by the best technical advice.

The Indian Forest Administration furnishes a good model, but here again there is some administrative weakness at head-quarters. There is one forest policy and one technical head in the Inspector General of Forests, but all details are left to the local Governments, and the effectiveness of the forest administration varies in the different States. In South Africa the system is simpler and more effective. Since the Union of the various States, there is one Chief Conservator and the Conservators of the various States are under his direct control.

357.—*Proposals for a Commonwealth Forestry Department of Australia.*

One thing is certain, there must soon be a Federal Forest Administration for the northern tropical "Territory" and for the Federal Capital site, and there is a growing need from a national point of view that the Federal Government should take over either the whole of the forest administration of Tasmania, or annex the uninhabited South-West quarter of the Island (p. 360). It is a sheer waste of its forest resources to allow the uninhabited South-West of Tasmania to remain undeveloped, while there is no part of Australia so well suited to grow the cold-country softwoods that are now imported, or the pulp for the paper-mills of the future. From a national point of view, there is a mine of wealth in this area, but it is a mine that the resources of Tasmania are quite unable to develop.

At the Interstate Conference on Forestry, Melbourne, 1912, the Presidential address recommended each State reserving 10 per cent. of its area as demarcated forest; adding the second and perhaps better course is for the Commonwealth to take over a sufficient area of forest, especially in States with the least population and largest areas of virgin forests, and put the area so acquired under efficient control and management.

After the war, or as soon as Forestry in Australia is placed on the footing of other civilised countries (excepting England, where conditions are exceptional), there should be a Federal Minister responsible to Parliament for the expenditure of the £1,500,000 or £2,000,000 yearly required for some years to organise the forests; but under this Minister in charge of forests there should be a Chief Conservator of Forests who should have unfettered and responsible control of all details of forest expenditure and of all technical details of Federal Forestry.

It would be advisable also that the Chief Conservator should inspect and report from time to time on the forests and forestry of the various States. It is shown that the present administration of the Tasmanian forests is a national injury to Australia (pp. 360-373).

In the States, now, Forestry is sheltered (or plundered as the case may be), under various Ministers. It may be stated generally that the Department of Lands is, from its training and antecedents, the worst fitted to have control of Forestry, and the Department of Public Works the best. Though Forestry is under the Minister of Agriculture in many countries, this is mostly as a matter of administrative convenience. There is little real connection between Forestry and Agriculture, while Forestry is as much a "Public Works" matter as railways and irrigation; and in such an important matter as roads it is often impossible to say whether a high road is more properly a public or a forest road. The Railway Department, too, is commonly the Public Department that makes the largest use of the public timber.

CHAPTER III.

Influence of Home Industries.

358.—Seasoning-kilns and Hardwood Flooring-boards.

It is certain that Australian hardwoods are not employed to the full extent of their economical use. A floor made of well-seasoned hardwood, such as that which issues from the Government "Seasoning kiln" in Melbourne, makes, when waxed and polished, a nearly perfect floor. As a Forester all my life, and something of a house-builder, it was pleasant to see these hardwood flooring-boards, seasoned in a few hours, as dry as a bone, and not a crack in them; their surface as smooth to the touch as a billiard ball. All honour to the Victorian Forest Department that, after a hard fight, it got these seasoning mills established. Such a flooring-board would be much sought after in Europe if they were properly put on the European market—not the English market, for there they prefer rough carpet-covered floors in all but the best houses. In most Australian houses now one sees house floors made of rough unseasoned hardwood, or equally rough imported softwood, their defects concealed by the unwholesome carpet of English houses, or a shabby painted floor-cloth of linoleum or such preparation.

The floor of hardwood, stained and waxed, is beyond all comparison superior to the more or less dirty substitutes which take its place in English and Australian homes. Moreover, it is really less troublesome to keep in order than carpets and linoleums.

A hardwood floor in England is expensive, a carpeted floor looks warm and comfortable in a damp chilly climate. In Australia hardwood is the common wood of the country, and the climate is no longer damp and chilly, yet the unwholesome British carpet remains.

359.—Advantages of the "Hardwood" Floor.

There is a popular belief that a stained and polished floor is only for the houses of the rich. A short trial shows that this is not so. I have had experience of polished floors and servants in every climate. The result is always the same. They soon find the waxed and polished floor less trouble to keep clean than carpets. It is true that such a floor requires a little trouble to put in order, more trouble than going in to a shop and buying a carpet. Naturally the floor requires to have its roughness planed off by a carpenter; and then to be stained (not painted) and waxed. The floor-stain sold in shops may be good or bad. The common old-fashioned flooring stain is the burnt umber sold by grocers. A better modern stain is permanganate of potash. Buy the crystals, dissolve them to a strong dark red solution, and use. This dries a rich brown. It is a good stain whenever light woods require to be darkened. It bites into the tissue of the wood and is permanent. Burnt umber is only on the surface, and, on a floor, depends on the waxing to keep it from coming off. Waxing (common bees' wax being used) may be done by hand, but the ordinary way in France is to skate about on pattins tied over with dusters.

Once waxed and polished, there is little more trouble. The waxing is only required at intervals: short intervals in the best rooms of the house, long intervals

in a kitchen, passages, etc. All scrubbing and carpet-sweeping goes out. The dirt-absorbing carpet and scrubbed floor is replaced by the non-absorbing waxed floor.

In small houses that cannot be well kept, the waxed floor may be replaced by the cleanly, very sanitary, carbolineum floor (p. 52).

360.—*Contrasts due to using "Softwood" Floors.*

A softwood waxed floor is better than a carpeted floor, but the hardwood floor is the ideal. And this, though expensive in England, is the most economical in Australia. Yet it is rarely seen in Australian houses. Too often it is replaced by an imported softwood floor over which is *nailed* the unwholesome British carpet. From every point of view such a floor is wrong: it is dirty (sometimes appallingly dirty), unwholesome, and disloyal to the Australian forest. It will be said there is nothing new in all this, but it is sometimes useful to renew attacks on an abuse.

It was a sad sight in Melbourne to see the comparatively small quantity of hardwood flooring-boards turned out of the Government seasoning kiln at Newport, and at the docks the huge quantity of inferior softwood flooring-boards being imported.

It is said that the hardwood parquet floors in public buildings in Australia have not been always successful. Different hardwoods have been used and the floor has not worn evenly. The fault is with the layers of the floor, not with the wood.

361.—*Paper-making from Wood-pulp and the coming exhaustion of Foreign "Pulp" supplies.*

It has been shown (p. 185) that Australia is paying yearly to the extent of £3,000,000 for imported paper. It has recently been announced that New South Wales intends to give out a £500,000 contract for paper made in Australia; the paper to be made anywhere in Australia during two years, and afterwards only in the State of New South Wales. But paper-making with the raw material imported is not a complete solution of the £3,000,000 loss. Australia, with its wide areas, is naturally fit to be a producer of raw material, and the question therefore arises, "How is the raw material for paper to be produced in Australia?"

The paper pulp which is now obtained very cheaply from numerous areas of surplus wild forests in America will come to an end with the exhaustion of these wild forests. But the paper pulp produced in such large quantities from German and other forests in Europe will continue to be produced. There are 663 mechanical paper mills in the forest country of Germany, and 67 chemical paper pulp mills, or a total of 700. And similarly in Sweden and other European countries, and the United States of America. The Coast Erosion Committee, reporting on Forestry in England, could only hear of two pulp mills in England, and these worked with imported timber!

362.—*The Choice of Trees to be cultivated in Australia for Wood-pulp making.*

It has been shown (p. 82) how the management of Australian forests on modern methods will provide the timber that is now imported. It will also provide material for paper pulp making. But in the planting of softwoods, the species best fitted to make paper have to be considered; of these, the first that comes under consideration is Insignis pine. It grows more rapidly than any other pine, and produces a wood of which the only fault, if it is a fault, is that it is soft. Its rapid production of heavy crops of soft timber renders it one of the most suitable trees for planting for paper pulp, though its resin content, small as it is, may be a difficulty. But, as is mentioned elsewhere, the danger of disease in large plantations of

Insignis pine has to be considered, so that for safety, it is necessary to consider the planting of some other pines as well.

It has been mentioned that in Western Australia and in the warmer parts of Australia, the best growth of Insignis pine is obtained in cool, well-watered mountain areas. The same remark applies to a greater extent in the case of *Pinus strobus*, the "Weymouth-pine" of Europe, and the "White-pine" of North America. This valuable pine has yielded enormous supplies of soft coniferous timber, and will do so again when the second-growth forests in the United States come into bearing. It is one of the most advantageous pines to plant in Australia in that it is somewhat shade-bearing, has an excellent covert, keeping the ground clean and safe from fire beneath it, and has naturally a rapid and tall, straight growth; but it has the disadvantage in Australia of not being hardy, except in quite cool and damp (generally mountain) situations. It can grow above the area where Insignis pine can grow well. It must be remembered, however, that the Strobus-pine is badly attacked by fungus in England.

And above the Strobus-pine again, comes the extra-tropical Silver-firs. These, with their soft fibrous timbers, are the best in the world for paper-making. But they will only grow in Australia in the coolest and dampest mountain areas. It is doubtful if they will succeed anywhere in Western Australia. In the Eastern States, Tasmania and the mountain areas of Victoria afford inviting fields for their growth.

363.—*Bamboo-growing for Paper-pulp.*

It has long been known that the young shoots of Bamboo supply first-rate material for paper-making, and it is probable that as the soft coniferous timber of temperate climates becomes exhausted paper-making from Bamboo stock will be practised to a large extent. Considerable areas in tropical countries have been reserved for this purpose, but at present it is difficult to make bamboo paper pulp to compete profitably with soft-timber coniferous pines.

In Australia, where the production of raw material for paper pulp is one of the problems facing the Forestry of the future, the production of paper pulp from Bamboos has to be considered. There are large areas of semi-tropical forests in Queensland and the northern portion of Western Australia, to which Bamboos can be introduced at slight expense, and left to spread naturally against the day that they will be sufficiently abundant to be worked for paper material. The bamboo is a *grass* and it spreads itself naturally like a grass in tropical and sub-tropical climates.

As a tropical and sub-tropical product, it should be noted that Bamboo-growing offers a field for White industry better, in some respects, than sugar-growing (and paper is as necessary to civilised life as is sugar), since the growth of Bamboo as a semi-tropical wild product is free from the continuous exhausting labour incidental to the cultivation of sugar by White labour in the tropics.

CHAPTER IV.

Employment for Rural Labour.

364.—*Rural Depopulation in Britain and France.*

Rural depopulation is bad in France, in some of the provinces; but it is eating the heart out of modern England! According to Rider Haggard's statistics, the rural population of the British Isles is between six and seven millions only; a slender stock of strong manhood to support the empire! On an average, one Englishman in every five or six, taking the United Kingdom through, is a "Londoner," and judging by the cockney accent, which is so rapidly corrupting Australian speech, one-third, or perhaps half of the Australian population has been recruited from within the London Metropolitan area. Why, in view of this, some special and tangible inducement is not held out to the *bona fide* English country immigrant I have never been able to find out. My observations in England tended to show that Australia was not getting its fair proportion of country English immigrants.

365.—*The Excess of City Populations in Australia is the great Social Problem of the Commonwealth.*

Rural depopulation is admittedly the great social problem in Australia. There are many rural districts in the older States where the population is stationary or receding. According to the statistics published in the *Commonwealth Year Book*, 1914, the proportion of the population in the capital city of each State is:—Victoria, 46 per cent.; South Australia, 45 per cent.; New South Wales, 39 per cent.; Queensland, 23 per cent.; Western Australia (Perth, without Fremantle), 38 per cent.; Tasmania (Hobart, without Launceston), 20 per cent. The proportion is generally stated higher, possibly because the whole of the suburban areas are not included in these figures.

It is not realised by many in England, and by fewer still in Australia, that State Forestry affords a considerable remedy for rural depopulation. The democratic Governments of Australia do much for the people, and particularly during the early days of settlement. State Forestry places it in the power of the Government to do more. The opening up of the country, in the organisation of the forests, and the considerable expenditure involved in doing so, would be a powerful help to many of the struggling settlers. In a word, the £3,500,000 yearly now being lost over imported timber and forest products; the £588,000,000 that Australia stands to lose during the next 30 years (p. 176), would be spent in Australia, and it would be spent entirely in the support of the greatest rural industry under the direction of Government; an industry too, which according to the laws of forest economy, must remain under Government direction. Subsidiary to this is the social evil of pauperism and work-houses in England, and Government work for the unemployed in Australia. State Forestry has its bearings on these problems.

366.—*Australia's problem of "The Unemployed" partly solvable by State Forestry.*

On the continent of Europe there is no pauperism (in the English sense), and there are no "work-houses." In England there is no State Forestry (in the con-

tinental sense) and £43,000,000 going out of the country yearly for imported timber, while nearly one-third of the area of the British Isles is waste land. I know one of the depopulated parishes of England within an easy day's walk of the heart of London (20 miles from Charing Cross) where there is not now enough population to support a school, a public house, a parson, or even the smallest shop!

Australia has its unemployed. Said the Melbourne *Age* of 29th March, 1915, in perhaps the best of its recent writings on State Forestry:—

Thousands of pounds have been spent to provide the unemployed with work of such little value that they might almost as well have been engaged carrying bricks up a ladder in order to carry them down again, yet here is profitable work for thousands. For this fine undertaking (Forestry), as well as for the planting of exotic timbers, the State wants first of all direct and independent control, a Forestry Department free from political influence, managed by an expert who has the knowledge of a skilled Forester.

It is often a difficult problem for Australian Governments to find employment for weakly and unskilled labour. State Forestry offers the advantage of a *store of elastic* Government work for the unemployed in the same way that it offers a store of elastic second class grazing for the farmers in times of drought.

Most public work must be done when it is wanted; but there is always a store of forest work that can be hastened or postponed with little inconvenience. Thinnings, planting, and timber-cutting can be hastened or postponed a year or two, according to the exigencies of the State. That is a question for the forest "Working-plans" and the Forest officers who are carrying them out. Of course, anything like political interference in Forest management must be absolutely barred. That is one of the public scandals of the past.

367.—*Forestry and "The Unemployed Whites" in South Africa.*

At the Cape, during the financial depression that followed the war, I had a camp of Government unemployed who did quite useful work in thinning and stripping Wattle-bark; a large proportion of them were weakly alcoholics, whose useful work in a town had come to an end. They were all white men (the coloured man rarely starves) and of little use under an African sun, but they were at work half an hour before sunrise, and with three hours in the evening, got in seven hours a day of quite useful light work. These broken alcoholics did more useful work for the State than a robust inmate of an English work-house, and a proportion were temporarily reformed. South Africa spends nothing on work-houses, and about £1,000,000 every seven years on State Forestry; in England this position is reversed.

368.—*Western Australia's second greatest rural industry hanging in the balance.*

For its development Western Australia requires money and population—scientific Forestry will supply both these—but, to begin with, chiefly population. For estry means a large rural population. In Germany, where statistics have been carefully worked out, it has been calculated that on an area of 35 million acres of forest one and a-quarter million workers live directly on the forest and three and three-quarter millions indirectly. Western Australia, with its thin rural population, and its large public debt amounting to nearly £100 per head, can least of all the Australian States afford to lose by bad Forestry its second rural industry. Its Forest industry seems now to hang in the balance. Good Forestry will preserve to Western Australia its chief rural industry after Agriculture, and in the future its greatest source of national wealth, after railways; bad Forestry will lose both.

Twelve years ago South Africa wanted Ironbark sleepers from New South Wales. If New South Wales had not burnt the Ironbark, it could by now have

supplied several million pounds worth of Ironbark sleepers to South Africa. But neither New South Wales, Queensland, nor Victoria could supply the Ironbark sleepers except at a prohibitive price, and South Africa got sleepers from the Northern Hemisphere.

Is it the policy of Western Australia to abandon its fine timber to destruction as has been done in East Australia, or to *increase its population* and build up a great rural industry in conserving its forest?

Western Australia is exporting £1,000,000 worth of timber yearly; its name stands first on the hardwood markets of the world. This name has been built up at some sacrifice. Great quantities of timber have been given by the State to the Timber Companies at little more than nominal rates. Is this position to be lost by allowing the forests to go to the wall as New South Wales has done, and compelling the hardwood trade to go elsewhere for its supplies? Now seems to be the critical time in the Forestry of Western Australia, the parting of the ways. Every consideration of prudence and patriotism seems to demand a vigorous Forest policy at once. As a matter of finance there should be the accumulated forest surplus for immediate necessities, and a Forest loan after the war, to put the forests in order as Japan has done and build up a great rural industry like Japan has also done.

369.—*Australia's Governor-General speaks out.*

This point was urged recently by Sir Ronald Munro-Ferguson after a tour through one of the best forests of Victoria, and the Governor General of Australia knows more about Forestry than any other English statesman. He said:—

> He looked to the time when "Forrest" would be the centre of even greater prosperity, when the forest country surrounding it was properly developed. Germany had before the war 4,000,000 engaged in her timber industry, a number not far short of the population of Australia. There was no reason why Australia should not equal that record in the future.
>
> The Governor-General said that, after what he had seen of the forest country, he believed that Australia might well become the hardwood timber supplier of the world. He looked forward to seeing a great development in the use of Australian timber within the next few years.

If the forest be only picked over as at present, the trees that happen to be mature at the time utilised and the rest destroyed, not only is a great deal of timber and money wasted, but a comparatively small quantity of employment is provided. Timber and employment are both lost together!

370.—*Extra-tropical Forests produce more Timber and employ more Labour than Cold-country Forests.*

The Government returns show how little employment there now is in the forest. In the *Commonwealth Year Book* for 1914, while 22 pages are devoted to employment, unemployment, wages, rates, etc., in towns, and a little space is given to agricultural and pastoral industries, I can find no mention whatever of forest employment, apart from that at timber mills. As a fact, the forest as at present worked, or perhaps it would be more correct to say neglected, affords but little employment.

When, however, we come to consider the number of men that find employment in the cultivated forests of Europe, the position is very different. Then we find State Forestry representing one of the most important rural industries.

Forestry in the Extra-tropics gives more employment than forestry in cold countries. Thus, to protect the forest against Man and his fires comes all the labour and cost of fire-protection; then the extra-tropical forest usually requires more planting, natural regeneration not being so strong as in climates with milder summers; and lastly, the very fact of the timber growing so much faster (maturing

in about half the time) doubles the labour required in thinning. Happily against this extra cost of working and consequently extra employment comes the greatly increased yield of the warm country forest. No cold country forests come near a mean yearly yield of 700 cubic feet per acre per year (p. 105).

I may give another example: The maximum gross timber-stand of any extensive cultivated forest in Europe is probably the 20,000 cubic feet of the "Black Forest regeneration cuttings." But the Karri forest of Western Australia in the condition of a "pure," wild, uneven-aged forest of one light-demanding species will yield up to the same figure, taking merchantable timber only. As an even-aged, cultivated forest with the Karri associated with a "shade-bearer," the gross yield corresponding to the "Black Forest" figures would be probably from 60,000 to 80,000 cubic feet, viz., three or four times the "Black Forest" timber.

371.—*Forestry versus Sheep-farming as Labour-employing Powers.*

Perhaps the worst error in the history of Australian colonisation has been allowing good forests to be destroyed for sheep-grazing. The employment on an Australian sheep station is of the lightest character. A reliable estimate gives one man in permanent employment for every 7,500 sheep, or perhaps as an average for forest lands, one man per 7,500 acres; while ordinary Forestry gives employment throughout the year at the rate of one man per 800 acres. So that, approximately, Forestry gives ten times the employment that sheep do. And yet this squandering of the public estate, this reckless loss of rural employment, still continues. Victoria with its increase of population failing, threw away 100,000 acres of good forest and all the employment it represented for the slender employment on a grazing area, as lately as 1912 (Conservators' Conference, Melbourne). And in the other States I have not heard of any complete stoppage of the waste. The English calculation is also that Forestry gives ten times the employment afforded by sheep.

Forests of the same size give ten times as much average employment as sheep farms, without reckoning the population absorbed in attendant industries, which, in many cases, amounts to treble this figure. (Dept. Com. on Forestry in Scotland.)

On this Committee sat, amongst others, Sir Ronald Munro-Ferguson (the present Governor General of Australia), Sir John Stirling Maxwell, and Lord Lovat, all recognised authorities on Forestry in Scotland.

The Coast Erosion and Forestry Commission of 1909, which collected a mass of evidence on the same subject, came to the conclusion that while there were great differences depending on local circumstances, it might be taken as a general average that with sheep in England there would be employment for one man on 1,500 acres; while on the ordinary planted forest there would be employment for one man on 100 acres. The "General Federation of British Trades Unions" reckoned in 1911 that on an average, sheep-farming gave employment to only one man per 1,000 acres.

CHAPTER V.

World-wide Effects of Forestry on the Labour Markets.

372.—*Forestry labour in Belgium.*

For comparison, it will be useful to see what is the extent of employment in the well-cultivated forests of Europe, apart from officials and timber workers. (Those from Leiria I must forward on my return to England. In default of these the published returns from some of the West European forests may be taken.)

Belgium is not one of the forest countries of Europe. It is only recently that much attention has been given to Forestry; the total area of State-managed forest is only 430,000 acres. Yet Belgian Forestry, as is mentioned under "Suburban Forests" (p. 157), now gives winter employment to an average of 32,000 men, and permanent employment throughout the year to 750 men. At the same time it is computed that its forest expenditure is giving a return of between 4 per cent. and 5 per cent. (Rowntree *Land and Labour*). This high employment figure is due to the cost of much planting, now required, in restoring the forests.

373.—*Forestry labour in Germany.*

In Prussia, where there is much poor forest on very sandy soil, the average employment rate is one man per 185 acres of forest.

The following figures of employment were given in the English *Quarterly Journal of Forestry* for April, 1913. The figures relate to the German State of Bavaria, which was one of the first of the European States to practice scientific Forestry, and which has long kept careful forest statistics. The figures may be depended upon as being reliable, and they relate to a good class of forest.

Average Distribution of Forest Labour in Bavaria.

Felling and moving timber	59 per cent.
Roads	11 „
Planting and sowing	24 „
Thinning and various	6 „
	100 „

In Germany the practice is for the trees to be felled and brought to the roadside by the Forest Department, where they are then sold by auction.

Most of the timber labour is piece-work, most of the sowing and planting is done by day labour. This is exactly as it should be. Forest labour is paid at a somewhat higher rate than other local labour. It averages more than rural labour in England. The labour in the Bavarian forests mostly takes place in winter, the same men working on their farms in summer. Taking the four winter months, it is found that on an average 40 acres of forest give employment to one man. For full time all the year round the average figure is one man per 130 acres.

Thus, taking an average of Prussia, where much of the forest is poor, and Bavaria where nearly all of it is good, and increasing this by 60 per cent. to allow for the timber work being taken off, we get a mean figure of 942 *acres per man per year*, as average German forest-employment exclusive of timber work.

In Australia the working hours are shorter and rates of wages are higher than in the German forests.

374.—*How the labourers' "Living Wage" is maintained by Forestry.*

The cost of rural labour in Australia has been artificially raised in some of the States to a level with town rates. Usually the rural labourer, with cheaper living, a healthier life, and more children to help him, is paid, the world through, at a lower rate than the town labourer; and, where he is properly cared for, as in many parts of the Continent of Europe, is actually better off than the town labourer working at a higher rate. Allowing on the one hand for the increased cost of fire-protection, and on the other for the present artificial restraints on rural labour to pass away, we may perhaps assume 800 acres of ordinarily worked Australian forest as supporting one labourer and his family. This supposes that the forests are worked as intensively as in Europe, and that, as at present in Australia and in South Africa, the timber is sold as it stands in the forest. On the German system of the Government cutting the timber and hauling it to the roadside or tramways, this figure of 800 acres will be decreased by 60 per cent. as above, and becomes 480 acres.

Employment in an ordinary Australian Forest—800 *acres to* 3,000 *acres per man.*

When we come to the labour required, in the first instance, to convert the wild forest to the cultivated forest as a going concern, the forest employment represents a much higher figure. This is evident at a glance. The buildings, roads, and necessary planting will absorb at first much labour. Japan, as mentioned, spent £250,000 (say £1,000,000 on the Australian wages scale) yearly for many years when the wild forests were being put in order.

It will naturally be many years before the Australian forests are worked as intensively as in Europe. We may perhaps assume that for the present there will not be an average of more than one labourer per 2,000 acres, the actual number being graduated according to the accessibility and value of the forest.

It will thus be seen how important is the rural industry implied in the management of the State Forests, apart from all timber working and officials.

375.—*The Labour Party in Britain demands State Forestry as a "Distress Preventive" and Emigration-check.*

The strongest argument which is now being put forward in favour of State Forestry in England is the employment factor. In politics it forms one of the planks of the English Labour Party. "Wait till there is distress in England for want of employment," said a prominent Labour politician to me not long ago, "and you will see the first real step taken in State Forestry." That was a few months before the war broke out.

The position generally, in Britain, is that the "Crofter" in Scotland and the small-holder in England cannot live, under modern conditions, during winter on their holdings. They must have some extra winter employment. In Europe they get this from the State Forests. "Therefore," say the advocates of State Forestry in England, "let us establish State Forests here as on the Continent of Europe." This is particularly insisted on by the Royal Scottish Arboricultural Society, which, at a great gathering of Foresters, celebrated its Diamond Jubilee last summer.

Foresters from most parts of the Empire (except Australia) and several foreign delegates were present. The remarks of the Canadian delegate regarding employment in Forestry are instructive. He said:—

> Another thing which has struck me in connection with the view taken here, is the fact that you are counting on Forestry to increase the population of the country. The difficulty that we run up against in Canada is the fact that when we wanted to hold land for Forestry purposes we were almost denounced, as trying to prevent population by taking lands for Forestry that ought to be used for agricultural development. It has been very interesting to me in going about Scotland to see the situation, that development of Forestry does not mean decreasing the population, but increasing the population and prosperity in the country. I can go home and preach that doctrine to Canada with a great deal more confidence and heart than I could do before I came over on this occasion.

Colonel Martin-Martin, the delegate from the western "crofter" country, said:—

> Travelling down from Skye, I could see at every railway station the attractions offered by the Colonies to take the "crofter" away from his country. "Come to Canada," and "Send your sons to Australia" were posted all over the line!
>
> That, gentlemen, is what our "crofters" are doing now. They are leaving the country and one cannot wonder at it. Many of them say to me, "The croft only offers a home; it does not offer a living." That is the position. The only way the croft can offer a living is with the assistance that may be given by occasional employment in Forestry: and that is why we on the West Coast are so anxious to see Forestry advanced. (*Trans. Scot. Arbor. Soc.*, Part 2, 1914.)

Colonel Martin-Martin might have added that very often a small holder is no better off in Australia than in the west coast of Scotland.

376.—*The despairing "Small Holder" in Australian Forests.*

During my seven months' tour in Australia I have spoken to many a small holder, isolated in the forest, who has told me that the game was nearly up; his resources were about finished, and that, like so many, he must *go to the town* or starve. He had worked hard, but his holding would not keep him. No roads, no railways, and most of the Government development expenditure going to the towns or the better settled rural districts. I have endeavoured to comfort such a one by telling him that better days were ahead, that the forest country around him was going to be developed, and that Government work and money would be coming to him for work on roads, forest work, and buildings.

I may conclude by quoting an estimate of employment put forward lately for a good Government forest in Victoria.

A recent writer proposed to stop all tree-felling in the "Cement" Valley, Dona Buang, Victoria, over about 3,000 acres of forest. Figures were then put forward showing that the timber there was worth, indirectly, £20,000 a year in perpetuity, reckoning timber royalties, railway freights and wages to workers, or at the rate of nearly £7 an acre. I am not prepared to say that for a wild forest this figure is not exaggerated, but for a properly organised forest it would not be.

377.—*Private Forests detrimental to rural and Municipal Employment.*

Belgium has accomplished what England has been talking about doing for the last 30 years. As mentioned (p. 204), the Belgian Government started an active policy of State Forestry some years back, not only to produce timber at home, but because the cutting down of private forests was seriously lessening rural employment. As is generally known, Belgium and England are the two most densely populated European States. The Belgian Government has now a Forest Department of 750 men, and provides winter employment for 32,000 men. And it

An Orchard in the Jarrah country.

is getting a fair interest on its forest expenditure. Like South Africa, Belgium reimburses Municipalities one-half of all their expenditure and manages their forests for them.

378.—*Amount of employment requisite for working Australian "Forest Reserves" and probable cost.*

Forest employment in the forest reserves of Australia falls into three classes:—

(1.) It has been (p. 49) shown that when the demarcations are completed, an area of some 50,000,000 acres will await organisation at some future date, and an area of some 2,000,000 or 3,000,000 acres requires to be completely organised at once. How much of this 2,000,000 or 3,000,000 acres will be organised in any State will again depend on the forest policy pursued by that State. Dividing 50,000,000 acres by 2,000, as the figure while present conditions obtain (p. 205) it will be seen that when the whole of the forest reserves are organised they will provide permanent employment throughout the year for some 25,000 men on day labour and 1,666 resident Foresters on firework, etc.

(2.) The above relates to permanent employment. Temporary employment will be required in the work of organising the forest for regular working, that is to say, roads, fire-paths, and buildings.

(3.) It is impossible to make any general estimate of plantation employment, for the amount of employment will depend on the policy of each Australian Government. Such a State as Tasmania is apparently as far off forest plantations as the Negro State of Hayti; the rich State of Queensland is in much the same position, while South Australia and Victoria have been planting for many years, and New South Wales talking about it. New Zealand is at present planting 2,000 acres yearly; the average cost has been £14 per acre. The amount of employment involved can be gauged by the fact that planting will cost from £10 to £14 per acre for average planting up to the "closing" stage, while wide planting for inferior timber will cost from £5 to £8 per acre.

379.—*Employment calculated on basis of Annual Expenditure.*

Perhaps the best indication of the actual employment in the forest is a consideration of what will be the forest expenditure, and we may take that as lying probably between £1,000,000 and £2,000,000 (p. 210). Japan, as mentioned, spent £250,000 (say £1,000,000 on the Australian wages scale) yearly for many years while its wild forests were being put into order. And South Africa, which is in population and industrial development not much above one of the larger Australian States, is spending £1,000,000 in each seven years on Forestry. We may take it, therefore, that as soon as scientific Forestry is taken up systematically by the Australian States, there will be an annual expenditure of at least £1,000,000. Averaging unskilled rural labour at £150 per annum, this will represent the employment of some 7,000 men yearly.

CHAPTER VI.

The Relations of Forestry to Public Finance.

380.—*Climate-effect of Forestry on Public Works and Local Areas.*

The "climatic effect" of forest is a large subject which I prefer to treat here only so far as it relates to certain specific instances, such as the effect on the Melbourne water-shed (p. 326) and the burning out of the forest on Mt. Wellington, Hobart (p. 336).

The effect of fires generally on water supply has already been discussed briefly under Fire (p. 324).

The practical effect of forests on climates in Australia is probably limited to floods and to erosion on certain water-sheds as a general effect, and as a local effect the loss of perennial water in streams issuing from forest-clad valleys. There is also a temperature-equalising effect. The climate of Madrid, which is a dry high-lying extra-tropical climate, is commonly believed by the inhabitants to have had its climate deteriorated by the felling of the neighbouring forests. Madrid is the most recently founded of the European capitals, and there are clear recollections and records to establish this change. It is believed to be colder in winter, and more exposed to the parching winds of summer. This effect is quite local, but it is of considerable local importance when forest adjoins towns and villages. Hence the importance of well-selected suburban forests (p. 156).

My views on the climatic effect of forest in the extra-tropics are expressed in the Colonial Office Blue-book entitled *Cyprus Forestry,* 1908. There are a few copies of this in Australia, and it is easily procurable through the Government Stationers, Waterlow & Son, London.

An experiment at San Bernadino, California, in a climate like the mountains of South-Eastern Australia, showed that the stream flowing from a forest valley on an average lasted three months longer than that from a valley without forest. (U.S.A., *Agricultural Year-book,* 1913.)

The best known case of water produced by forest is the water and fertility on the barren volcanic island of Ascension, lying in the South-Atlantic nearly on the way between Cape Town and England. When the first trees were planted they had to be watered with condensed water; now tall Cluster-pine trees condense water from the drifting clouds and a small stream of water has been produced. (H. Boscawen, Inspector of Forests, N.Z.)

381.—*Forest Revenues misappropriated by State Governments.*

When we consider the present value of the hardwood production of Australia (total production, valued at about £5,500,000 yearly and an export of about £1,000,000 to countries outside Australia), and the prospective cost of putting the hardwood forest in order (£588,000,000 by the end of 30 years from now (p. 176)); when one reflects on the loss to the country of the present importation of softwood, roughly £10,000 a day, plus the cost of laying down softwood plantations to meet it, and the fact that water in Australia (as in South Africa) is often more valuable than land, and that forests, though they may not much increase the rainfall, are the great water conservers; when one turns over these hard facts, it is evident

that Forestry, not only in Western Australia, but in every Australian State, merits being placed on a footing quite different from that on which it is at present.

Looking at the Forest Statistics (p. 210) it will be seen that it is only in three States that the expenditure of the State Forestry Departments has anything approaching the magnitude of the interests involved. Victoria, which is the premier State in Forestry, is spending little more than £40,000 a year on Forestry (against South Africa's £144,000), while the large and rich State of New South Wales is spending only £26,695 (not much more than South Australia with its £20,958), and this *practically all on salaries*. Against this trifling expenditure have to be set revenues of about £100,000 in New South Wales and Queensland; though these figures are really too low, since the habit has grown up of debiting portions of the forest revenues to other departments. Thus, about one-third of the Queensland forest revenue, the value of timber taken from the forest, is quietly appropriated by the Railway Department and does not appear at all on the accounts.

382.—*Forestry as a factor in Australian National Credit and Thrift.*

Forest finance falls under two heads (1) National credit; (2) Thrift.

1. As has been mentioned under various points connected with Forestry, the National credit will be raised by expenditure on such an obviously necessary public work as putting the forests in order, according to the methods adopted in other countries in the same position as Australia. National forests are a great public asset comparable to such public assets as railways and irrigation works.

2. *Thrift.*—The present forest policy, as shown under cost of 100 years of bad Forestry (p. 176), and Forest Statistics (p. 184) spells ruin. When the war broke out, about £10,000 a day was going out of Australia to pay for timber which could be produced equally well in Australia as in the countries where it is grown; and the reckless Forestry of the last 100 years will, according to a moderate computation, take 30 years to rectify, while at the end of that time Australia will stand the loser to the extent of £588,000,000. The present-day value of this figure discounted at 4 per cent. would be £243,500,000 (p. 176).

This appalling figure represents (1) the loss (with interest) of home forest production; (2) the loss of timber for export; and (3) the cost of timber imported, allowing for increases on the basis of the last few years. There is a large indirect loss to various wood-working industries in the increasing cost of timber as a raw material, but on this indirect loss only a small portion is included in the figure of £588,000,000. Every consideration of public thrift indicates Forestry as the most important public measure on which to expend borrowed capital.

383.—*Loan money must be the form of the National invested capital.*

Happily this is the clearest part of the outlook for Australian Forestry. Money to develop the forest must obviously come from a loan, and there is no more legitimate expenditure than one to develop the forest resources of a forest country; no expenditure that will give a more certain and lasting return; no expenditure for which there is better security. Without this expenditure the Australian forest has no *permanent* value. Most of it cannot exist in contact with civilisation; it becomes burnt.

Says the Melbourne *Age* of 29th of November, speaking of local management:

A State appropriation of £50,000 or £100,000 to put the national forests in order would be a fine investment. Borrowed money could be applied to no better purpose.

At his election speech, the Victorian State Premier promised a loan of one-third of a million pounds (p. 314). I heard a specific forest loan discussed when I was

in South Australia, and in Western Australia loan money has been wisely appropriated to establishing Government sawmills for working the Karri forest. These are the only States that are taking their forests sufficiently seriously at present to require forest loans.

384.—*The amount of capital required for annual investment in Australian Forestry.*

Nearly every industry requires the investment of capital to start it. The Forest industry is no exception. The wild forest has to be converted to the much more productive cultivated forest. It has to be organised with roads, buildings, and resident Foresters, if only to protect it from fire. In an important paper, read at the meeting of the British Association, it was shown that big irrigation works could not be expected to give a full return before 30 years. That may be taken as being the position with regard to expenditure on Forestry in Australia. The benefits will be apparent *at once* in the stoppage of fires and the re-growth of young timber, but it will be *at least* 30 *years* before much benefit in a financial point of view can result from these operations. Japan, as mentioned, spent the equivalent of £1,000,000 a year in organising the wild forest. South Africa has spent some £2,500,000, and the work is only about half done. It is now spending about one-seventh of a million pounds yearly and, as we have seen, in white population and industrial development South Africe ranks as about equal to one of the larger Australian States. Germany has for long spent £7,000,000 a year on its forests (or about £3,500,000 if we deduct the timber working), and it has got the yield doubled in a generation. Australia should spend at least £1,000,000 yearly from now forward.

Considering that the forests of Australia now yield (p. 212) yearly some £5,500,000 worth of produce (the total output of the saw-mills is returned at £8,536,000, and they only get a part of the timber and forest produce), an expenditure of £500,000 yearly, increasing temporarily to perhaps £2,000,000 yearly as the work proceeds, is but a moderate figure. Any expenditure less than this necessarily forces the conclusion that Australia is not making the best out of its forests; the critic would say squandering its best natural resource and sinking in the scale of nations.

Along with railways and irrigation, there can be no more legitimate reason for borrowing than National Forest Organisation. There is little doubt that the capital required to put the wild forests into order and render them secure against fire will give a better return than either capital invested in railways or in irrigation. The lowest return on the forest expenditure will probably be that yielded by the planting of softwoods, necessary though it is; the highest by fire-protection.

385.—*The question of State Loans or a Federal Loan for Australian Forestry.*

The only point to be discussed as regards a forest loan is whether, in view of the national aspect of Forestry, there should be a Federal loan and advances to the State, or various separate State loans. Probably in the end there will be both, as in the United States of America. Another point is whether Forestry funds should be provided out of general loan money, or whether there should be a specific forest loan. In South Africa forest funds come partly out of revenue and partly out of Railway loan money, the Forest Department growing sleepers for the Railway.

General borrowing for the purposes of general expenditure means, necessarily, the application of the money to many purposes, which the lender may be inclined to question, and thus to demand higher rates, and Forestry is such a long business

that money on easy terms is essential. A comparatively low rate of interest is one of the chief reasons why the State can grow timber at a profit, as against the private individual. And to secure this low rate of interest it may be advantageous for the borrowing State to take the lender into his confidence.

Often there may be quite legitimate expenditure, which it is hard for the outsider to understand. I have never heard a rational explanation of why, at this moment, the State of Victoria, with its population growing so disappointingly slowly, is spending some £3,000,000 on electrifying the suburban Railways (a "doubtful luxury" most Londoners would say) when there is such a rich and fertile back-country awaiting the development of roads and railways. The ordinary lender would say at once in such a case:—"Here is noxious political interest, starving the country and putting in work on city expenditure that might be postponed."

But a loan, for a specific purpose, would be secure against such criticism, when that loan was to be applied solely to Forestry, viz., to husbanding the resources of the country according to the best modern methods.

Then we have (1) the general security aspect; (2) the specific security aspect of a loan.

(1.) *General Security.*—A State recklessly squandering its chief natural asset, its forests, burning yearly hundreds of thousands of pounds' worth of the most valuable timbers in Australia—its durable softwoods and Blackwood—(as Tasmania is now doing) cannot, in the credit system of the world, stand beside a State like Victoria that is adopting modern methods of State Forestry and conserving its forests. It is easy for a recklessly governed State to disguise its sins for a time. Visitors come to the towns and see wonderful progress there; an unnatural and forced development if you will. They are shown picked bits of prosperous rural districts, but there is something behind this, and sooner or later the other side of the picture gets known.

(2.) *Specific Security.*—The present credit of all the Australian States is good; their 4 per cent. stock scarcely varies; but, if after the war, there comes acute money stringency, then a State which, like Tasmania, at present has its forest managed on the lines of the Negro Republic of Hayti, or of the dark ages in Europe, may find a difficulty in securing money for such a perfectly legitimate purpose as forest development and conservation.

And it may be well then to have a purely forest loan, the money to be spent solely in conserving the forests, and the *forest revenue forming a first charge for the security of the loan.* One can recall similar cases of specific security being offered in the case of other countries in times of financial stringency. The case of Tasmania is like that of modern Greece in its darkest days. When Greece essayed alone to combat Turkish misrule and was defeated, though Greece was then at its lowest, money was secured on fairly easy terms by hypothecating the Customs.

It is unnecessary to multiply examples. Any country with a sure natural asset is at liberty to use that asset as a special security for a special loan. The Australian forests present a tangible security that is yielding to-day some £5,500,000 worth yearly of produce (of which £1,000,000 is exported), the value as it leaves the forest (p. 212). No one who knows anything of modern Forestry in these latitudes would doubt the easy fire-protection or the possibility of doubling the productiveness of the forest in about a generation.

CHAPTER VII.

A Loan Policy and the Financing of Forestry.

386.—*Urgency of an immediate "Forest Loan" policy.*

In view of the heavy loss that is being incurred by fires in the forest, and the general loss owing to the postponement of more active Forestry, it would be advisable to raise a forest loan at the earliest possible date.

There will probably be much unemployment after the war. This could be met by a small loan, and then, as soon as the money market became less stringent, a general forest loan of, say, £10,000,000. But of course the unemployed could only furnish a small part of the labour required, and perhaps a more important aspect of the matter would be encouragement to immigration; for, after the war, and the arrest of the flow of borrowed money, there must come the same want of employment in Britain that occurred at the close of the Napoleonic wars. When the Forest Reserves are fully completed, and fully organised, I have computed (p. 207) that there will be permanent employment in the Commonwealth forests for some 25,000 men on labour, and some 1,666 salaried resident Foresters in charge of Forest Stations. This is, of course, looking far ahead. The immediate requirement is the organisation of some 2,000,000 acres for the production of timber, and the organisation of the remainder, so far as may be necessary for a reasonable extent of fire-protection.

At the same time it must be remembered that every day lost in putting in the softwood planting required to meet the importations of softwood means a loss of £10,000 a day on a basis of the present importation, and a loss of £16,000 a day on a basis of what I have estimated as the average importation during the next 30 years.

387.—*Annual Value of Australia's output of Forest Products.*

The value of the present Australian forest-produce, £5,500,000 as it leaves the forest, may be estimated in two ways:—

1. It has been seen (p. 187) that the "bulk" of timber used in Australia comes in nearly equal proportions from imported timber and from home produce. The normal value of slightly manufactured imported timber when the war broke out being £3,500,000, we may take the *market* value of the home timber as being the same, viz., £3,500,000. To this has to be added the value of other forest produce not sawn timber, viz., logs hewn and split, timber, firewood, tan-bark, etc., which I have estimated approximately at £1,000,000 (p. 174). Then there is the value of exported timber which, during the last few years, has averaged £1,000,000. Adding together these three items we have:—

Timber value on basis of equality with imported timber ..	£3,500,000
*Other forest produce, estimated approximately at	1,000,000
Timber exported	1,000,000
Total	£5,500,000

2. Again, the raw or forest value of Australian timber and forest produce worked yearly I have estimated amounts, in round numbers, to £2,000,000 (p. 174). The part of this that goes to the mills I have estimated at *£4,500,000 on its arrival, and the value of the same timber as it leaves the mills more fully manufactured £9,500,000.

The correspondence between these two estimates is seen by adding together the two items marked * in each set of figures. These total £5,500,000, which is the same figure obtainable as above, by assuming equal values for the imported and home-produced timber. This correspondence is remarkable.

It is really not quite so close, because the average work on the imported timber is more than the average work on the home-timber going to the mills, but this may be counterbalanced by the complete work on the hewn sleepers, split palings, etc., which, of course, do not go to the mills at all. But the correspondence is sufficiently close, and it shows that the yearly value of the timber and all other forest produce as it leaves the Australian forest is approximately £5,500,000.

388.—*The Forests and the Railways are Australia's two greatest Permanent Assets.*

The two greatest permanent national assets of Australia are railways and forests, which may be compared thus:—

Up to June, 1913, railways had cost £171,250,000 and had had a net revenue (for the previous year) of £6,358,000, which equals a return at the rate of 3.71 per cent. interest.

If, to take outside figures, it were to cost £45,000,000 to put the Australian forests in order, as (practically) fire-proof cultivated forests; and if, at the end of 30 years, the forests were yielding *no more than they now yield*, plus the present cost of imported timber, there would be a return of £8,500,000 worth of timber and produce yearly, against a capital expenditure of £45,000,000, which is at the rate of 16 per cent., and this, be it remembered, is a minimum return; for from 30 years onwards the production of the cultivated forest would rise rapidly, while the cost of maintenance would be no more than that already indicated (p. 202). The cost of maintenance would depend on the proportion of the reserves that it was desirable to work intensively for *full production*, and the proportion worked only so far as was necessary for *fire-protection*. From 30 years onwards, the State Forests would be maintained at just as high a level of productiveness as might be thought desirable. That would mean ample supplies of timber to meet all home use, both hardwood and softwood, while there would be enough hardwood to supply the hardwood markets of the world, an export of hardwood, worth perhaps £5,000,000 yearly.

The present yield of the Australian forest cannot, however, be taken as presenting the real basis for regulating the expenditure (pp. 182, 174, 93).

389.—*The financial attitude throughout Australia in regard to Forestry.*

Owing to the popular idea that Australian forests were inexhaustible and, therefore, that the timber was of no account; also to the unfortunate mingling of politics in forest management, the "royalties" (or Government dues) on the timber are only about one-quarter of a low average rate, £0.01 (the "metric tickey" standard). If, indeed, we take the common rates for timber obtainable in European forests, the Australian "royalties" appear still lower. Thus Cluster-pine is a cheap and abundant timber in Portugal; the average rate at which Cluster-pine timber sells in the State forest of Leiria is 4d. per cubic foot, which is over six and a half

times the average royalty on Australian timber. The mean royalty on Australian timber works out to a general average of about 2.4 farthings per cubic foot.

The financial attitude of Australia with regard to Forestry has been criticised as similar to that of the class of people who will carefully consider expenditure on a postage stamp and think little of risking hundreds of pounds in a doubtful mining venture. Australian States have been refusing small sums required for urgent forest works, and indulging in public works of a costly nature and doubtful present necessity. While the Commonwealth generally has stinted and starved its most solid asset, its forests, two States, Western Australia and New South Wales, have literally robbed the forest financially, taking from infant forests the little they have yielded. And all this financial wrong-headedness has occurred at the very time when the forest estates required that liberal expenditure which other young civilised countries (Japan and now the United States of America, for instance) are spending on them. The sequel is that Australia has now to face an inevitable expenditure, before the forest position can be rectified, of at least £588,000,000 (p. 176). It has so far got into the forest reserves only one-eighth of the area required for the country, according to the standards adopted by Europe, and America and Japan. Central Europe has one-fourth of its area under organised State Forests; India one-fourth of its area, and Japan between one-third and one-fourth. To get one-fifth *of its fertile area only*, Australia must now buy back at considerable expenditure the forest lands that have been so recklessly alienated. This is particularly the case in South Australia and Queensland.

390.—*The financing of the South African Forestry operations.*

In analysing forest expenditure, it is customary to classify it under two heads, (A) Salaries, (B) Works. For many years in Australia the whole of the Government expenditure on Forestry has gone under (A) Salaries; it is only under special circumstances that such a practice is justifiable.

In South Africa the ratio between (A) and (B) was $\frac{4}{9}\frac{8}{6}$ or exactly one-half, in the last published returns.

In New South Wales, where there is the largest Forest Department in Australia, $\frac{2}{3}\frac{9}{4}$ represents the proportion between (A) and (B) in the last returns. The figures are eloquent. With everything to be done in fire-protecting and organising the forests, practically the whole of the New South Wales expenditure goes in salaries; while in Victoria and South Australia the expenditure under the two heads (A) and (B) stands in a satisfactory relation.

It will be of further interest to examine the Forestry expenditure in South Africa. It has been mentioned how in 1905 there came a period of depression in Cape Colony, and retrenchment in all Government Departments. The Forest Department of Cape Colony at that time was in charge of Sir Lewis Mitchell, an ex-banker, and Mr. Rhodes, financial adviser. And it was decided to compute the forest expenditure from the beginning up to that date. The total came, with interest, to close on £1,000,000. This was a good deal for a poor colony, mainly dependent on agriculture, with none of the gold of the Transvaal. The total public revenue of Cape Colony at that time averaged less than £5,000,000 yearly.

A year was then devoted to making careful valuation surveys of the timber growing in the plantations of exotics, where most of the money had been spent. These valuation surveys will be found described in the Cape Yearly Forest Blue-book for 1905. The result showed that about one-third of the total timber being then brought into Cape Colony at a cost of some £250,000 sterling yearly was then growing and being produced yearly in the Government forest plantations. This was good enough; there are not many capital expenditures which recoup themselves

in three years. Forestry has since progressed in Cape Colony without any serious financial checks.

In the richer colony of the Transvaal, ample funds have been available for Forestry ever since Forestry began after the Boer war. No Colonial Statesman has shown a foresight or an appreciation of Forestry equal to Lord Milner. While the country was still in the hands of the Boers, I was asked to send up a junior Forest Officer to make a start in Forestry. And as soon as the war was over, I toured the Transvaal and framed a forest policy for Lord Milner. That policy has been consistently adhered to, and the bare treeless plateau of the Transvaal has now some of the largest tree plantations in South Africa. "I am certain," said Lord Milner in his farewell speech, "that Nature intended large areas in the Transvaal to be covered with trees." Forestry in the Transvaal and Free State has been limited since, not by want of funds, but by the difficulty of finding suitable trees for the climatic conditions prevailing on the high altitudes of the South African plateau. I recommended Mexico as the chief country to obtain trees from, but it was for long difficult to obtain seed from Mexico, and latterly it has been impossible.

South African Forest Expenditure, 1912-13.

Including the special plantations of the Railway Department.

	£		
Salaries	39,000	} or in round numbers (A)	£48,000
Travelling	9,000		
Plantations	80,530	} or in round numbers (B)	£95,985
Forest protection ..	13,000		
Uniforms	1,170		
Various	1,285		
	£143,985		£143,985

The revenue and expenditure on Forestry in South Africa have risen from a few thousands in 1882 to the following figures:—

1910—Revenue, £53,000; Expenditure, £85,000.
Timber worked, 1,500,000 cubic feet, valued at £22,500, or at the rate of 3¾d. per cubic foot. This is the workable timber as it stands uncut.

1911—Revenue, £51,000; Expenditure, £113,000.
Timber worked, 1,408,000 cubic feet, valued at £25,000, or 4½d. per cubic foot workable timber as above.

1912-13—Financial year. Revenue, £57,000; Expenditure, £119,000.
Timber worked, 1,250,000 cubic feet, valued at £26,000, or 5d. per cubic foot.

It will be seen that there is a gradual decline in the timber worked, which is natural as the excessive stock in the virgin forest comes to be marketed.

In addition to the cash revenue, there are large free issues of timber to the Kaffirs in the east of South Africa, which are valued at about £38,000 a year. These rights are deplorable, and are being commuted with the demarcation of these forests. The missionary influences and negrophile attitude of the Government Departments in charge of the Kaffirs have been difficulties.

391.—*The financing of Forestry in Portugal.*

Portugal, with the same climate, and growing the same trees as extra-tropical Australia, has during recent years made considerable advances in Forestry, so that

its forest finance is of interest to Australia. Since the year 1901 it has been the custom in Portugal to Budget the forest expenditure as equal to the forest revenue. Thus, the present forest revenue (end 1913) of £222,000 is also the forest expenditure on work. This is an excellent arrangement, since it avoids any break in the work. The Forest Department knows beforehand what will be the expenditure and can carry forward its work accordingly without loss. And then there is the additional stimulus to nurse the revenue, for Portuguese, like other Forest Officers, are always in want of money. Thus every £1 of additional forest revenue put into planting means something like an acre added to the national forest area. Salaries are paid for separately by the State, and amount at present to about £10,000. This is a very favourable ratio to the expenditure on work. ("Extra-tropical Forestry in Portugal," British Association).

392.—*The financing of Forestry in France.*

The French Budget may be taken as a good example of the finances of a well ordered democratic State, under normal conditions. I say normal conditions, because there has been no extraordinary industrial development, as in Germany and the United States, affecting prices and the use of timber. The average consumption of timber per inhabitant during recent years works out in France to 25 cubic feet against 39 cubic feet per head in Germany. The French State Forests have a gross revenue of rather over a million pounds sterling; an expenditure of £600,000, and thus a net revenue of some £500,000. But the larger part of the forests managed by the French Forest Department are communal (Municipal), and those bring in a revenue of some £1,250,000. Thus, altogether, France gets £2,250,000 from its public forests, reduced as these are.

The forest area in France is some 23,500,000 acres altogether, 17 per cent. of the total area of the country, instead of some 25 per cent., the figure at which Frenchmen would desire to see it. The area of State Forests is small, only about 3,000,000 acres, owing to losses during the troublous times of the French Revolution; during poor Government in the time of Napoleon III., and followed by the German pillage of the provinces of Alsace and Lorraine, where were the best French State Forests when I was doing my Forestry training in France as a boy. But the greatest loss was at the French Revolution; then the area of State Forests was 11,500,000 acres.

The first idea of the French democracy at the Revolution was to appropriate the State Forests, and when the error was found out it was too late to retrieve more than a fraction of the forests. The area of State Forests is now being gradually increased; the French Budget has a standing credit of one million francs (£40,000) for this purpose. This will, no doubt, be increased if the German menace is removed after the war.

Of the £600,000 spent yearly on the State Forests, nearly one-half goes in the pay of forest officials. Contractors (millers and timber buyers) do nearly all the timber "work" in the Forests, so that the gross figures for both revenue and expenditure are less than in Germany where the timber working is done by the State. The average yield of the French State Forest, taking the average of all the forests, good and bad, accessible and inaccessible, is 10s. per acre gross and 6s. per acre net. But the last figure is really larger owing to the method of keeping accounts; forest education, forest extension, and expenditure on inland *fisheries*, being reckoned as forest expenditure. (It is true that these also are reckoned as forest revenue, but they produce very little.)

As in other countries, the great difference in the yields of the inaccessible and the accessible forests in France is a marked feature. The coniferous forest near

Besançon, for instance, an industrial centre, yields yearly at the rate of £3 9s. per acre net. The suburban forests near Paris contain little coniferous timber, but in spite of this were yielding before the outbreak of the present war close on £1 per acre per year net.

393.—*The financing of Forestry in Western Australia.*

Western Australian Forest Finance.

The forest finances of Western Australia present the following figures:—

	£
Yearly forest expenditure, in round numbers	12,000
Yearly forest revenue, in round numbers	48,000
Accumulated surplus of forest revenue	326,000
Yearly importation of timber	120,000

Yearly export of timber and forest produce to other States of Commonwealth and other countries:—

	£
Timber valued at	997,994
Sandalwood	40,987
Mallet Bark	44,610
	£1,083,591

CHAPTER VIII.

Publication of Official Information acquired by Commissions and by Technical Researches.

394.—*Royal Commissions on Forestry.*

There have been two important "Commissions" in recent years in New South Wales and Victoria, and only two years ago one in New Zealand.

For the last 40 years Royal Commissions have been the usual answer of Governments in England to awkward questions regarding the British neglect of Forestry. These Commissions have been costly and cannot be said to have had any direct effect on the policy of any Government; but they have brought together an overwhelming mass of *evidence in favour of Forestry,* and have doubtless helped the important declaration on Forestry made by the present Government (Mr. Lloyd-George's Swindon speech) shortly before the war broke out.

The Australian and the New Zealand Forest Commissions have differed from the English ones in the point that they have been without technical advice. There has been *no professional Forestry,* either on the Commissions themselves or in the evidence tendered. This necessarily has meant *a great deal of useless work and a discussion of purely technical points on Forestry, which have been long settled in other countries where the conditions of climate and vegetation are like Australia.* It has also led to recommendations being made which could not possibly be carried out and which would be of no use to the forests or to anyone else if they were carried out. The last report of the Royal Commission on Forestry in New Zealand is a striking example of this. The cost of this Commission was some £5,000.

At the same time, these Royal Commissions have been costly businesses. Quite an appreciable quantity of softwood planting could have been done in Australia for the cost of Royal Commissions. The New South Wales Royal Commission report of 1908 cost, I understand, some £6,000, and so far it is not very apparent what New South Wales has got to show for the money.

The Victorian Royal Commission on Forestry was, perhaps, more costly (it lasted longer), but whatever it has cost the result has justified the expenditure. It consisted of 14 reports on special Forestry questions and a general final report, the last issued in 1901. The latter is a carefully prepared and able report, which the student of Australian Forestry reads with interest, but, of course, much labour and unnecessary discussion would have been saved if the Commission had had a technical adviser.

395.—*Geology and Forestry.*

Geology with the lure of alluvial gold and mining has been pursued in Australia to the neglect of Forestry. The gold lure was a very exciting one; timber gains were prosaic, and the man in the street looked on the timber supply as inexhaustible.

Mining is *the* great stimulus to a new country! Rich as has been, and is still, the mineral wealth of Australia (the alluvial gold discoveries and the more valuable permanent mines), it seems likely that English ideals have unduly exalted the value of mining, and depreciated the value of scientific Forestry in Australia. The mines of England have scarcely a parallel for value, while the want of national Forestry is one of the chief sources of national poverty in England, costing the country, according to the latest statistics, some £43,000,000 yearly for imported timber.

The position of these two industries has got reversed in Australia. Mining is nursed at the expense of Forestry, by special leases giving often ruinous forests rights, and with Australia, the premier hardwood producing country of the world, its forests should have received equal consideration with its mines. This was done in South Africa when gold was discovered in the heart of the Knysna forest country at Millwood in 1887. The gold mining there had every facility and help from the forest, and when it came to an end, left the forest in rather better position than it found it. Money was brought into the country and the working of the forest and its improvement hastened. Mining, after all, is often a temporary industry; Forestry should be the greatest national rural industry, a source of never failing wealth and health to the people.

Mining homestead leases in Queensland give the lessees 20 to 80 acres at 1s. per acre for 30 years, and they are allowed to select any forest land on a mineral field.

Under the Mining Act, any holder of a miner's right can take *any* timber free for mining purposes. He can go anywhere, get anything, and *destroy the forest as he likes.* A tin-mining company in North Queensland have been using Red Cedar for mining sluices! In Tasmania the unique and very valuable Conifers of that unfortunate island are allowed to be used for mining timber while there is abundance of inferior timber which should naturally be used for mining timber. Getting this valuable timber for nothing they do not value it. Huon-pine, Celery-top-pine, King William-pine, and Blackwood have been ruthlessly burnt down.

396.—*Mining and Forestry.*

If there is one thing that the traveller in Australia sees more of than the ruined forests, it is the decay or final end of payable gold-mining. Yet, neverthe-

less, the high expenditure on geology and mining in Australia continues. Geology is still taught as if it was of the first importance to the country, while actually, *in the future*, it has nothing like the wealth or importance to the country of Forestry. Expenditure on Museums and Government mining officials is ever increasing; thus, since 1905 the gold yield in Victoria has fallen off by 50 per cent., yet the Mines Department costs the country 60 per cent. more! In 1904-5 the Mines Department cost Victoria £45,424. Ten years later, instead of declining to half or one-third of this expenditure, it had actually risen to something not far off the double, that is to say £76,965.

Tasmania, with its utterly bankrupt Forestry, with no beginning of forest surveys and demarcation, has a fairly complete geological map. The geological survey is extremely interesting from a scientific point of view. Possibly it may have repaid its cost; but the loss from the postponed forest surveys and demarcations is incalculable. The valuable Huon-pine has disappeared from all the accessible forests. Celery-top-pine has nearly shared the same fate, and the useful King William-pine which, from its more rapid growth, could have economically been retained on better class ground, has also been swept away from the accessible forest. Blackwood, with figured logs running up to values of £50 a piece in Melbourne, is being burnt as rubbish in one part of the country, and imitated by staining and veneering in another, on account of its scarceness and dearness. A good authority allows 10 years for the practical end of the Blue-gum forests of Tasmania.

397.—*Education and Forestry.*

There are chairs of Geology or Mineralogy at all the Universities. There is not one of Forestry; yet, looking ahead, we see Forestry standing to the country at about the same importance as the national debt (p. 174). In 30 years the loss to Australia from bad forestry will, at the lowest estimate, exceed considerably the value of all the gold won up to now from Australian soil and will amount to about double the present public debt, State and Federal.

398.—*Agriculture and Forestry.*

Forestry is the business of the State, Agriculture of the private individual. This is recognised in the schools of political economy the world through. I have mentioned elsewhere what other countries are spending on their State Forestry.

Ordinarily all that the State can do for Agriculture is to help the farmer with advice; sometimes with a State farm, and sometimes with seed and fertilisers, when the ordinary trade channels are not satisfactory. Too often experimental farms fail, as does also the Government teaching! But it may be fairly assumed that in a new country the Government should aid, as far as may be, the farmer and his work.

But in Forestry it is another story; the Government, for better or for worse, has to do the bulk of the work itself, hence a necessary heavy expenditure, such as £7,000,000 a year on Forestry in Germany. *But in Australia these relative positions of Forestry and Agriculture have got completely reversed!* Thus, to take the case of Victoria, where among the Australian States at present Forestry is engaging the most attention, I find that for 1914-15 the expenditure on Agriculture by the State was £166,000, while on Forestry (apart from certain special items, included in forest expenditure) it was under £66,000. Here we see an exact reversal of the natural positions of two great ruling industries. One cannot run against economical laws without the risk of extreme loss.

Division VI.

SPECIAL TO WESTERN AUSTRALIA.

CHAPTER I.

Legislative Enactments.—Forest Regulations under the Land Act.

399.—*A fundamental "Forest Act" required.*

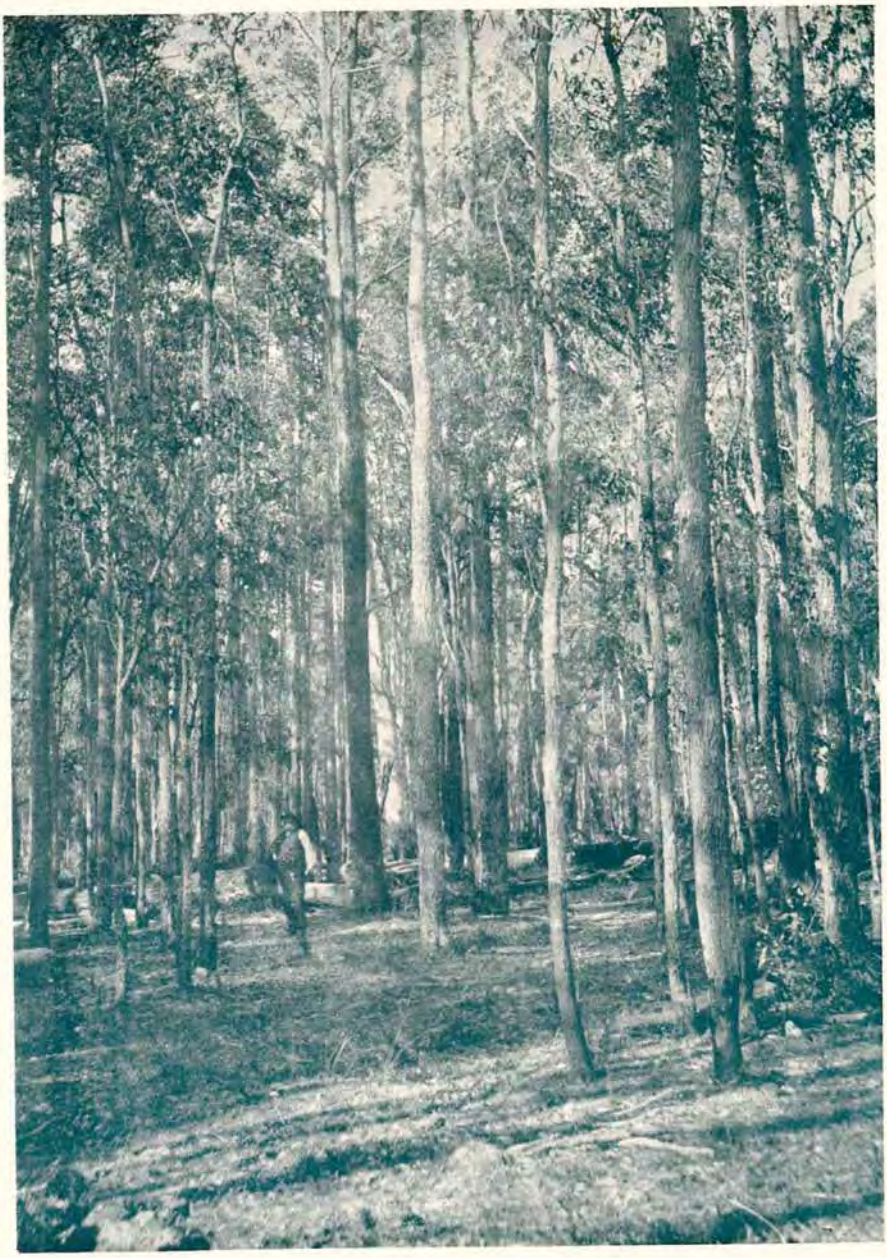
West Australia requires a working Forest Act, not a rider to a Land Act. In framing the Victorian Act, the South African Forest Acts and the Indian Forest Acts were taken into consideration. The more recent Forest Act of British East Africa (the newest and latest white man's British colony) might also usefully be taken into consideration, and my draft Act on which the British East African Act was founded. It may be useful to note here certain observations on the present Forest Regulations of West Australia as framed pursuant to the Land Act.

400.—*Advisory Boards to be avoided.*

Act No. 58 of 1904 amends the Land Act of 1898 and gives the machinery for an Advisory Board on Forestry. I understand that there is no Advisory Board. It would be desirable to get rid of the possibility of one being appointed. In the history of forestry in various countries, especially in England, there have been Advisory Boards at various times. They have rarely served other purposes than that of causing delay in forest administration. They have often been actually appointed for the purpose of causing delay, by Governments that have wished to have the appearance of doing the right thing for the country without offending a section of their supporters. Obviously *forestry requires business methods*, the appointment of a capable administrator as Chief Forest Officer, and holding him responsible, and him alone, for a satisfactory working of the forest estates. A responsibility divided between the Conservator and an Advisory Board means a dual control (as at this time in New South Wales), which is as harmful to the forest management as to the management of any other business concern.

401.—*Present "Regulations" inelastic.*

I have perused the West Australian timber regulations, dated 24th March, 1910. Speaking generally, they are not suitable to a forest which is worked on modern lines. They are too complicated and too inelastic. A forest, like any other pro-



Jarrah Regrowth, 25 to 30 years old: Jarrahdale Concession, W.A.

perty, must be managed by the constant supervision of a man on the spot, or at no great distance, and it is the man on the spot working under the guidance of the "Working-plan" who is responsible for the felling of the right timber; and then the regulations get reduced to little more than a license to cut certain timber under certain conditions, designed to hamper the buyer as little as possible.

I am here assuming that the comparatively small area of State Forest (in the fertile South-West corner of West Australia) will be at once organised and worked for the highest production. Many of the regulations have, no doubt, been framed to meet abuses, but they are incapable of general application, without interfering with that liberty of action which should be left in order to ensure good prices for the timber.

402.—*"Standard" felling sizes prevent "clean cutting."*

I assume further that the accessible forest, which is also that which will be worked first, will have mostly "clean fellings" on its "Working-plans." In that case there will naturally be no longer standard sizes for felling. To permit a saw-miller only to fell timber above a certain size adds to the expense of working the forest, reduces the saw-millers' profits, and is one of the reasons why he now pays royalties on so low a scale.

Regulation 45 specifies the minimum felling diameters of the various West Australian timbers. It is not apparent whether these minimum felling diameters, this attempt to fix the maturity of the timber by regulation, is intended to serve the interests of the saw-miller or of the forest. As a fact it does neither; and though it may be useful in certain cases of rough working, it is liable to lead to abuse (p. 95). The eminent French Forester, Count de Vaisselot, who introduced systematic Forestry to South Africa in 1883, stopped the use of such a rough expedient, and it has never since been revived in South Africa even for inaccessible mountain forest. In the Eucalypt forests of West Australia the nearer approach to clean cutting the better for the forest, so that the fixed felling limits will have no use, except in certain areas which it may be expedient to work for a time under "Jardinage" or Selection fellings.

403.—*Surveys should be at cost of Government.*

It seems also an undue tax on a saw-miller to make him pay for surveying the forest. It is the duty of the forest owner, here the Government, to have forest plans, and if such forest plans have not been made, to define a forest working area with a plane-table sketch, beacons, tree blazes or other marks on the spot. It seems hardly fair to ask the saw-miller to pay for the backwardness of the Forest Department.

404.—*Lease period should be proportionate to capital outlay.*

Section 24 of the regulations indicates 10 years as a period for a timber lease or concession. In place of this, it may be preferable to fix six years and renewal if necessary, provided that the working of the grantee is satisfactory. Ten years is too long a period for the Government to be bound to an unsatisfactory grantee who may evade responsibilities, and be concerned in fire-setting or illicit grazing. It is necessary, on the one hand, to give the grantee sufficient time to guarantee him against the risk of building a mill and getting little return; and on the other hand, it has to be remembered that a grantee can do incalculable mischief before there is sufficient evidence to cancel his grant, and then there is the risk of tedious and expensive legal proceedings.

The most satisfactory plan is to make the period of the grant correspond with the value of the mill, and to discourage applications where the proposed expenditure on the mill does not appear to accord with the character of the timber to be worked. Thus, a too expensive mill may lead to loss, and be detrimental to future tenders; a poor, small mill may be given a chance, but only for a short period, and for a small area of forest.

405.—*Auction sales advisable if competition obtainable.*

It should be the rule, whenever competition can be secured, to give the forest revenue the benefit of auction sales. In South Africa it is auction sales which fix the final prices of timber wherever competition can be secured, though there are Government minimum rates to avoid the risk of combination amongst buyers. In France the practice is similar, though there a Dutch auction is often followed, the timber being put up at a high price which is gradually lowered until a bid is secured. In Queensland auction sales of timber are the rule, and in New South Wales are followed to a considerable extent. Auction sales form the common method of disposing of timber.

406.—*Government's right to cut timber free for public purposes.*

The second part of Regulation 24 seems unreasonable. It might be preferable to require the timber grantee to deliver at market rates, or certainly to compensate him for the timber taken for public use. A Conservator of Forests is ever in search of markets for his exploitable timber, and he is naturally only too glad to arrange terms for the timber to be taken for Government use by another Government official.

407.—*Lessee to furnish monthly certificate of logs milled.*

Section 31 may be necessary for some time, but previous measurement of timber in the log by the Forest Department is the correct course. In the Eastern States this is already being carried out in some cases. In South Africa it is always done.

408.—*Cutting areas closed after two years' cutting.*

Section 30 is too rigid. It is for the Conservator to arrange the felling areas in accordance with the "Working-plan," and the needs of the saw-miller; and the working areas should be yearly instead of two-yearly. Much mischief may be done to the natural regeneration of the forest where operations in one felling area are allowed to extend over a year.

409.—*Cutting not to be in advance of one month's mill requirements.*

Regulation 34 is not only vexatious for the mill owner but wrong in principle. Its effect is to prohibit the felling of timber in season. The saw-miller should fell his timber during the felling season, say, from the Autumn Equinox to the shortest day, and he must fell sufficient timber during that period to keep himself supplied for the rest of the year. It is difficult to imagine how a regulation so detrimental to the proper working of the forest, and the best utilisation of indigenous timbers could have been allowed to find its way into the forest regulations. It should not only be repealed forthwith, but in its place a regulation inserted requiring the felling of timber in season.

410.—*Mill sites on "Permits" obtainable on annual rental.*

Regulation 35 seems inexpedient, a peg on which troublesome legal proceedings might be hung, since here there is a formal grant from a Minister to occupy land in

the forest. The area required for the mill should more naturally form one of the points of agreement when timber is sold to the sawmiller by the Conservator of Forests. Provision should be made for the leaving of a few seed-bearers (old over-mature trees) on the mill site, in the interests of natural regeneration when the mill leaves the site.

411.—*Royalty computed on 23 working days monthly and 50 per cent. wastage per load.*

Regulation 37.—The first part of this regulation is of obvious use, but the second part, if enforced, would, in most countries, be considered a petty interference with liberty in the bush. A bush-worker is subject to all sorts of accidents from bad weather, sickness, etc., and he should be given a liberal allowance of working time—a calendar period with complete liberty to work when and how he likes during that time. If you set out to allow a man 23 working days a month and he cannot get that he has a grievance.

412.—*Timber to be cut in order of succession; "sleeper" timber last.*

Regulation 42.—This section seems to be well intentioned, but to defeat the object in view, which is to get the whole of a Section of forest worked *as quickly as possible* and then closed for re-production. When timber is sold to the miller he should be left, without interference, to make the best he can out of it, according to his market.

413.—*Tuart and Wandoo not to be cut for export.*

Regulation 65a, prohibiting the cutting of Tuart and Wandoo for exportation is apparently prompted by the desire to insure the conservation of these trees. But in a forest that is systematically worked it would have the opposite effect, since every Eucalypt cut will reproduce itself in a greatly increased number of either stool shoots or seedlings, which is the A B C of Forestry, to see that they come forward in such proportion as is best suited for their development. When sufficient funds for thinning are wanting there may be too many stems for a rapid growth, but this will tend to give better shaped trees in the end. If there is any sort of conservacy at all there will be protection against fire and cattle. Of course there are certain trees of which the natural re-production is difficult, but that is not the case with Tuart and Wandoo. Indeed the regulation appears to be prompted by one of the popular errors with regard to Forestry (p. 165) and to have perhaps the opposite effect to that intended.

CHAPTER II.

Technical Investigations of Australian Timbers by G. A. Julius.

414.—*Nature of investigations.*

I have perused "Western Australian Timber Tests," 1906, by G. A. Julius, and also a supplement to same embodying further tests made by the same investigator in the following year (1907).*

Mr. Julius' timber tests are of a complete and elaborate nature; in fact they reveal a curious inequality of Government effort! The mechanical tests of Western Australian timber are more than enough for the next century, while the State's treatment of the forest, necessary to preserve the timbers, is antiquated by at least a century!

Mr. Julius has avoided sources of error which have invalidated some other timber tests: the previous tests of Western Australian timbers seem to have been particularly conflicting and unreliable. Warned by the United States' experience (Prof. Johnson's tests) that the strength of air-dry timber (12 per cent. moisture) is some 75 per cent. greater, especially in compression, than the same timber when either green or wetted afterwards, Mr. Julius has been careful to have all the timber he used in testing dried down to the 12 per cent. moisture standard. No artificial seasoning of any kind was employed (he states), but the seasoning he adopted seems, perhaps, open to question.

415.—*Reliability of the Tests.*

He has avoided a common cause of error with timber testers in using sufficiently large sections of timber; and he has obtained reliable average figures by taking mean figures of numerous tests. His total number of tests reach the high figure of 25,800, and in the first tests of Western Australian timbers he used over 2,000 cubic feet of timber—equal to about 60 tons (short). Of a timber so little esteemed as Yate he had a supply of 93 cubic feet. At the same time the tests have embraced timbers of all dimensions, thus cross-bending tests were made on pieces as small as 1 inch x 1 inch, and as large as 12 inches x 18 inches.

His 1907 tests, published as a supplement, differ considerably, both in scope and in some of the results from the first or 1906 tests, since the first incorporated the results of other observers. I have, therefore, taken the later figures (weight and strength of Ironbark, for instance) whenever there was a difference.

416.—*Importance of the identification of the Timbers tested.*

It may be noted that when in his report Mr. Julius uses the word "variety" (as on page 8), he means "species." No timber varieties such as the "fiddle back" varieties of Eucalypts or Blackwood, or the *symphiocarpa* variety of Yate, have been distinguished botanically.

* NOTE.—I have also perused " Notes *re* Timbers of Western Australia, 1908," issued under the authority of the Hon. Newton J. Moore, Premier and Minister for Lands, and prefaced by a red slip signed by the previous Premier, Hon. C. H. Rason. This volume requires revision and bringing up to date. It speaks too much of antiquated systems of Forest Management. Even the horses in the photos suggest forests not yet organised for the most economical working. Though bearing a date of publication two years later than Mr. Julius' tests, it yet repeats the errors *re* Western Australian timbers that were corrected by Mr. Julius' tests in 1906.—D.H.

It is, unfortunate, too, that the two Ironbarks, *Euc. paniculatu* and *Euc. crebra,* have been confounded even in the later tests. Their timbers are different; the two trees grow in different localities, and have quite different economic values. The one can be profitably planted; the other, not.

All the plates of illustrations are mislabelled "Australasia" for "Australia," and the mistake is repeated in both the 1906 and 1907 plates. The tests embrace no New Zealand timbers.

"Borneo Djatti," of which the botanical name is wanting on Mr. Juluis' 1906 list, I made out from specimens in South Africa to be probably only *Tectona grandis.* The species of Casuarina, tested as "Swamp-oak," is not given. This is unfortunate, for it had the highest transverse strength of all the timbers tested, after Yate, and, for its weight, is the strongest timber on Mr. Julius' list! Weight for weight it is 5 per cent. stronger than Yate. This is not stated in Mr. Julius' results, but no other conclusion can be drawn from the figures given in the big sheet Schedule No. 1 of 1906. Thus, under "Transverse strength—ultimate fibre stress," Yate 21,500, Swamp-oak 20,650; and under "Weight" (12 per cent. air-dry), Yate 71, Swamp-oak 65, the ratio being thus 21,500 Yate to 22,518 Swamp-oak, or Swamp-oak is 4 per cent. stronger than Yate, weight for weight. The figures look like a misprint. Similarly, *weight for weight,* Salmon-gum is practically as strong as Yate in transverse breaking strength.

Yate is the strongest of all the timbers tested, and nearly of all Australian timber hardwoods; though it can hardly yet be said to be a commercial timber.

417.—*The strongest Australian timbers.*

The strongest timber in Australia is reputed to be Brigalow (*Acacia harpophylla*), nearly half as strong again as Ironbark. It can be had in timber sizes up to 24in. in diam. x 20ft. or more long; it grows to a tree 90ft. high. It has been called the "Blackwood" of South Queensland.

In the 1906 tests fifteen species of native Western Australian timbers were tested, and these compared with seventeen other well-known timbers, Australian, English, and American; while in the second series of tests the 24 chief hardwoods of Australia were tested and the results published in the supplement of 1907. The whole seems now quite the most complete series of tests ever made of the more valuable Eucalypt timbers of Australia.

418.—*Test for strengths as "beams."*

According to Julius' last published results (Schedule 1 in the 1907 supplementary tests), the heaviest of all Australian commercial timbers when first cut are Ironbark (*Euc. paniculata* or *Euc. crebra*), and Greybox (*Euc. hemiphloia*) of East Australia, 80lbs. per cub. ft., though practically as heavy are Yate (*Euc. cornuta*) and Wandoo (*Euc. redunca*) of West Australia, which when first cut average 79lbs. per cub. ft. But, when air-dry, the Eastern and Western timbers fall apart! Ironbark and Greybox go down to 64lbs. and 52lbs. per cub. ft., while Yate and Wandoo remain at the high figure of 71lbs. per cub. ft., which is the heaviest air-dry weight of all Australian commercial Eucalypt timbers. Then come West Australian York-gum 67lbs. and New South Wales Ironbark 64lbs. It is noteworthy that Tasmanian and Victorian Blue-gum (*Euc. globulus*) both come out 55lbs. per cub. ft. in Julius' final tests.

Amongst the light-weight cold-country Eucalypts, which in certain cases descend as low as about 25lbs. per cub. ft., Julius has Swamp-gum (*Euc. regnans*) and Stringy-bark (*Euc. obliqua*) with 41lbs. and 42lbs. per cub. ft. respectively. This

is about the same specific gravity as Teak (Gamble), though Julius quotes Teak higher. Karri and Jarrah have nearly the same air-dry weights; 58lbs. and 55lbs. per cub. ft. respectively.

Taking all the tests together, except spalling (Plate 3 of 1907 tests), air-dry Karri is 54/62 or 87 per cent as strong as Ironbark. But weight for weight, Karri indoors is practically as good as Ironbark, since, at the standard of 12 per cent. moisture, Karri is only 58/64 or 91 per cent. as heavy as Ironbark (Schedule 1 of 1907 tests). The difference of these percentages is only 4 per cent., so that for practical purposes, *air-dry Karri as regards strength in all directions is as strong as air-dry Ironbark!*

This must be carefully noted because Ironbark forms, as it were, the timber standard of the Eastern States. It is, perhaps, the most important practical result of Mr. Julius' timber tests. But though Ironbark holds an unrivalled position for strength in the Eastern States, Karri as a forest tree is a faster grower, has a better reproduction, carries much more timber per acre, and is more easily protected from fire. For the production of timber an acre of Karri must be worth at least three or four acres of Ironbark. This should be noted in demarcating the Karri forests of Western Australia. Prof. Warren's tests in 1892 made New South Wales Ironbark about half the cross-breaking strength of cast-iron and half the tensile strength of wrought iron.

419.—*Karri timber for beams.*

The strength of Karri as an air-dry beam (transverse strength Schedule No. 1, 1907) is still more remarkable than its strength generally. The use of Karri beams should become widespread in Australia, and Karri house beams be as popular outside Australia as are now Jarrah sleepers. And Karri house beams should go to Europe since two Karri beams will do the work of three Oak beams and perhaps half-a-dozen pine beams. These facts are not known in Europe, where Oak is so highly prized but can no longer be produced economically. The transverse strength of Karri for beams of approximately 20 square inches is, when air-dry, 17,300lbs. per square inch; against 21,500lbs. for Yate; against 19,400lbs. for Ironbark; against 17,000lbs. for Blue-gum; and against 11,800lbs. for English Oak (this last being in the 1906 tests).

Karri, weight for weight, is 98 per cent. as strong as Yate, the strongest timber in Western Australia, and weight for weight is as strong as Ironbark within 1 per cent., since Ironbark weighs 64lbs. per cub. ft. when air-dry (1907 tests), while Karri weighs only 58lbs.; so that Karri, while 89 per cent. as strong as Ironbark, is only 90 per cent. the weight of Ironbark.

Mr. Julius gives the wieght of air-dry Blue-gum as 57lbs. in the 1906 tests, and as 55lbs. in the 1907 tests; it is more usually taken at 60lbs. If we take 60lbs. as the weight of Blue-gum (*Euc. globulus*), Karri, weight for weight, is 14 per cent. stronger than Blue-gum. Taking 52lbs. per cub. ft. as the weight of English Oak, Karri is 31 per cent. stronger than English Oak, weight for weight.

"The strength of beams cut 'on the quarter' is 12 per cent. less than that of beams cut in the usual way, across the medullary rays," says Mr. Julius. Cutting "on the quarter" in the case of timbers with "silver grain," such as Oak, is more ornamental, and such timber fetches higher prices for ornamental work.

The strengthening effect of seasoning in average size beams (up to 25in. square) is a maximum gain of 33 per cent. in the case of Karri and Tuart, down to 14 per cent. in the case of Wandoo (page 16). Karri in compression, as in other tests, says Mr. Julius, shows the greatest difference between the strength of green and dry wood, green timber being 46 per cent. weaker than dry. Plate No.

12 gives the curves of crushing strength at various percentages of moistures for various timbers, Yate, Karri, Jarrah, etc.

Between Karri green and Karri dry there is a gain of nearly 100 per cent. in the case of a 10in. x 10in. and smaller beams, cross-bending. The curves on Plate 4 show a breaking strength of about 11,500lbs. green and 21,000lbs. per square inch dry (8½ per cent. moisture).

The curves on Plate No. 12 of average crushing strength of different timbers are equally instructive:—

Karri	gains on drying	46	per cent.	in compression	strength.
Yate	„ „	43	„	„	„
Blackbutt (*Euc. patens*) ..	„ „	40	„	„	„
Tuart	„ „	35	„	„	„
Jarrah	„ „	31	„	„	„
Red-gum (*Euc. calophylla*) ..	„ „	29	„	„	„
York-gum (*Euc. loxophleba*) ..	„ „	23	„	„	„
Wandoo (*Euc. redunca*) ..	„ „	23	„	„	„
Morrell (*Euc. longicornis*) ..	„ „	22	„	„	„
Salmon-gum	„ „	21	„	„	„

—(Julius Rep., page 18.)

Karri and Jarrah have nearly the same air-dry weight (58 and 55lbs. respectively), but Jarrah has only 15,000lbs. per square inch transverse strength against Karri's 17,300lbs. Nevertheless, the sufficient strength of Jarrah, its moderate softness and easy working, coupled with its indisputable durability, are the qualities which have rendered Jarrah supreme among the Eucalypt hardwoods of Australia; though *as a house beam* it cannot compete with Karri.

Tabulating these results, we get for equal weights:—

An air-dry Karri beam is, weight for weight, 98 per cent. as strong as Yate.

„ „ „ „ 99 per cent. as strong as New South Wales Ironbark (1907 tests).

„ „ „ „ 14 per cent. stronger than Tasmanian Blue-gum.

„ „ „ „ 31 per cent. stronger than English Oak.

And for equal weights, Jarrah has 91 per cent. the strength of Karri.

Finally, as regards strength of beams, we reach this conclusion. Since Yate, relative to its bulk, averages about half as strong as wrought iron, relative to its weight it must be three times as strong as wrought iron. And as Karri, relative to its weight, is 98 per cent. as strong as Yate, a beam of Karri must be 98 x 3 = 2.94—practically three times—as strong, weight for weight, as wrought iron.

It is a pity that Mr. Julius, as an engineer, did not give us the figures worked out to this interesting point. For, there is little doubt that in future house-building in Australia, with the better timber from the improved forests, house-beams will, with sleepers, be two of the largest uses for Eucalypt hardwoods. No doubt, comparing a "T" or "double T" iron girder with a square Karri beam, the strength difference in favour of the wooden beam vanishes. But iron girders are not always obtainable just of the size required, at short notice, and in case of fire they pull the walls down: a square wooden beam, too, is ornamental in a house, while a "T" iron girder is not, and has to be cased with wood, with the objection that any sham in house-building always carries with it. I think, therefore, that Julius' figures of the strength of air-dry Karri beams should be circulated amongst architects in a popular and handy form (p. 238). At this moment new public offices in Hobart are being built with imported softwood beams, while Karri beams would be stronger, less liable to fire, and probably cost less.

420.—*Relation of density to strength.*

Heaviness and Strength.—Heaviness is no certain criterion of strength in a timber, though Mr. Julius rather favours its being so. Of the timbers on his 1906 list the heaviest (air-dry) is the lignum-vitæ of British Guiana, which weighs 73lbs. per cubic foot; but it is nearly the weakest as a beam. It is hardly stronger than English Oak or Victorian Red-gum. Yate, it is true, is the heaviest and also the strongest of Australian timbers, but it occupies this position (1907 tests) because its timber is strongest against both pulling and pushing strains, particularly pulling; and a beam has a pulling strain on its under side and a pushing strain on the upper side. But among timbers generally there are many which are very hard and heavy but which fail in pulling strength (tenacity of fibre); such timbers are therefore not strong as beams.

Heaviness or density in a timber goes with strength against a pushing or squeezing strain, but heaviness does not go with strength against a pulling strain. Says Julius (p. 15, 1906 Report):—

The greater the density and therefore the weight the greater is the strength to resist compressive strain whether applied edge-wise or cross-wise, but density is no criterion as to tenacity or tensile strength.

Thus Karri, which, when seasoned, is lighter than Yate, Wandoo, Morrell, Tuart, Salmon-gum or York-gum, is stronger as a beam than any of these except Yate, Salmon-gum, and Tuart.

Wandoo, again, when air-dry, is as heavy as Yate (these two timbers have the heaviest air-dry weight of all the commercial timber Eucalypts), and in some of the compression tests has come out over Yate; but it entirely fails against Yate as a beam. Indeed as a beam Wandoo is weaker, on account of its low tensile strength, than Salmon-gum, Iron-bark, Tuart, Karri, and even Red-gum (*Euc. calophylla*).

421.—*Moisture and sap variations corresponding to localities of growth.*

Moisture.—What are called succulent plants are generally associated with dry-country conditions: it is not so, however, with timbers.

(1) In every case the timber grown in dry districts, that is to say, Wandoo, York-gum, Salmon-gum, and Morrell has the moisture percentage very low, averaging 28 per cent. The sap is of a thick viscous nature. These timbers, when cut, season very slowly, and shrink to a comparatively small extent in seasoning.

(2) Timbers such as Tuart and Yate, which grow in a medium rainfall and usually in open soils, have a higher percentage of moisture (37 per cent.), and the sap is of a more fluid nature. They season more rapidly but shrink very little in the process, this being markedly the case with Tuart.

(3) In the case of straight-growing timbers occurring in close forest with a heavier rainfall—Karri, Jarrah, Red-gum (*Euc. calophylla*), Blackbutt (*Euc. patens*)—the moisture percentage, when green, averages 60 per cent. of the absolute dry weight, and the sap is very fluid. These timbers season more rapidly and shrink to a greater extent.

The short table on seasoning at page 34 is perhaps the most useful in the book. When a man hauls a log of newly felled Jarrah, one-third of the weight is water; of Karri, rather more than one-third of the weight of Yate, under one-fourth; of Salmon-gum and Jam, only one-fifth. This shows the economy of using Salmon-gum for fuel. Probably Gimlet-gum is equally economical, but it is not in Mr. Julius' list. Jam fencing posts can be carried economically too, since there is only one-fifth water in the quite green post. Banksia timber, when green, is half its weight simply water.

That rapid seasoning does not impair the strength of timbers is illustrated by the fact that the two logs of Yate which yielded the highest strength result in all Mr. Julius' tests were rapidly seasoned—within two or three months.

The table shows also how very slowly hardwood timbers season naturally, even with the long dry Western Australian summer; but it is not clear to what extent these conclusions are vitiated by the timber being "dried in the open," exposed to sun perhaps on one side and rain on the other, especially as Mr. Julius' tests were taken during the damp winter season.

Saps.—At page 35 of the 1906 Tests is given an interesting table of the examination of saps of the seven most valuable Western Australian timbers—Jarrah, Karri, Wandoo (*Euc. redunca*), Blackbutt (*Euc. patens*), Red-gum (*Euc. calophylla*), and Yate (*Euc. cornuta*), from which we see that Jarrah and Wandoo, the two durable timbers, have thick sap and most of the less durable hardwoods fluid sap. That seems to be the only conclusion that can be drawn from an interesting investigation. Of the two durable timbers Jarrah has much the least percentage of acid and the other, Wandoo, has the highest but one on the list. The interesting observation is recorded that Jarrah and Wandoo saps do not easily decompose, while Karri sap does.

422.—*Market factors affecting hardwoods.*

Says Mr. J. H. Maiden, the Government Botanist of New South Wales, in "Notes on the Commercial Timbers of New South Wales," 1904 edition:—

> I have often pondered whether seeing that the State is the principal proprietor of forests . . . . whether State Depôts might be established where stocks of timber could be held; such timber being felled at the proper time, seasoned for a considerable period, and branded with a mark which would guarantee its true name.

Here Mr. Maiden states exactly what is wanted to allow Australian timber to compete on equal terms with imported. It cannot at present compete on quite equal terms with the imported, since, owing to the bad forestry of old days, it is nearly all hard-wood. That is all the more reason why it should not be handicapped by (1) felling at the wrong season, (2) not seasoning, (3) not being true to name.

Many of the Australian States have adopted measures by which timber for exportation is inspected before shipment. It is equally advisable that timber used locally should be offered to the buyer with some guarantee. Only in this way will it be possible for the various Australian hardwoods to take their legitimate places in Australian houses. At present, architects are afraid to specify hardwoods on account of the difficulty of getting them seasoned and true to name. If they put unseasoned hardwood into the ceiling beams of a house, it is liable to crack and warp and bring down the ceiling, and the architect ends by taking the fire-risk and specifying imported beams. The experience of Victoria and the Government seasoning kiln, near Melbourne, has shown how readily the trade seizes the opportunity of getting seasoned hardwood.

The rest of the business—(1) getting the timber felled at the right time, and (2) true to name—is a matter of forest administration for which the Forest Department should be held responsible.

423.—*Importance of a correct felling season.*

Best time to fell.—In South Africa there is a fixed felling season beginning approximately at the Autumn Equinox in March and ending at about the longest day in June. This is approximately the best season to fell timber in the ordinary climate of South Africa or Australia. There are, of course, variable seasons, and there is some difference in the seasons for different timbers. The plausible theory

has been put forth that the best felling season depends on the blossoming time; but when, as with so many timbers, the blossoming time is in spring, that is absolutely the worst time to fell timber! In practice, too, there must be a fixed date when the "coupes" or felling areas in the forest can be opened for felling, and it is convenient to fix that approximately coinciding with the autumn Equinox and the shortest day.

There is also a curious theory which is held in widely separated parts of the world, but which I have never had the opportunity of proving or disproving—that a timber felled with the waning moon is better in quality than timber felled with the waxing moon (see my "Forestry in Cyprus," page 51).*

In one of the Cape Forest Blue Books (about 1893) details are given of an experiment which I undertook to test the exact value of Eucalypt timber felled at different seasons. The species was *Eucalyptus globulus*. Being a close plantation, it was possible to obtain regular cylinders of wood admitting of accurate measurement and weighing. The result was that the timber felled in autumn and early winter contained considerably less moisture than that felled in spring and early summer, while during the summer the amount of sap in the timber gradually declined.

The regulation requiring timber to be felled at the proper season causes little actual inconvenience to the miller or timber-worker, the felling season soon becomes known and recognised, and it is merely a matter of arrangement to fell or ring the timber during the felling season, and work it as may be convenient during the rest of the year.

424.—*Natural and artificial seasoning of timber.*

Mr. Maiden, in his useful notes to which I have referred above, points out that the theoretical seasoning of a log would be boring a hole down the middle. This, however, would only be a palliative, since the area exposed to drying from the centre would be so much less than the area exposed to drying from the outside. But what is worth noting is that the fine timber usually seen in the shell of old hollow logs is, no doubt, largely due to equable seasoning.

As a fact, very little consideration will show that the only practical way of getting moisture out of bad-seasoning timber is to cut it up to the smallest possible dimensions, and stack, under pressure, in a building sheltered from sun and rain. I have had a good deal to do with seasoning timber specimens, and have always noted that the smaller the dimensions the better the seasoning, provided precautions are taken against a too rapid seasoning.

The amount of sheltering from wind will depend on circumstances. If the timber is in small dimensions, such as flooring-boards, it will season rapidly without splitting if carefully stacked under pressure, but larger pieces exposed to dry-air currents may crack badly.

Timber standing in the forest ring-barked is seasoning under the most trying conditions: only very good seasoning timber such as Teak can stand it without much injury. Burmah Teak has always been ring-barked; India Teak not. Ring-barked timber is exposed to excessive and rapid drying on the outside, or wherever cracks open and let the air in. Such timber is liable to crack, and, when felled and cut up, to warp badly. It is exposed, further, to attacks from insects and fungoid rots. I once tried ring-barking on an extensive scale with the various timbers found in the South African forest. The result was that every timber de-

* NOTE.—Certain sleeper specifications for South African railway contracts contain a clause relating to the moon governing period of felling.—C.E.L.—P.

teriorated, and had to be sold at a lower price than the same timber green. When, in a forest worked under selection fellings, dead trees and windfalls are sold here and there as they occur, it is the practice to part with them at half-rates in South Africa. That is due mainly to the inferior quality of timber as compared to trees felled green. At the same time, I have met more than one practical timberman who has advocated ring-barking for a short period before felling, usually not more than a year.

I am of opinion that all timber in Government forests should be required to be felled *or ring-barked* during the Government felling season.

The following may be laid down as general rules for seasoning:—

1. See that the timber is felled in season, when the sap is down; ring-barking for a short time may do good, and can do no harm, but ring-barking must not be done for more than a year before felling.

2. Cut the timber at once to the smallest permissible dimensions, and stack it under the heaviest attainable pressure in a well-ventilated building. Timber seasons well enough out of doors in Northern-Europe, but in countries where the sun is hotter, rain more fitful, and burning dry winds blowing every few days, exposure may spoil the best seasoning timber.

3. Certain timbers which season badly, or which require to be perfectly free from cracks, must have special precautions. Thus, quickly-growing and immature Eucalypt timber may require slow-drying and clamping at the ends. That, after all, is not very difficult to secure with hoop-iron and a few nails. Many other hardwoods besides Eucalypts are better with such treatment—Oak, in France, for instance.

Timber required for joinery or cart-building naturally requires more careful seasoning. Sandalwood is seasoned very slowly, being kept wrapped in its own sawdust and shavings.

The rationale of timber seasoning is to store it under a roof where sun and rain cannot deteriorate it, and dry it just as rapidly as it will stand. *Euc. regnans* flooring-boards in the seasoning kilns at Melbourne dry out to the centre in a few days at an artificial heat about equal to a summer hot wind. I have seen the same result at a Cape Town cabinetmaker's; and in the seasoning mill belonging to the Zurich municipality, in Switzerland. It is just a matter of thoroughly testing what heat the timber will stand for the seasoning required. This is easily done in a hot oven. Mr. Julius' tests were not entirely mechanical, and it is unfortunate they did not extend to this.

There was a preliminary discussion on timber seasoning at the Melbourne Conservators' Conference, held in November, 1912. The whole subject stands postponed until the meeting of the next Conference. But, in the meantime, some useful remarks were made by the Conservator of Victoria, the only State in Australia where seasoning has been done systematically on a large scale by the Government.

Mr. Mackay said that seasoning kilns to deal with an output of from 120,000 to 160,000 sublic feet yearly would cost something like between £5,000 and £7,000, but he considered that expenditure well warranted by the advantages accruing to the State from being able to put seasoned hardwood on the market. He characterised natural seasoning as the ideal process, but impracticable on account of the length of time required.

This opinion was endorsed by Mr. Gill, the Conservator of South Australia, who has for some years been doing natural seasoning of Blue-gum. When I was

in South Australia this was shown me. The process was slow but thoroughly effective, and it must be remembered that Blue-gum, *Eucalyptus globulus* (except Tasmanian Blue-gum) is one of the most difficult timbers to season. Some of the South Australian plantation, *Eucalyptus globulus,* naturally seasoned timber, was submitted to the Coachbuilders' Association, in Adelaide, which passed a favourable opinion upon it. It was stated "that if the timber could be delivered in Adelaide at a reasonable price there would be a great demand for it."

Electric Seasoning.—Electric seasoning consists in passing an electric current through the green wood for a day, and then putting it away to season in the ordinary way for some four or five months. I have no personal knowledge of the process, and the use of electric seasoning seems to be extending slowly, if at all. The advocates of the process state that the action of the electricity passing through the green wood is to hasten the subsequent drying, reducing the time required to one-tenth or one-twelfth of that required in ordinary seasoning. And it is claimed that electric seasoned wood is better than air-seasoned wood, showing less warping and cracking.

The process was described to the Powellising Commission, at Melbourne, in May, 1914, by a firm of Melbourne billiard table makers, who were using it for seasoning Blackwood to a large extent, and to a small extent Mountain Ash (*Euc. regnans*).

Water Seasoning.—In the Japanese system of water seasoning the logs are immersed in brackish water. They thus escape the borers, worms, and other destructive agents of both fresh and salt water. Under this treatment the timber continues in the water for a certain time, according to the species: if this time be less, or if it be greater, the timber so seasoned is not so good. While in the water, the timber is restacked and brushed with straw hand-brushes at intervals. It is an old process, and is successful with some timbers that are difficult to season in any other way. After coming out of the salt bath the timber has, of course, to be dried like any other timber; but a good deal of the putrescible matter has been washed out. The system merits further investigation.

Natural Seasoning.—Lastly, there is the question of artificial *versus* natural seasoning. Many people have a prejudice in favour of "natural seasoning." But there is no such thing really as "natural seasoning." The action of Nature is to destroy timber like everything else that is dead, and it depends on the class of the timber and of its environment just how quickly that destruction proceeds. The Indian climate soon deteriorates most timbers (excepting Teak and a few others), and it makes not the slightest difference whether the timbers were grown in India or out of it. Jarrah sleepers, which season easily in the southern portion of Western Australia, I have seen fly to pieces under the equatorial sun of British East Africa; and in this respect they are no better and no worse than the hardwood timber grown on the spot. If man wants to have his timber preserved, and in good condition, he must defend it, as best he may, against Nature.

425.—*Deformation during seasoning.*

Shrinking, Cracking, and Warping.—On this important point Mr. Julius has only general observations, but it is a most important point for the buyer of unseasoned hardwoods, and practically all the hardwood leaving Western Australia now, in large pieces, is unseasoned. Mr. Julius' observations have shown that it is impossible to season hardwood in the log within any reasonable time. For practical purposes, both as regards length of time and to avoid cracking, hardwood timber should be seasoned after it is cut up. Whether the Western Australian Government should supply seasoned timber of small dimensions is a point which

admits of little discussion. Every dealer admits it should be done and usually lacks the capital to do it. The supply of seasoned hardwood by Government has been a question much discussed lately in Victoria.

Mr. Julius made some general tests on the shrinking of timber. These should be completed by exact measurement of the shrinkage accompanying the loss of fixed percentages of moisture. This, as is well known, varies with each timber. Thus, Blue-gum (*Euc. globulus*) has a bad reputation for seasoning in South Africa, in Southern Europe, and in California, while in Australia the mature timber seems to season like other Eucalypt hardwoods. New Zealand Kauri is reputed to shrink not only in breadth but in length, while Tasmanian Huon Pine is reputed neither to crack, warp, swell, nor shrink, and Celery-top Pine is said to be even more remarkable for not shrinking. Among Western Australian timbers Wandoo is stated to be the best seasoner.

426.—*Reputation for durability of Australian hardwoods founded on Jarrah.*

I understand that no systematic durability testings have been made in Western Australia. This is really more important than all the tests for strength. It is its *reputation* for durability that has sent Jarrah over half the civilised world. What is the exact measure of its durability remains to be tested. We know it is not as durable as some of the Eastern Australian timbers; in Western Australia it is not as durable as "Jam," but Jam has not yet been used for sleepers, though with careful selection and good forestry it would be just large enough. Wandoo is the other durable timber of Western Australia, but its exact durability compared to Jarrah, Jam, or Ironbark is unknown. It is unfortunate thus, that Mr. Julius' tests have not embraced durability more than the examining of durable samples sent to him; but the absence of these durability tests is primarily the fault of others, since a length of time is required to complete them.

Nevertheless, fairly accurate results can be obtained following the procedure adopted at the School of Forests, Nancy, France, by taking slips of small dimensions and placing them in conditions where destructive agencies abound. Thus, thin slips of most timbers soon begin to show attack by fungoid rots when placed in damp garden soil. In a series of tests conducted on these lines in South Africa I found that the heartwood of *Pinus canariensis* was about twice as durable as Jarrah.

Two hewn square Jarrah piles were drawn from the Swan River for testing after having been in use for a period of 72 years. They were completely saturated with salt water and were found to be thoroughly sound. Salt water in itself is a preventative of decay, but it is worth noting that the animal and vegetable life of the salt water there left this Jarrah pile practically untouched for 72 years.

427.—*Sleeper tests of durability.*

It is desirable that Mr. Julius' exhaustive tests on the strength of timbers should be completed by a similar series of tests on their durability. This would not be difficult. Certain of the future Forestry stations should have inserted in the ground, with proper marks for subsequent identification, posts, both sawn and round, of the various Australian timbers, such posts being examined and their gradual decay recorded every two or three years. These test-posts should embrace both sap-wood and heart-wood, for some timbers have no separate heart-wood; and then there may be durability in the sap-wood, otherwise the *sap-wood in most timbers is about equally perishable.* I had a series of tests with heart-wood and sap-wood posts made in South Africa.

Mr. Julius' durability tests were limited to finding the real condition of sleepers that appeared to be sound, and on recording the length of time that sleepers had remained sound in the ground. He examined two Karri sleepers that had been in service in a damp position for 19 years, and although decayed they still held the dog spikes to a degree quite sufficient to render them safe in use. This, of course, only shows that untreated Karri will sometimes last as long as Jarrah. When I was in Western Australia samples of old Karri posts were shown me that had been longer in the ground and were more sound than the sleepers reported upon by Mr. Julius. But, of course, exceptional durability is of little account. It is the average *dependable* durability that is valuable in a timber. *There is no doubt that untreated Karri cannot be depended upon in the ground.* There is ample evidence of this in South Africa; hence, the importance of impregnation with a good antiseptic.

I understand that the most durable of all Western Australian timbers (it is rarely large enough for sleepers) is Jam (*Acacia acuminata*). This is not mentioned in Mr. Julius' tests. In another country without the enormous sleeper resources of Western Australia in Jarrah, probably sleepers would be adapted to the average maximum size of the "Jam" timber. It is noteworthy that Jam (or Raspberry Jam) fencing posts have been used for fencing the railway running through the Jarrah country.

428.—*Spike-holding power of sleepers.*

Of special interest too are Mr. Julius' tests of the spike-holding powers of various timbers used as sleepers, and after varying terms of service. Thus, Plate No. 34 shows the condition of a Wandoo sleeper in this respect after eight years' service. The photo. shows an average condition; and it is stated that to draw the original "spikes" an average pull of practically two tons (long) was required; and another Wandoo sleeper, after 18 years' service required a pull of 1½ tons to extract the spike. Jarrah sleepers do not hold the spike so tightly, but a Jarrah sleeper 13 years old required an average pull of 1,641lbs. to pull out the spikes; this was the mean of 40 tests. That seems good enough, but another lot of Jarrah sleepers, 20 years old, required an average pull of 1,809lbs. to get their spikes out (mean of 19 tests).

429.—*Wood-working characteristics not investigated.*

The important point of "easy working" is not included in Mr. Julius' tests, which is unfortunate. Thus, Jarrah works up well, and I have seen beautiful furniture made of it in Perth, while Karri is stated to work up so badly that furniture, except of a rough description, is impossible. Jarrah certainly works up particularly well for a hardwood, and it is this easy-working, coupled with its durability, which has led to its popularity in countries outside Australia. Mr. Herbert Stone, of Birmingham, who made an elaborate series of timber tests, including Western Australian timbers, gave particular attention to this point. His results might be obtained and published in Western Australia with the completion of Mr. Julius' strength-tests on Eastern Australian timbers. (See the Hon. the Premier's red letter preface.)

430.—*Low inflammability of hardwoods.*

Everyone knows that coniferous softwoods will take fire and burn nearly like paper, while the hardwoods ignite less easily. This is about the only set-off which hardwoods have against the superior advantages of softwoods as regards easy

working, and usually (weight for weight) greater strength. It is particularly desirable, therefore, that the exact non-inflammability of hardwoods should be tested.

Of the two chief commercial timbers of Western Australia Karri burns easily, Jarrah with difficulty. As a general rule, Eucalypt timbers do not burn easily. In South Africa when firewood was supplied on a large scale for use to a neighbouring town, it was found necessary to coax people to buy gumwood by mixing with it a considerable proportion of wattle firewood, chiefly Black Wattle and Saligna Wattle.

For reasons which I have discussed elsewhere—want of seasoning and regularity in the supply—architects in Australia do not sufficiently use hardwoods in the beams of houses. At this moment, at Hobart, in Government buildings being built, I notice that all the beams are of imported Pine timber! It is important, therefore, that the exact non-inflammability of hardwood timber compared to pinewood should be published and brought to the attention of architects, and the public in order that it may be seen by them, and by the Insurance Companies, exactly what is the risk involved in using imported coniferous timber instead of Australian hardwood.

Says the Superintendent of the Melbourne Fire Brigade in a recent letter to Messrs. Trapp & Co., of Melbourne:—

> Many fire-resistant buildings put up on proper fire-resisting lines are practically reduced to quick-burning constructions by the use of soft-woods. . . . For girders and weight-supporting beams and columns of every kind hardwood is far more suitable than steel or iron unprotected. . . . I shall lose no opportunity of pushing the claims of hardwood over soft-wood where the question of fire-resistance is involved.

In the Government Blue Book—"Notes *re* Timbers of Western Australia, 1908"—it is stated that the British Fire Prevention Committee made inflammability tests with Jarrah, Karri, and other Western Australian timbers a few years ago. Jarrah, Karri, and Tuart are mentioned as being resistant to fire, and Blackbutt (*Euc. patens*) especially so.

I have spent weeks in burnt Eucalypt forest being "settled," ring-barked, burnt, and grassed. The burnt logs strew the ground six to eight feet high, but it is always one story. The logs under the most favourable conditions of raging hot winds, are usually *only charred on the outside.* They must be drawn together in heaps to burn to ashes, apart from places where they have fallen together so close as to make a natural bon-fire, and apart from hollow logs where there is a funnel draught.

431.—*The extraordinary strength of Yate.*

Before closing this report, says Mr. Julius, one item remains deserving of special mention namely, the extraordinary strength of *Eucalyptus cornuta*, locally known as Yate.

This timber is as yet practically unknown, but is common to the South-West portion of the State, the trees usually attaining a diameter of from 2ft. 6in. to 3ft. and a maximum height of 100ft.

As a "sawn" timber, it is probably the strongest in the world, being far ahead of the rest of the Australian hardwoods in every variety of test,* and in one tensile test with this timber a breaking load of 17½ tons per square inch was recorded, a value only 3½ tons below that usually specified for wrought iron of ordinary quality.

The results given are fair averages only, the timber being obtained as (3) logs which were wholly cut up and tested.

Its tough nature is well shown on Plates Nos. 49, 52, 57, 63, and 68, which are reproductions of photographs of tested specimens.

An inspection of these shows that *weight for weight* the tensile strength of Yate is much greater than that of wrought iron, since Yate, air-dry, weighs 71lbs.

* [NOTE.—According to the later tests (1907), it is not so strong as the common cross-grained Blue-gum in tension, but this is the only exception to its pre-eminence over all other Eucalypt timbers, including Iron-bark.—D.H.]

per cubic foot against iron 467lbs., so that wrought iron is 6.6 times heavier than Yate. On an average, Mr. Julius' tests give Yate a tensile strength almost exactly half that of wrought iron, *bulk for bulk,* so that Yate, *weight for weight,* has, say, three times the tensile strength of wrought iron and nearly three times the transverse strength.

I cannot help thinking that these results require to be more widely known. In bicycles and air machines, in spite of the advantage of the tubular structure to which metal lends itself so easily, a wood with an average tensile strength, weight for weight, three times that of wrought iron and a maximum strength five or six times, might meet the wants of designers where the ordinary timbers would fail.

Plate No. 3 of the 1907 tests shows clearly the unique position of Yate in Mr. Julius' tests; it gives a graphic reproduction of the total strength of Australian Eucalypt timbers in resisting all except "spalling" strains. It is not clear why this was not included. Among 23 of the principal species of Eucalypts and Turpentines the Yate of Western Australia is first, the Salmon-gum of Western Australia next, Tasmanian Blue-gum third, and New South Wales Ironbark fourth; at the bottom of these timbers is the ordinary Red-gum of Victoria. From this it will be seen that a beam of Yate is decidedly more than twice as strong as a beam of ordinary Victorian Red-gum, the figures being—Red-gum 34,160, and Yate 70,675.

432.—*Two varieties of Yate.*

It must be remembered that the Yate referred to in these experiments is the so-called "Tree" Yate, not the "Bushy" Yate (*Euc. cornuta, var. symphiocarpa* of Maiden) which has been so largely planted near Cape Town and planted also occasionally in Australia. I have seen it in South Australia and on the "Domain," Hobart. The "Tree Yate" (*Euc. cornuta*) of which the timber was tested by Mr. Julius I only know of, in two plantations, one in Cyprus and one planted by me at Knysna, in South Africa, in 1886.

It would have been interesting if Mr. Julius had distinguished the two habitats of the "Tree Yate" in Western Australia, viz.: (1) The Yate growing on sandy soil near the coast ; (2) that growing near the lakes. From this last was obtained three ordinary purchased logs (one two feet and the others rather under two feet in diameter) which measured together, 93 cubic feet. The logs came, one from Capel (Busselton Railway) and the others from Mount Barker. Two of the trees had been felled within three months before (page 33 of 1906 tests), but the third and smaller piece was from a tree that had been felled three years previously. The two green logs were rapidly seasoned, but not with artificial heat. (It is stated, page 7, *ibid.*, that no artificial seasoning was used.) One of the logs was not received till 9th March, 1906, and the completed tests were published by 21st July, 1906, so that the seasoning, though not artificial, was rapid.

In 1907 more tests of Yate were made, bringing the total Yate tests up to 482, so the average figures are strong enough. Of the three very strong beams in the first tests, viz., Yate, Salmon-gum, and Swamp-oak, the two first were verified in the 1907 tests, the last is not again mentioned.

433.—*Summary of results.*

The outstanding features of Mr. Julius' timber tests are:—

1. The strength of air-dry Karri as a beam. It gains rapidly in strength as it seasons, and when air-dry is, weight for weight, 98 per cent. as strong as Yate. Result of 1,050 tests.

2. The sufficient strength of Jarrah (for equal weights 95 per cent. the strenght of Karri), and the conclusive proof afforded by these tests, 776 in all, of its reliability as a durable timber. There is some antiseptic property in its sap. As a general purpose timber, there are few, if any, hardwoods to equal it in Australia.

3. The great strength of Yate particularly in tension, as proved by 482 tests. Combining all the various tests, transverse, tensile, etc., its average strength is more than double that of Victorian Red-gum, and, apparently, bulk for bulk, nearly equal to wrought iron in tension as a maximum value, and half as strong as an average value. In tensile strength Yate is only surpassed by the common Blue-gum.

4. The durability of Wandoo, and its usefulness as a sleeper. It is said also to be the best seasoner of the Western Australian Eucalypts.

5. Iron-bark shows a well balanced strength in all the seven kinds of tests. It is about six-sevenths the total strength of Yate.

6. Tasmanian Blue-gum has the highest tensile strength of all the 24 timbers tested. That is to be expected from its cross-grained tough structure.

7. The high tensile strengths of Blue-gum and Yate suggest a usefulness in the making of such structures as flying machines and bicycles, where combined strength and lightness are required.

It will thus be seen, as indeed might be expected, that there is no entirely-good all-round timber, viz., durable in the ground, strong, and quick-growing. Jarrah and Wandoo are durable in the ground, Karri is very quick-growing and strong when well seasoned, but not durable in the ground. Yate, the "Samson among the timbers" for strength, is reputed not durable in the ground, but it seems to last better in South Africa.

A tree that is at the same time durable, quick-growing, and strong is difficult to find in all Australia, though perhaps those coming nearest to it are Grey Iron-bark (*Euc. paniculata*) of New South Wales, and Yellow Stringy-bark (*Euc. muelleriana*) of Victoria. These are both medium fast-growers.

434.—*Importance of preserving the natural Jarrah forest.*

Karri and Yate are good trees in forest plantations; they grow quickly, in good form, and give a rapid return for the cost of planting. Jarrah does not give an adequate return on the cost of planting in any part of the extra-tropics where it has been tried. Nor have I had any success in the planting of Wandoo in South Africa.

From which it results that if Western Australian is to preserve its pre-eminence in timbers it must preserve its Jarrah forests, for they cannot economically be re-planted; while, if scientifically treated, they will give a higher yield of better-shaped timber. And it would be an exceedingly unwise proceeding to destroy Karri forest where that has been carefully demarcated. To replant it would be a costly proceeding, and it is so valuable a timber that it will always command a market; it is also one of the rapid-growing timbers of the world. Its air-dry weight is 58lbs. per cub. ft. as against 64 for Ironbark, so that, weight for weight, it is as a beam, practically as strong as Ironbark. It has been largely planted in South Africa and its exact growth tested.

435.—*Some further tests desired.*

Mr. Julius' tests should be completed as early as may be in the following particulars:—

1. *Durability.*—Short-time tests, as explained, with small slips of wood placed in localities where fungoid wood rots, borers, white-ants, and other destructive agents abound. But the real test is one of several years with timber in natural conditions out-of-doors.

2. *Seasoning, Cracking, Shrinking and Warping.*—Systematic tests with each timber, conducted under a roof, with both rapid and other seasoning and with the various precautions usually adopted. Mr. Julius' seasoning was unfortunately "in the open" and with slow natural seasoning only, his results showing that this seasoning is not economical.

3. *Inflammability.*—Tests for this should embrace some laboratory work, and practical tests on timber in various sizes, particularly in house beams.

436.—*Suggested publications in pamphlet form of Julius' results.*

What seems now wanted in the interests of the Western Australia timber trade seems a short pamphlet embodying Mr. Julius' results. At present these are partially summarised on a sheet which measures nearly 3 feet by 18 inches, and which is thus awkward to handle or carry about. But the information is nearly all of practical value and should be at the elbow of every man who is interested in Western Australian timbers. The foolscap-size Blue-books describing Julius' work contain much descriptive matter only necessary for record; also photos that are of interest only to engineers or to anyone completing Mr. Julius' tests. The Blue-books contain much more than is required by the ordinary buyer and seller of Western Australian timbers. For every-day use the forester and timber-user want a handy summary.

I may give a concrete instance of the usefulness of such a summary on Western Australian timbers.

About two years ago it was found that the Great Hall at Westminster (London) of which the roof is composed of Oak, was in danger of collapsing. Disease had got into the Oak timbers to an alarming extent, and extensive repairs had at once to be undertaken.

A discussion then arose as to what timber should be employed. One or two practical men pointed out that to put more Oak into the roof was employing a timber which would probably in this position fall a prey to the same decay that had attacked the old roof, which was not particularly old. The sentiment, however, was in favour of Oak, and this was finally settled upon, though it will take several years to complete the repairs.

There will be a different sentiment on the subject now that the war has brought the solidarity of the Empire into such prominence. It is pretty certain that sentiment now would rather see "Australian Oak," which is the commercial term for various Eucalypt timbers, put into the roof than German or Austrian Oak; and for the straight well-grown Oak, required for Westminster Hall, beams would be unobtainable to any great extent in England and would have to be imported; mostly from Hungary.

A pamphlet such as I have suggested would show what was the exact strength of Eucalypt timber that could be relied upon in the Westminster roof; that, for instance, Karri as a beam was a little heavier (61bs. per cubic foot air-dry) and was 46 per cent. stronger than English Oak. These figures, with the sentiment now prevailing, would be powerful considerations. Possibly the Australian timbers in this historic hall blended with the old English Oak timbers, and saving the old fabric from disruption, would be regarded as a memorial of those who have fallen in this war. And there could be no better demonstration of the real strength and usefulness of Australian hardwoods that that the English-speaking world should know that it had taken the place of Oak in the Great Hall at Westminster.

I should strongly advise such a summary being printed with Mr. Julius' comprehensive timber chart, summarised and brought into the form of a handy card-folder.

CHAPTER III.

Information Relative to the Mallet-bark Industry.

437.—Two kinds of Mallet-bark.

Sandal-wood and Mallet-bark are two special features in the Forestry of Western Australia.

Both in recent years have yielded an export worth from £60,000 to £70,000 yearly. This is too much to allow let slip. My stay in Western Australia was not enough to give me more than a cursory study. My notes may, however, perhaps be useful.

I saw two kinds of Mallet trees at Narrogin, the ordinary Mallet-bark (*Euc. occidentalis var astringens* of Mr. Maiden), and the so-called "Silver" Mallet-bark. Mr. Maiden seems to have published the best account of Mallet-bark, and this was reproduced recently in the *Kew Bulletin*.

At present there are no restrictions on felling it, and when felled *no stumps re-shoot,* but there is usually a good crop of seedlings on the dry gravelly ridges where Mallet commonly grows. I take it that on these dry gravel ridges there is less ground herbage and the Mallet Eucalypt has there a less chance of being burnt and killed. Mallet is not a long-lived tree. Here, at Narrogin, it dies off when comparatively young, like a Wattle, and when of only medium size. I was shown what was considered a big tree; it was only 20 inches in diameter and 50 feet total height. Where there is a better rainfall, the trees grow larger and live longer. On the ironstone ridges, near Narrogin, I saw Mallet Eucalypts growing in patches, or strips of nearly pure forest, from one to 50 acres in extent.

The law requires Mallet trees to be felled, but the ordinary stripper prefers to get what he can reach at the base and leave the rest. The tree then dies, and the greater part of the bark is wasted. It is stated that in the past much more Mallet bark has been wasted than utilised. That seems only natural. The Government took no real care of their valuable natural asset. If an owner does not take the usual precaution to look after his property he has only himself to blame for its misappropriation. A few years ago an attempt was made at Narrogin to enforce the regulations, but this was soon abandoned, and the forest official withdrawn. It is stated that a supervision of cutting over the whole Mallet area was attempted, a difficult and expensive operation. But that the usual course of laying out felling areas and working these in rotation was not attempted, and it is difficult to see how that could have been attempted in the absence of a properly organised Forest Department.

438.—Mallet-bark export.

The export of Mallet bark began in 1903 with £859 worth. The export reached its maximum with £154,087 in 1905. In 1906 it was £140,720. In the year ending 30th June, 1908, £81,000 worth of Mallet-bark was exported from Western Australia, excluding a small quantity that went to the Eastern States. This was the end of the easy accessible bark rushed on the market after the first discovery of Mallet-bark. By the following year the export had fallen to £47,000, the prices ranging from £4 to £4·5s. per ton, delivered on the railway. But during next year

(ending 30th June, 1910) there was a recovery to £96,000. For the year ending 30th June, 1913, the total export to the Eastern States and other countries was, in round numbers, £59,000; as in previous years, about two-thirds going to Germany and one-third to Belguim. The following table shows the Mallet-bark export at a glance:—

Year.	Mallet-bark. £
1907	97,432
1908	81,000
1909	47,000
1910	96,000
1911	73,247
1912	44,610
1913	59,000
Total	£498,289 Aver.—£71,184

The export of Mallet-bark is decreasing, but in the opinion of Mr. Fox of Narrogin, will continue for some years before finally coming to an end, assuming that nothing effectual is done to preserve it.

439.—*Tannic acid percentage.*

A number of analyses made of Mallet-bark gave the following percentages of tan:—21 per cent., 27 per cent., 31 per cent., 27 per cent., 26 per cent., 32 per cent., the average being 27.3 per cent. This percentage is below average Black Wattle, and considerably below the best samples of Golden Wattle or *Acacia pycnantha*. Earlier accounts give Mallet-bark between 38 per cent. and 42 per cent. I understand too from a conversation I had with a large exporter in Albany, that the bark now being collected is inferior to that first brought in. From this it appears that in spite of statements to the contrary, the tan percentage of Mallet-bark is generally less than Black Wattle. The average of the figures given me at Albany being 27 per cent. as compared with 34 per cent., the general average for Natal Black Wattle; while Black Wattle grown in Victoria and Tasmania, or the Black Wattle grown on the Equatorial highlands of Africa averages even higher.

Mallet-bark is not the only Eucalypt which has a useful bark for tanning. Indeed it seems probable that with the systematic working of the forests we shall hear about many other Eucalypt barks going to the tanners. With the present wasteful methods of working and absence of roads no one troubles about the bark. Gimlet gum (*Euc. salubris*) is stated to have a fair percentage of tan, but the bark is too thin to strip with profit.

440.—*Mallet-bark trees need protection.*

Mallet-bark is one of the few Eucalypts that usually does not shoot again from the stumps of cut trees. Being thus a non-coppicing species, it is unlikely that it would hold its own in the forests of the future against fire and axe. As soon, however, as modern methods are introduced, fire-protection will give it a new lease of life. It has a good natural regeneration from seed, and the protection of the forest from fire will entirely alter the conditions prevailing in the forest where, at present, some 95 per cent. of all the young trees are burnt and re-burnt until they are destroyed. A non-coppicing species such as Mallet-bark, has little chance of surviving a strong fire, since when it is burnt it will either not re-shoot at all, or not so freely as a coppicing species. Thus in the fire-protected forest of the

future, Mallet-bark is pretty certain to be more abundant than in the forest of to-day which has grown up with the White-man's fires of the last 60 or 70 years, and the Black-man's previous fires. Forests with Mallet-bark in them now, or where it will grow, should therefore be demarcated and reserved without delay.

Should prices for Mallet be maintained it will be desirable to try some Mallet bark planting, the more so from the fact that Black Wattle, *as a plantation tree,* is doubtful in the West Australian climate. Such a plantation of Mallet would, of course, be especially indicated where there was a demand also for mining poles or firewood. It would depend on the price of Mallet seed, whether such a plantation could be made more economically from broadcast sowings or nursery transplants; most probably it would be the latter.

Unless Western Australia sinks to the position of having to import Wattle-bark, I think it probable that in the future local tanneries will depend for their supplies of bark, not on Black Wattle (*Acacia decurrens*), but on Pycnantha Wattle and Mallet bark, the Mallet coming up abundantly in the fire-protected forest. Fire protection in the forests where the Mallet Gum grows is easy, and I assume it will be put in hand at once. Only this will prevent Mallet-bark becoming a botanical curiosity.

CHAPTER IV.

Information on the Sandalwood Industry of Western Australia and India.

441.—*The Western Australian Sandal tree.*

Santalum cygnorum as it occurs in Western Australia is a small tree or bush, in size much like the true Sandal of Southern India, *Santalum album.* Ednie Brown, in "Forestry of Western Australia, 1899," describes it as a bush or small tree, seldom more than 15in. in diameter and from 12 to 18 feet in height, with boles from 8 to 10 feet; maximum sizes are boles of 18in. diameter and 12 feet long and weighing up to nearly one-third of a ton. Very exceptional trees have been cut which produced timber weighing half a ton.

It occurs widespread in the drier parts of the South-West of the State, and is said never to form pure forest. This, one would expect from the parasitic character of the roots.

442.—*The Indian Sandal tree.*

With the Indian Sandal I am well acquainted, as the first ten years of my service were spent in Mysore where the best Indian Sandalwood is produced. As sold at the yearly Government auctions, Indian Sandal is bought by weight at prices which approximate to those of sugar, though first class wood sells for more.

Sandal is classified for sale purposes into a number of different grades, and every particle of the heartwood in root or stem is valuable. The sap-wood has no value and is carefully adzed off. The roots, shavings, and sawdust are used for distilling the medicinal oil used as a specific for Gonorrhœa.

There are three or four grades of wood, and the last or unclassed Sandal is known as "bagar adad." The first class consists of beautifully clean billets without crack or blemish of any sort; in fact, prime carving-wood. This is kept sea-

soning in Sandal sawdust so as to keep it free from cracks and preserve its full fragrance. The part of the tree richest in oil is the root heart-wood.

443.—*Trade factors prejudicial to Western Australian sandalwood.*

West Australian Sandal, judging from what I have seen and heard, is little inferior in fragrance and essential oil to the Sandal of Southern India. The sawdust that was used in the Sandalwood Distillery at Torbay seems to me as rich in oil as that which I had to handle and estimate so carefully many years ago. But Western Australian Sandal has never fetched more than between one-half and one-third the price of Southern Indian Sandal. This is due, I suspect, to—

(1.) The Western Australian Sandal not being cleaned, graded, and prepared for sale, like the Indian Sandal;

(2.) The prejudices of the conservative East;

(3.) Undue profit netted by the Sandal merchants in Bombay or China.

Sandal dealers are adepts in combination, as I once knew to my cost! The Bombay dealers have at present a monopoly of the Indian Sandal trade, and probably work in with the Hong Kong dealers. And the Bombay merchants do not seem to be much influenced by the true value of the wood in essential oil. Recently, when in British East Africa, I tried them with a small consignment of wood of "mu Hugu" (*Brachylaena Hutchinsii*, so named at Kew). This is a fine timber-tree growing in Equatorial Africa. It has but the faintest smell of Sandal, but a Bombay sandal merchant, at first, gave an extraordinary price for it. Probably it was used as a faked wood and rubbed over with Sandalwood oil. There is a good deal of this done in the Sandal carving and box trades in India!

444.—*Sandal distillation in Western Australia.*

The Sandalwood Distillery at Torbay did not pay, I understand on account of some fault in the management. The factory lasted for three years, and a first rate distillation plant, I am told, was used in it. There was a good out-turn of oil, but I have not heard how the medical profession took to it. If the Sandal in Western Australia be conserved, an oil distillery and the sale of a standard pure oil guaranteed by the Western Australian Government, might become a lucerative undertaking.

445.—*Sandalwood not a forest tree, but a parasite.*

It is stated that West Australian Sandalwood shoots only to a small extent or not at all when cut, and that there is generally little seedling reproduction, though Mr. Richardson mentions in one of the Annual Reports of the Forest Department that he found a notable reproduction on one occasion at the gold-fields. Mr. Ednie Brown speaks of the cut-over portion of the Sandalwood country being closed to grow up to maturity, the area closed being the whole of that cut-over during the previous 40 years or more. Presumably there was little serious in this proposal since the closing period was for two years! This was far too short a period to have been of any practical use. Further particulars regarding Western Australian Sandalwood are given in the *Handbook of Western Australia*, 1913.

There is a reference in Mr. Ednie Brown's "Forests of Western Australia, 1899," to a small Sandal plantation being attempted near Pingelly, which did not succeed. That was the case generally with plantations of *Santalum album* in Mysore, India. The reason is probably that Sandal grows as a root parasite on other trees, and unless it can find a congenial host it soon dies; therefore, in making

a Sandalwood plantation one has to think, among other things, of the right host for the Sandal. It is curious that in Mysore, South India, Sandalwood finds one of its commonest hosts in a species of Lantana, an introduced shrub which has run wild with more than the vigour of the Briar (*Rosa rubiginosa*) in parts of Australia and Tasmania. Considering that the ordinary rate for a labourer in South India is little over 3d. per day against 8s. or 9s. in Australia, and that any proposal to make Sandalwood plantations in Australia would immediately compete with the higher priced Sandal of India, it seems pretty certain that it would be a useless expenditure of funds to attempt Sandalwood planting in Western Australia.

446.—*The export trade in Sandal.*

At the same time a tree which has an export value of from £40,000 to £80,000 a year, and which has been an article of export from Western Australia for 60 to 70 years, should not be allowed to become exterminated, and the £40,000 or £80,000 a year lost to the country. A tree, too, which used to give to the farmers £7 or £8 per ton and to the merchant some 15s. per ton in handling! In early days 20,000 tons of Sandalwood are said to have left the port of Bunbury alone! The value of the export during recent years has been as follows:—

Year.	Sandalwood.
	£
1907	65,058
1908	84,688
1909	45,863
1910	47,281
1911	69,141
1912	43,354
1913	40,987
Total	£396,372
Average	56,624

From this it will be seen that the export of Sandal from Western Australia has in six years declined by one-half; but this loss of £40,000 a year is but a faint indication of what Western Australia has lost in other ways from antiquated Forestry methods!

The above figures, taken from the Yearly Report of the Forest Department, differ somewhat from those given at page 393 of the *Commonwealth Year Book* for 1914, but the result is the same: a fall from £77,468 in 1908 to £32,000 in 1912.

447.—*Conservation of Sandal in India.*

In South India, and particularly in the State of Mysore, Sandalwood occurs under conditions similar to those in Western Australia. I knew it well in Mysore as a small tree spread over a wide range of country, and in fact more outside the State Forests than in them. Under such conditions it would be easy for the tree to have been cut out and destroyed, as has been the case over large areas in Western Australia. But in Mysore, as far as is known, this has not occurred, and for many years past the Mysore Government has drawn a steady revenue of about £67,000 a year from Sandal. It will be well, therefore, to note how this has been accomplished.

In the State of Mysore—one of the model States of India, with a Parliament and modern institutions—there is a very old and general reservation on Sandal trees wherever they grow (p. 244). The Sandal tree in Mysore is termed a Government tree, "Sarakarada mara," and anyone who cuts or injures a Sandal tree

in any part of the country commits an offence. The tree springs up self-sown in odd corners, hedgerows, and waste ground, and under this special protection (being reserved as a Government tree), it has continued to thrive and be the considerable source of revenue to Government which I have mentioned above.

In the western part of Mysore Sandal has been attacked by a fungoid disease called "Spike," which has played havoc with it, and against which little can be done on account of the scattered distribution of the tree. The disease is possibly connected with the growth of the tree's comparatively new host Lantana. "Spike" may eventually greatly reduce the production of Sandal in South India and thus improve prices for the West Australian wood, but the first effect of it has been to throw a quantity of prematurely old wood on to the market!

448.—*Other countries producing Sandal.*

Sandal has been produced in large quantities in Hawaii, Sandwich Islands, and other islands of the Pacific. This Sandal seems to have been generally inferior to the Sandalwood of either South India or Western Australia. The Government of these islands has been on a par with that of Tasmania in Forestry; and the Sandal has been exterminated. So India and China, which have used Sandal from time immemorial, and are proverbially conservative in their customs, will have to look for their future supplies to Western Australia and the "Spike-ravaged" Sandal tree of South India.

449.—*Sandalwood working in Mysore.*

In the Military Station of Bangalore, South India, Sandal springs up along the hedgerows and fences of the gardens for which that great military station is famous. The tree is ornamental, does not grow too large, and so no one objects to its presence. If a tree is really in anyone's way, all that the owner has to do to get it removed is to send a note to the nearest Forest Office, and then, if the tree be mature, or if there be any urgent reason for its removal, the Forest Department takes it away and it is stored in the nearest Government Sandal-store (Khoti). In Mysore the Government fells the Sandal trees and brings them to the Government stores, where they are sold yearly by auction.

It is necessary that this working of the Sandal be done by Government, for two reasons: (1) Because the work, being spread over the whole country, there is no other ready means of checking the quantity of Sandalwood removed; (2) the Sandalwood grows in certain areas which are cut over by the Forest Department at suitable intervals. This cutting and working of the trees by the Forest Department enables it to gauge the number of immature trees that are coming forward, to keep an eye on them if any destruction of them is apprehended, and to make arrangements for their being cut when mature, so as to keep up a constant supply.

450.—*How to conserve Western Australian Sandal.*

As the only means of preserving Sandal in Western Australia I recommend that the Mysore system should be adopted there. And I see no reason why, if the matter is properly explained, there should be any serious objection. The trees might be placed frankly under the protection of the public as a valuable public property helpful in the reduction of taxation! And in the case of trees springing up on private land it might be advisable to concede a portion of the value of the trees to the owner of the land on which they have grown as royalty or commission. In all future leases of land the cutting or sale of Sandal could be made unlawful without a license. People would soon get to look on Sandal as a Gov-

ernment tree, playing a useful part in helping the revenues of the country, reducing taxation, and bringing them in something in the end.

I had the advantage of discussing this question with Mr. Rae of the Survey Office, Albany, and he seemed to think that there would be little difficulty in endorsing the Government reservation of Sandalwood on future titles. In practice such reservation would cause no inconvenience, since it would be only on waste ground that self-sown Sandal seedlings would have much chance of developing.

In Western Australia it would be easy to prevent Sandalwood being stolen, by declaring it a Government monopoly, and thus rendering the export illegal. Sandalwood is not used at present in Western Australia and is not likely to be, since in India and China its use is restricted to cremation purposes and the making of carved Sandalwood figures and boxes, in which it would be difficult for Western Australia to compete with the cheap labour of India and China.

"Sandal reserves" should be demarcated and proclaimed. There will, no doubt, be a considerable natural regeneration in all the Government reserves in the drief parts of the South-West as soon as these are fire-protected, and places where Sandal occurs now should be demarcated into special Sandal Forest Reserves. These would be grazing areas open to grazing from the time that the Sandalwood was six feet high till it reached maturity. Any largish Sandal reserve would naturally be cut up into compartments and closed and opened in rotation; there would be introduced exotic trees in such reserves. Sandal might find a congenial host among such introduced trees and come up in greater abundance.

To resume, therefore, to preserve a national asset of considerable value, Sandalwood should be proclaimed a Government monopoly, the trees being Government trees wherever they grow, and the mature Sandal trees worked by the Forest Department. It should be preserved wherever it occurs just as opossums are preserved; Sandal cutting, removal, or sale being made illegal. And Sandal could be increased by cautious planting as soon as it was seen that it was amongst a congenial host. The whole question of the root-parasitism of Sandal should be carefully studied; it is undoubted with the Indian Sandal, and is pretty certain to be necessary or useful to the Western Australian Sandal.

Any other scheme of preserving Sandal is impracticable, even if it were possible to make plantations. The natural reproduction of Sandal is poor; it does not shoot again when cut, and does not readily come up from seed in a fire-swept forest. Probably there would be a good natural regeneration in a fire-protected forest. It occurs scattered over such a wide extent of country that there are no means of protecting it against fire and grazing except in the fire-protected State Forests of the future, and it does not grow in the dense better-class forest. It never forms "pure" forest (one species) nor is it likely to do so on account of the parasitical character of its roots. Where it is at all abundant special Sandal grazing reserves should be demarcated. I rely mainly on fire-protection for its natural regrowth there in the future.

CHAPTER V.

The useful Trees recommended for Planting or Trial in Western Australia.

451.—*List recommended by Ednie Brown.*

I may insert a few general notes here on useful trees for planting in Western Australia, but any complete notes would have to await my return to England. My time in Western Australia was short, but all the trees mentioned here I have had under cultivation for many years in that part of South Africa where the climate is the same as the South-West of Western Australia.

At page 50 of Mr. Ednie Brown's "Forestry in Western Australia" is given a list of exotic trees which he thought could be successfully grown in Western Australia. As this list might lead to disappointment, it is better to say at once that the greater portion of it is worthless. It recommends trees that are not climatically suited, either as regards the total quantity of rain, or the distribution of the rain, or as regards temperature, whether with regard to mean temperature or the ability of the tree to stand extremes. Many of the trees mentioned will give no satisfaction to the planter; others, like Jarrah, are good in themselves, but too slow-growing to plant, viz., as forest trees, the cost of planting, with interest at 4 per cent., is always greater than the value of the timber product.

There are 54 species mentioned in Mr. Brown's list. Of these, nine only are really suitable and worth planting on a large scale, while eight more are worth experimenting with. I base my opinions on the results obtained after 30 years of arboriculture, where the climate is practically a counterpart of the climate between Perth and Albany.

452.—*Reasons for special selection of trees.*

The following list of trees is far from complete, especially as regards ornamental trees. The graceful Pepper and Willow trees, the striking and useful Norfolk Island Pine, for instance, are not mentioned. These notes relate mostly either to trees which have not yet been grown in Western Australia, or have not been appreciated at their true value in the Forestry of the country; to trees whose cultivation could support a large rural population, and especially to species which experience has shown can be introduced to the half empty Eucalypt forests, and spreading naturally, add greatly to the value of these forests, not only with their own timber, but by improving the shape and quality of the existing hardwood timbers. This supposes, of course, that the forests are sufficiently protected from fire.

453.—*Trees recommended enumerated in alphabetical order.*

Abies and Picea (spp.)—The Abies and Piceas are the ideal trees to mix with Eucalypts in a cold, damp climate, but none of the Piceas or Spruces are of the least practical use in Western Australia; and the Abies or Silver-firs are little more promising. *Abies religiosa,* the most southern of the Silver-firs (growing actually within the tropics on mountains), requires a summer rainfall.

If there is any small area with a wet climate and not less than 2,500 feet elevation, *Abies pinsapo,* the Spanish Silver-fir (a winter rainfall tree), might be tried. It grows at about this elevation not far from Gibraltar. *Abies nordmaniana* might also be tried as a wet mountain-top tree.

Acacia decurrens, var. mollis.—The Mollis variety of the Black Wattle is the one that produces the good bark in South Africa; but, as far as known at present, there is little difference in the tan strength of the different varieties enumerated by Maiden in his useful pamphlet, "Wattle and Wattle-growing."

The Silver Wattle, which Maiden calls *Acacia decurrens, var. dealbata,* should be kept out of Western Australia. It shoots from the root, which the other varieties do not (or very little), while the bark tan-content is always far below that of the other varieties; and under cultivation there is the danger of its crossing with the other varieties and thus lowering their tan value. On fertile land Silver Wattle is liable to become a "noxious weed"; it has cost £10 an acre (= £80 at Australian wages rate) to extirpate Silver Wattle from the neighbourhood of houses at Ooty, South India. The other varieties are little more than types and merge into one another.

For Eastern Australian Forestry a variety with a rich bark should be sought and propagated. Here is a useful field of investigation for the Federal Forest Service which we may hope soon to see established. For Western Australia, Black Wattle breeding might develop a species both rich in tannin and hardy against the summer droughts, for, as mentioned (p. 112), *Acacia decurrens, var, mollis,* is not hardy in the South-West of the Cape Province where the climate is the same as that between Perth and Albany. Australia is now losing £250,000 a year over tan Wattle bark, and it is desirable to retrieve the position without delay. It is simply the fatuous neglect of Forestry in Australia that has let the Natal farmer plant Black Wattle profitably on his maize fields and oust the wild product of Australian forests (p. 112). See Wattle bark (p. 111), and Forestry in Tasmania (p. 346).

Acacia melanoxylon ("Blackwood").—Blackwood is, of course, not indigenous in Western Australia, but it is worth introducing and there is every chance of its growing successfully in damp valleys and alongside streams. It will there grow in dense sand and, as in South Africa, tend to check forest fires. It is in damp places, in fact, that it is found growing in most of the forests of Victoria, while in the wet country of North-West Tasmania it grows in stretches (beds) over the damp flats.

Being an Acacia it is a free seeder, like most of the other Acacias, and what is more, it comes from suckers wherever the roots are broken, and to a considerable extent naturally. When going over the plantations and forests with the Conservator of South Australia I came to the conclusion that no tree showed such a strong natural reproduction as Blackwood.

I have already mentioned how it is being planted to a large extent in South Africa, with the idea of its spreading naturally and displacing useless underwood in the forest. It has the further merit of being a shade-bearer and thus growing between and among Eucalypts where they themselves could not grow. I saw Blackwood coming up naturally and growing vigorously among old planted Eucalypts, Pines, and other planted trees in South Australia.

Blackwood, at its best, in some of the figured woods has an appearance similar to Walnut, but the wood is always harder and more difficult to work than Walnut, and though largely used in Melbourne does not, in price, average near to Walnut. Figured Blackwood, like figured Walnut, runs to quite special prices. When I was in North-West Tasmania I heard prices quoted in the forest up to £50 and £75

per log (p. 341). Blackwood was selected for the Australian trophy sent to the Panama Exhibition.

Blackwood appears also to be more difficult to season than Walnut. I have heard a story of a Blackwood stringer supporting a staircase some 5in. or 6in. square that had been in a building five or six years, and which then had to be bored through for a gas-pipe. To the surprise of the carpenters it was found to be still quite wet in the centre!

Enormous quantities of Blackwood have been burnt in the North-West of Tasmania and the helpless Tasmanian Government is doing nothing to conserve or improve its Blackwood forests, so that the former large supply of the wood from there to Melbourne will not last.

Blackwood for the Karri Forest.—Blackwood as I saw it in South Australia offers a suggestive lesson to the Forester. In South Australia I came to calling Blackwood the "Beech" of the Eucalypt forest; it comes up so frequently self-sown under the Eucalypts and growing up with them improved their shape, and in one place made the planted or natural Eucalypt forest more valuable for the self-sown Blackwood than for the Gums originally planted! It may be the same in West Australia.

The Conservator of Forests, British East Africa, wrote to me lately that he looked on Eucalypt planting as merely the first stage in the natural regeneration of the more valuable softwood forest.

On the Nilgiris, South India, the same thing has happened. Eucalypts (light-demanders in Forestry) have been planted, and then, under them, have come up, self-sown, the shade-bearing indigenous forest. If the indigenous forest were not shade-bearing and not able to grow in fire-resistant dense forest it would not have been there!

These facts point the way to Blackwood playing an important part in spreading self-sown among the damper Eucalypt forests of Western Australia. The stream-sides and swamps in the Karri forest should be filled up with Blackwood. I see no reason why they should not be, as in Victoria. Some small "cut and mulch" (p. 385) plantations of Blackwood would be required to start with. The so-called "Blackwood" river of Western Australia should really become the home of the Blackwood, the tree furnishing the most beautiful timber of Australia!

Blackwood as a Mountain-top Tree.—It is undoubtedly one of the virtues of Blackwood that it is able to put up with poor, cold, mountain soil. The class of soil which, in South Africa, is termed "sour." Such soils are common in the wet country which is the natural home of the Blackwood in Eastern Australia, and there is a little of such land in Western Australia.

Acacia pycnantha (the Golden Wattle of South Australia).—This, in contrast to the Black Wattle, will grow, I feel assured, like a weed in Western Australia, all over the South-West, between rainfalls of 15in. and 30in. It yields the richest tan-bark of all the Australian Wattles, but the stems are smaller and the bark costs more to strip than Black Wattle; also the yield of bark per acre is less than that of Black Wattle in countries where the Black Wattle grows vigorously.

I saw two varieties of *Acacia pycnantha* at the Hamel plantation. The raising of a large-growing vigorous variety, with a rich bark, should be one of the first objects of Forestry in Western Australia (p. 113).

Castanea vesca ("Sweet Chestnut").—Not far below the Walunt tree for usefulness is the Chestnut tree. The Chestnut, like the Walnut, will not grow generally as well in Western Australia as in the Eastern States of Australia. It wants some summer rain or moisture. It is especially a mountain-top tree. From

about 1,500 feet upwards and on good soil, preferably volcanic, the propagation of the Chestnut tree is worthy of consideration in Western Australia. There are 213,000 acres of Chestnut wood in Portugal; it is nearly all in North Portugal. But it is on mountains in Italy that it grows so well. The Chestnuts of Vesuvius are renowned, and enormous trees are recorded from Mt. Etna. In Sardinia, Chestnut meal and bread is (or used to be) the food of the peasants, but a terrible scourge is affecting the Chestnuts throughout the whole of the Mediterranean. Chestnut trees are dying wholesale and Foresters take the gloomiest view of the situation. The disease has not appeared in England, and care should be taken that it is not introduced into Australia.

Cedrus deodara ("The Himalayan Deodar").—One of the most remarkable forest trees in the world, but for forest work in Western Australia only sufficiently hardy in cool, damp, mountainous localities. I noticed a good specimen growing at Mr. Brockman's residence in the Jarrah forests near Donnybrook.

Ceratonia siliqua ("Carob").—An ornamental, dry-country tree, long cultivated on the Mediterranean for the sake of its sweet pods. It is usually a smallish tree but in a dry climate, hot in summer and cold and slightly wet in winter, with moisture in the soil, and a rich deep soil, I have seen Carob trees in Cyprus the size of average English Park Oak trees, with similar broad shady crowns. Such trees will yield some quarter-ton of the sweet Carob pods, which for domestic animals are one of the best feeds known. Ground Carobs are about twice as nourishing for stock as oil cake, and are understood to be the basis of various patent cattle foods.

The best Carob trees are reputed to be in Cyprus, and the fine growth of some of the trees there I shall not easily forget. The Carob tree should be a very valuable asset on the drier country of southern Western Australia. A single tree may produce the *equivalent of a quarter-ton of sugar* per year. If grown on a large scale it might pay to send the pods to the Victorian Government beet-root sugar refinery, having the pods to fall back upon in times of drought.

I cannot here repeat the whole story of the usefulness of this tree. Before the present war, Cyprus had to pay a heavy tribute to the Turks; that tribute was mainly paid out of Carob beans. The tree does not require the least attention when once planted, not even the occasional pruning which is given to the Olive. In Cyprus the fields are studded with it. It is an upper storey of productiveness often more than doubling the yield of the fields.

The most healthy trees I saw at Coolgardie were the Carob trees on the racecourse. They get a little help from watering there; but I have seen them in Cyprus growing without water, with little more than the Kalgoorlie rain of nine inches. In South Australia it grows very vigorously; but with the Australian neglect of arboriculture, no money is got out of it. Mr. Gill, the Conservator of South Australia, has it planted as a hedge round his house, and it makes a good strong-growing hedge; when a tree can grow strongly clipped as a hedge it shows its vitality. It grows well in the drier parts of Victoria, and is extensively distributed from the Government nurseries, but not in the form of large grafted trees, which is what the farmer wants. I nowhere saw any large trees, nor heard of a farmer making much out of Carobs.

In South Africa I grew it and distributed it from the nurseries. When I went to Cyprus I saw how this mere growing and distributing from nurseries was liable to fail. Carob grows very slowly at first, and to produce the best pods *it must be grafted.* The trees sent out from the Government nurseries should, therefore, be big grafted trees, grown in a full kerosene tin, that is to say, a pot about 15in. high and 10in. x 10in. A grafted tree sent out this size can be planted at

once by the farmer; and after a few years of protection against cattle would become one of the assets of the farm. Several trees must be grown together in order to secure a due fertilisation. Mr. Gill showed me quite good pods produced from his trees in Adelaide. But this is not the way they are grown in Cyprus. There they are planted out when largish trees and every tree is grafted.

In South Australia the Carob tree grows with the utmost vigour, but I could hear of no grafted trees, which will account for the cultivation not having extended much in Eastern Australia. I saw some very good trees at Adelaide, and some quite fairly-grown trees, grown without irrigation, in the dry country at Murray Bridge, South Australia.

I saw 30 well-grown trees at Kalgoorlie averaging 6in. x 25 feet. They produce an abundance of hard pods; they probably only want grafting to produce *good* pods. A Wardian case of good grafted trees should be imported, either from Cyprus through the Cyprus Government, or from Messrs. Vilmorn, of Paris. I followed the latter course in South Africa.

Carob trees, too, will not grow in any soil. They want the average good soil which is found in dry countries, and though they will grow in soils which contain no lime, I have frequently seen them fail in such soils. The Carob seems to rejoice in a good proportion of lime in the soil.

The typical Carob soil is a marl, i.e., a clayey loam containing lime. This is a common salt in Cyprus and the Carobs of Cyprus are commonly said to be the best in the world! The Carob fails on a poor sandy soil where a pine would flourish.

Cinnamomum camphora ("Camphor").—There are three well-grown Camphor trees on rich, damp land at Hamel. They have quite a good growth for their age, although the height is somewhat low on account of their having been grown too far apart. At 17 years they averaged two feet in diameter (at base) and have a total height of 30 feet. With this fair growth they are now black with seed, and the ground below is a thick bed of self-sown seedlings!

The Camphor will never in Western Australia show the luxuriant growth that it does in Queensland (p. 297), and it will only grow at all in Western Australia where there is a good supply of summer moisture, for it is a native of the dense, heavy summer-rainfall forest. But, as mentioned under "Forest Management and Working-plans," it should find a place bordering streams and in damp valleys in the Karri forest country. The Hamel trees prove that with a damp subsoil it is worth growing for shade and ornament, even in Western Australia, where its proper rainfall is reversed.

I may add that the Camphor of commerce is obtained by distillation of the wood, and, latterly, to a small extent, the leaves. Above three-quarters of the Camphor produced is used in the arts, amongst other uses, in making explosives. It has been made artificially from turpentine, and there is actually a factory where it is manufactured in New York; but, so far, the artificial Camphor has been inferior to the natural Camphor. The Japanese have nearly a monopoly of the Camphor trade and are reported to be planting 3,000 acres yearly on the highlands of Formosa.

Cupressus arizonica.—A handsome, fresh-coloured, full-foliaged tree, growing under favourable circumstances at the rate of nearly a foot a year, but often very slow-growing.

No ordinary drought or cold will kill or even injure it. It has held the record as the dry-country, frost-bearing Cypress on the cold high plateaus of South Africa for the last twelve years, and is not likely to be displaced. Indeed, I cannot recall

any tree which is more drought and frost bearing. Its continued success is referred to in the last South African Yearly Forest Report.

After the Boer war, when Forestry spread from Cape Colony over the whole of South Africa, it became necessary to procure this class of tree for the dry interior country of South Africa, where it is intensely cold in winter, hot in summer, and nearly always dry.

Apart from a few slow-growing Cypresses from North Mexico, which have not yet been tried so well in South Africa as *C. arizonica,* the latter should be the best Conifer for the country between the Coolgardie goldfields and the driest part of the Jarrah district. Here it should be tested against the best of the Australian dry-country Cypress-pines, *Callitris robusta, C. calcarata,* etc. In South Africa it has been found much hardier against severe frost than the best of the Australian Cypress-pines.

Cupressus Lawsoniana (Lawson's Cypress).—One of the class of flat Cypresses with graceful sprays of flat foliage. But it will not stand the long, dry summer of Western Australia, except in rare localities.

Cupressus lusitanica ("Busaco Cedar").—As mentioned, the Cedars to a great extent may take the place of the Pines in filling up the half-empty Eucalypt forests of Australia. A Cedar from Guatamala allied to Busaco Cedar, is flourishing in British East Africa where all the Pines have failed so strangely.

Busaco Cedar was introduced to Portugal about 300 years ago. I saw some of the oldest trees, originally planted by the monks in the Busaco forests. It is a beautiful tree, and on the whole merits the first place amongst the Cypresses. It is usually as quick-growing as *Cupressus macrocarpa* commonly cultivated in Australia, and its timber ranks as the most valuable amongst the forest trees of Portugal. It has there become completely naturalised, coming up abundantly self-sown. See the account of the Peña arboretum at Cintra, near Lisbon, *Ex-tropical Forestry in Portugal,* British Association paper (Dr. Ewart, Melbourne).

It has been little planted in Australia. The best sample I have seen of it in Australia was in the park at Albany, Western Australia, and growing there too, not on the soil most favourable to it, but in sand. The Albany tree is 20in. in diameter and some 40 feet high. Cypresses are difficult to distinguish, but I recognised this as a typical Busaco Cedar, except the rather large cone. The Albany tree has the typical flat top and striated bark of the Cintra Cypress.

The Busaco Cedar has been naturalised in Portugal for 300 years. The Portuguese believe it to have been originally *C. torulosa* of India and under cultivation in South Africa it can scarcely be distinguished from *C. torulosa;* but Dr. Henry, of Dublin, has shown that botanically it is most nearly allied to *C. Benthamiana* of Mexico. It is certain that all the various Mexican Cypresses are, more or less, closely allied to it and to each other.

Seed should be obtained direct from the Portuguese Forest Department. The Cypress seeds of commerce are as untrustworthy as the Eucalypts!

Cupressus sempervirens.—The Mediterranean Cypress. The tallest and best shaped trees in Perth are Mediterranean Cypresses. No trees in Perth show better growth. It will grow over a wide area in South-Western Australia, and produce a timber of first-rate value; but, unfortunately, it is too slow-growing to plant for profit. The value and slow growth of the Mediterranean Cypress is expressed in the Greek proverb that "The man who plants a Cypress tree is putting by a dowry for his grand-daughter"!

Happily, it may be introduced to the Jarrah and Wandoo forests with every chance of its spreading self-sown and forming in the future a pearl of great price

among the naturalised timbers of Western Australia. I speak, after having had the good fortune of seeing this unique tree in the wild state, in perhaps the only spot where it remains in Europe in that condition, the northern mountains of Cyprus. The variety to plant for timber and beauty is the wild half-spreading form, not the so-called "churchyard" variety with closely pressed side branches. It is, fortunately, easy to select the varieties in a nursery bed. If the close *fastigiata* variety be sown, about half the seedlings will come up of the open form, and if the open form be sown nearly all.

The Mediterranean Cypress is a tree that lasts for centuries. I was able to secure, not long ago, an excellent photograph of a very old Cypress tree near the Alhambra, Granada, Spain; it was a big tree when the Spaniards took Granada from the Moors.

The timber is reputed to be as durable as the tree is long-lived, but I have not had an opportunity of verifying this reputation.

Cupressus torulosa (Himalayan Cypress).—A fine Himalayan Cypress, but it will only grow well in the coolest, dampest parts of Western Australia.

Cupressus macrocarpa (Macrocarpa Cypress).—Chance and ignorance of extra-tropical arboriculture have made this, the only Cypress commonly cultivated in Australia, but it is used for little more than hedges and screens. Melbourne gardens show some beautifully clipped walls of verdure, but other Cypresses would probably clip as well and not be so liable to die out. A naturally bushy variety, propagated from cutting, has been obtained which is less liable to die out. This is commonly called *Cupressus Lambertiana* in Australia.

Almost the only well-grown Macrocarpa Cypress trees I have seen in Australia were at Bridgetown in Western Australia, and there in the streets it can be seen growing very well.

There are bushy and upright strains of this tree, the bushy kind, chiefly used in hedges, is often known as C. *lambertiana*. *C. macrocarpa* is seen occasionally in a form resembling the close-growing form of *C. sempervirens*. The ordinary *C. macrocarpa* is somewhat shade-bearing, and if grown with other trees takes the form of a tall upright forest tree.

It is a comparatively recent introduction to Portugal, but can now be seen growing there side by side with the old-established Busaco Cedar, and it produces a timber not much inferior to the Busaco Cedar.

In South Africa it has been largely planted for shade and ornament, and latterly for timber in the Government plantations. But it has the disadvantage of occasionally dying off for no apparent reason. I am told that in Eastern Australia and in New Zealand it exhibits the same unfortunate tendency. The cause of this sudden dying off has never been explained. It usually starts in the lower branches, not at the top as with most trees when they are attacked with fungoid or other disease. I saw some trees dying in this way among the street trees of Bridgetown.

C. macrocarpa shows its best growth on good soil, but there is a tree 20in. diameter and 46ft. high in the Albany park growing on sandy soil.

Eucalyptus Species.—With the wealth of hardwoods in the forests of Western Australia, and the complete absence of softwood, there is hardly any of the East Australian Eucalypts that merit the expenditure of money, even for their introduction only, to the forests of Western Australia; and there are not many East Australian Eucalypts that are climatically suited to the quite dry summers of Western Australia.

Perhaps *Euc. Muelleriana* for a little mountain-top planting, and two of the Ironbarks may be exceptions. There is no Eucalypt in Western Australia quite as durable as the Ironbarks, and only "Jam" among all the hardwoods of Western Australia; while "Jam," unfortunately, rarely grows quite large enough to take the place of the East Australian Ironbarks.

Ironbarks.—Experience in South Africa has shown that in spite of some difference in the incidence of rainfall, Grey Ironbark (*Euc. paniculata*) in the Jarrah country and *Euc. crebra* in the drier country are probably worth introducing.

Euc. paniculata in South Africa, which Mr. Maiden and the Conservator of Forests, New South Wales, place first among the Ironbarks, has been found to grow fast enough for planting purposes, and it is being largely planted there mainly for sleepers.

Euc. crebra.—In drier country where *Euc. paniculata* fails, *Euc. crebra* shows an excellent growth. In the Ayers plantation of South Australia I saw some 40 or 50 acres of it. It is the one quite successful Eucalypt in this plantation where the rainfall is only 17 inches. It is there planted alternately with *Casuarina glauca* and would, no doubt, have looked better still if planted with Aleppo-pine, for another block of planting in which Aleppo-pine and Sugar-gum were planted together, gave first-rate results.

Red Ironbark (*Euc. sideroxylon*) is also perhaps worthy of trial introduction, though it will not grow fast enough to repay the cost of planting on any large scale. This is one of the hardiest Gums, resisting frost, drought, and heat.

Eucalyptus cladocalyx (Sugar-gum).—While there is little to be said in favour of planting hardwoods in Western Australia, Sugar-gum is such a favourite as a road-side tree in the drier parts of the country that it is necessary to mention it here as a shade and avenue tree.

It is difficult to say whether this gum is a greater favourite in South Africa or in Australia. In the dry coast districts of South Africa there seems no tree that will equal it for rapidity of growth. Its handsome fresh-green foliage makes it a general favourite. In Australia, from Tasmania to Perth, it has been largely planted throughout the country, but especially in the drier districts; it is there that it finds its *raison d'ètre.* In many parts of Australia, *not in the dry country,* it has, however, been planted where trees of a better class should have taken its place—Hobart, for instance.

In many dry localities in South Africa it has been found not so drought resistant as the Coolgardie examples. "In the dry country of Victoria," says the Conservator, "it has been planted for some 25 years, and as it has attained in the plantations in that period a girth of 45 to 60 inches, its hardy habit, quick growth, and comparative freedom from insect or fungoid diseases have amply justified its selection as a standard Eucalypt."

A good deal has been written about the superior quality of the timber of Sugar-gum. This, however, seems scarcely borne out by the facts. To last at all well in the ground the timber, even in its native state of South Australia, requires to be well matured and carefully selected. As a timber it is certainly inferior to the dry country tree with which it competes in South Africa, *Euc. tereticornis,* but it is superior to that tree for avenue purposes.

Fraxinus spp. and Carya spp. (Ash and Hickory).—It is doubtful if any of these useful trees will find a home in Western Australia. If it is attempted to plant any Ash trees the trial should be made on some rich river flat. They are very sensitive to drought and hot-winds in summer in the latitude of Western Australia.

The same remark applies to the even more useful Hickories. In my opinion there is nothing in the forest of Western Australia to at all equal Hickory as a tool handle. I have tried most of the Australian timbers which are reputed to have elastic properties. *Euc. cornuta* may be the best; but it is far from equal to Hickory.

On the whole, I think Hickory and Ash tool-handles are more likely to continue to be imported than grown in Western Australia. The Ash, grown in South Australia, I have found to be better on paper than on the ground, though I saw Ash at Wirrabara in South Australia which may be *Fraximus velutina* growing well on black loam at the edge of a swamp. The trees were cut as 18in. diameter trees at 28 years. Elsewhere I have seen no Ash worth mentioning in Australia, except those in the Botanic Gardens, Melbourne, and there the species that have grown the best are *F. zanthoxoides, F. pubescens, F. americana, F. potamophylla.* The last is growing on dry ground, near the reservoir in the Botanic Gardens, Melbourne. It seems the one which offers the best chance of success for growing in Western Australia, and no doubt seed could be obtained from the Botanical Gardens, Melbourne. The first three on this list, as well as *F. excelsior,* which is growing fairly, are all heavily watered.

The Hickories (*Carya*) in the Botanical Gardens, Melbourne, show a fair growth, but they are in all parts of the garden that are heavily watered. In South Africa the Ashes and Hickories have generally failed, except in a few localities where there was good subsoil water or summer rains.

Juglans regia (Walnut).—The Walnut is quite one of the most valuable of extra-tropical trees, whether one considers the fruit for which there is a practically unlimited market in Australia. or the timber which in dealers' lists usually command the highest price of all ordinary timbers, or the fine growth of the tree for shelter, shade, and ornament. Walnut trees should be a considerable source of wealth in Western Australia, though they will not grow freely as in the Eastern States. Walnuts want a cool, damp climate, and a rich damp soil. But in the very dry climate of Cyprus, where the summer is intensely hot, they grow as a river-side tree, and under these conditions grow into good trees, yielding useful timber and excellent fruit. I have some interesting carvings of Cyprus Walnut in England. The Walnuts in Cyprus are the cheapest I have known. Delicious cakes are made from walnut flour there.

And lastly, when the old Walnut tree of the farmer's field or the tree by the creek in the forest comes to be cut down, some of these old trees will yield fancy prices for veneers. A log of Italian Walnut will occasionally sell for £300 for veneers. This is the wood one sees on the ordinary piano beautifully figured and mottled; and this figured Walnut comes from old pollard logs that have been hacked and lopped to increase their fruit-bearing, or prevent them getting too big for field crops.

Little Walnut planting has been done in South Africa. The coast is too warm and dry for them and the mountains in the West too dry.

The European Walnut in Western Australia will only grow in cool, damp localities, on good deep soil, and it will be five or six years before there is any appreciable return in nuts. Fruit-growers should graft on *Juglans nigra* as is being done in California. Either *Juglans regia or J. nigra* are easily raised by sowing fresh nuts. It is best to buy the nuts in the rind for seed purposes.

Walnuts will not thrive on a poor soil, and they seem to do best, as in Kent in England, where there is lime in the subsoil. The fruit from fair-sized trees in

England will often sell, unpicked on the trees, at £1 per tree. To make sure of good fruit the trees must be grafted.

Olea europoea (The European Olive).—The Olive grows well all over the drier parts of Southern Australia. I noticed a few well-grown trees at Perth. It grows equally well at Melbourne and Hobart. At Sydney I should be doubtful about growing the Olive on a large scale. It does best with a dry summer and moderate winter rainfall.

Olives grow with the utmost vigour in South Australia. I have been all over the Northern side of the Mediterranean where the best Olive trees are grown, and nowhere have I seen better Olives than in South Australia. The vigorous growth of the trees is shown by the fact that there are whole hedges of it which have been clipped for many years and do not show the least sign of failure or dying back. I have photographs and measurements of the Olive hedge at Mr. Uffindel's (President of the local Forest League) which is quite a remarkable sight.

The Olive seems to grow equally well in the semi-dry districts of Victoria, but Olive culture there has not been carried on to the same extent as in South Australia, where the are several small factories for making Olive Oil.

It is said that with the recent rise in the price of labour, Olive culture in South Australia has come to a standstill; and rather curiously, over a social question. The trees are there in full vigour, and yielding well, but it will not pay to employ men at 8s. per day to pick fruit, and the women and children, with their false pride against out-door work and sad British town habits, will not pick the fruit.

It seems, therefore, that pending some social reform in the present unfortunate life of women and children in England and Australia, Olive culture must remain in abeyance.

Pinus australis (*Pinus palustris*).—The true Pitch-pine of the Gulf States of North America, and the best of the four which are commonly called "Pitch-pine." (It may be noted that *Pinus rigida*, the so-called northern Pitch-pine, has nothing to do with what we import as Pitch-pine timber).

This very valuable tree is worth introducing to the Karri country and nowhere else in Western Australia. It requires warmth and moisture; but even in the Karri country it must be remembered that it may suffer from the dry summers. It may prove of some use as a stream-side tree. It has a peculiar straight habit of growth when young. Valuable though this tree is, its limitations in Western Australia are such that it is only worthy of cautious expenditure in planting.

Texan seed might perhaps be obtained, and this would be the best for Western Australia, but when all is said, the best Pitch-pine is not equal in durability to the "Pino tea" or Canary-pine, and that pine is climatically well suited to Western Australia as far north and east as 18 inches of rainfall.

Pinus canariensis (Canary-pine).—This has come to be the main high-class pine in South Africa. It is raised both from nursery trees and broadcast sowing. It is propagated more than any other Conifer in South Africa, after Cluster-pine (p. 122).

Very little has been planted in Western Australia. I found one little row of dominated trees in the Hamel plantations which, for their situation, look well.

When, however, I got to the Adelaide parks in South Australia, it was growing there almost better than any other tree. It has been planted only to a small extent in the Government plantations of South Australia, its merits not being quite known, and there being a difficulty in planting it, either from tubes or open root; the planting methods used there. Nearly all the trees that I saw planted in South Aus-

tralia looked remarkably well. It is quite a striking tree in the Adelaide parks and elsewhere in Adelaide. A row of trees at Wirrabara in the Government plantations averaged about 20in. x 70ft., and in general appearance looked better than a good many trees in the Canary Islands.

Canary-pine is undoubtedly, to some extent, shade-bearing. It is true that it is nearly always seen in open forest in the Canary Islands, but that is an effect of the fires which the weak Forest Department of the Canary Islands has no means of coping with. But I saw a few patches of dense pine forest where the soil and rainfall were better. In South Australia, I saw young trees of *Pinus canariensis* growing under the shade of other trees for long periods. It is undoubtedly shade-bearing there. It promises, therefore, to be a valuable tree to introduce to the Jarrah forests of Western Australia. It would grow anywhere in the Jarrah belt of forest, and some distance to the north and east of it. It has a particularly erect habit of growth and would impart this character to the Jarrah trees associated with it.

And it thrives on the poorest soil. Usually in the Canary Islands it is seen growing on poor, stony soil. There is no fire-protection, cultivation, or working of the tree, but a ruinous resin contract has been let lately. The timber, as mentioned (p. 122) has a nearly imperishable heartwood. The Spaniards "Pino tea," the well-matured heartwood of Canary-pine, must average at least twice as durable as Jarrah.

It is worth noting that Canary Pine has a wide habitat in the Canary Islands. I found it growing from sea level, where the mean temperature was about the same as Cairo in Egypt, to the mountain passes at an elevation of about between 3,000 or 4,000 feet, where snow sometimes lies for six weeks in the year. It is a vigorous tree in the Canary Islands. I saw no sign of disease anywhere, and it grows up to a considerable size. I have a photo. of a tree which I measured at 7 feet in diameter and 130 feet high; the official measurement of the same tree being 10 feet diameter and 140 feet high.

As mentioned under "Seeds," it so happens, fortunately, that there is an Englishman long settled in the Canary Isles (Mr. Alfred Perry, of Puerto, Orotava, Tenerif) who can be trusted to supply seed, either of ordinary good quality, or specially collected at any particular elevation.

Von Mueller mentions the height growth in Melbourne as 45 feet to 50 feet in 20 years; that is what I judged it at there. (It may be noted that the other particulars of Canary-pine given in Mueller's "Select Extra-tropical Plants" are somewhat misleading. I speak from experience after having spent three months touring in the Canary Islands forests two years ago.) Canary-pine has the rare quality for a pine of shooting freely from the root when burnt or cut. Thus, an ordinary pine plantation is liable to be destroyed by fire till it has seeded freely, when after a fire it shoots up again from the dormant seed in the ground. Canary-pine gets its seed later than any of the common pines and it may be a process of Nature (evolution) that in the meantime it is not destroyed by fire like other pines.

Pinus halepensis (Aleppo-pine).—This pine is thoroughly at home in Western Australia. Though most common in the Eastern Mediterranean, it grows well in the Western Mediterranean where the climate resembles the coast climate of South-West Australia. It is the natural complement of the Cluster-pine on *poor soils containing lime,* where the Cluster-pine will not grow. As a young tree, its bushy growth has often caused it to be misjudged. It will grow either in close or open forests. In Cyprus, when closely grown, it produces fine stems of clean, straight, soft white timber. When sparsely grown, as with the timber coming from the forests of Asia Minor where, under Turkish rule, Forestry has been as bad as in Aus-

tralia, the best of the timber is very knotty. It is commonly recognisable amongst "deals" in South Europe by the abundance of knots.

The important point to remember with Aleppo-pine in Australian Forestry is its growing on poor calcareous soils, and the use of the timber cut young for packing cases. For this purpose the Portuguese prefer it to Cluster-pine in the sand-drift planting on the banks of the Tagus.

The forests of Cyprus, nearly half a million acres in area, are practically composed entirely of Aleppo-pine. It grows there up to sizes of 4ft. 6in. diameter and 105 feet high. In winter, in Cyprus, temperatures are similar to England; in summer, to India. Aleppo-pine in Cyprus grows well with a rainfall of 15 inches only, falling entirely in winter. That shows what it may do in the drier forests of Western Australia.

In Australia the Aleppo-pine grows well just as far as it gets its own climate of quiet dry summers, and then becomes very poor. Its home is the eastern side of the Mediterranean, where the climate in summer is *quite* dry and intensely hot.

The few trees planted in Western Australia look perfectly healthy. I saw some about Perth and Albany, those in the park at Albany growing on sand.

Everywhere in South Australia the Aleppo-pine is the hardy pine, not showing any sign of disease, and prospering, though growing slowly, in the driest and most stony situations. In the Adelaide park there is a fine avenue, about half a mile long, of Aleppo-pine: the finest pine-tree avenue in Australia. At the Adelaide Botanic Gardens is a tree 28 inches in diameter and 103 feet total height.

But, in Victoria I saw no healthy trees. Those on the Domain, in which Mueller took such pride, are now dead, or dying. In New South Wales the Aleppo-pine looks worse. There is a large avenue of old trees at Paramatta, difficult to distinguish till one gets near them, so scanty and pinched is the foliage. Doubtless the summer rains bring disease.

For Western Australia there is the important question as to how the Aleppo-pine would behave in the Jarrah and Wandoo forests. I think there is little doubt that, for the drier Gum-forests, Aleppo-pine will prove one of the best, perhaps the best of all the pines. Everything seems in its favour. It is easy to transplant from a nursery; it is the most shade-bearing of all the dry-climate Mediterranean pines; it has the densest covert to pack round and straighten up the Eucalypts, and no one of the pines commonly cultivated has such profuse and early crops of cones and seed.

Pinus insignis (Insignis-pine).—It is unnecessary in these short notes on trees for Western Australia to speak more fully of *P. insignis* after what has been said with regard to "Softwood planting in Australia" (pp. 121 to 123), and in the discussion of "Management and Working-plans" (p. 81). It is the one pine that has been planted to any extent in Australia, and its rapid growth and usefulness are there discussed.

It has grown from 30 per cent. to 50 per cent. faster than any other pine planted in Australia. It has been grown always in sparse plantations, and has produced consequently a second-class timber; but, even with the worst timber, it seems capable of use for almost any purpose by the easy and economical plan of tank impregnation. The favourable points about Insignis-pine are: (1) its very rapid growth; (2) its easy impregnation with an antiseptic; (3) though a winter rainfall pine, it will seemingly stand more summer rain than the Mediterranean pines. All through Eastern Australia it is decidedly a more healthy pine than Cluster, Aleppo, and Stone-pine. Of course, it cannot stand an almost entirely

summer rainfall; it fails badly on the Queensland coast and in Natal (South Africa).

Its unfavourable points are:—

(1) It will not generally grow on very poor soil.

(2) It has had bad attacks of disease, even in its own winter-rainfall climate, that suggest caution in laying down large areas of "pure" forest (pure = unmixed with any other species). We may never know what caused its near extinction in its Californian home, before its great extension by planting in Australia, South Africa, and South America. *But one suspects disease.* And, curiously enough, its Californian mate, *Cupressus macrocarpa,* suffers from an unknown disease which it has taken, *in its seed,* to all countries where it has been planted. The disease that has attacked Insignis in Australia seems nothing more than the common *Diplodia pini.* This attacks various pines in South Africa.

(3) Its late seeding. Of the common pines it is the latest to show a good crop of cones, with the single exception of Canary-pine. Thus the period during which it is liable to be destroyed by fire without natural reproduction is longer. It does not shoot again when burnt, in the wonderful way of Canary-pine, so that it is really the pine most liable to suffer from fire, in spite of the opinion that its rough bark enables it to resist fire unusually well. Nearly all the common pines have similar rough bark when old enough.

(4) Climatically, it is on the cold side of the extra-tropics; it will not stand the drought and heat of the Mediterranean pines or Canary-pine.

I follow von Mueller in leaving undisturbed the old, well-established botanical name for the Insignis-pine. Mueller says:—

Professor Don having named and described this tree under two names simultaneously, the name (Insignis) given by Douglas may remain."

Pinus laricio, var. *corsicana* ("Corsican Pine").—In the Eastern States of Australia this pine has established a good record, but I am inclined to think it will not be of much use in Western Australia, except in a few cool, damp, mountainous situations. It finds such a climate on the mountains of Victoria and South Australia, and I have seen it growing on them with all the strength and vigor of Insignis-pine, and nearly the speed. Mr. Mackay, the Victorian Conservator, speaks of it as "healthy, hardy, and vigorous, and in some instances, after about the twelfth year, overtopping even the Insignis-pine. Logs of Laricio of 14 to 20 years' growth have been sold and cut up from time to time, the boles being from 6in. to 9in. in diameter."

The Laricio-pine has not done much in South Africa. Obviously a pine from Corsica, and Corsica requires a wet climate, so that its use in South Africa is more restricted than in Australia. For trial in Western Australia, the seed should be obtained from Vilmorin, or other reputable seedsmen, and guaranteed to come from a low elevation in the Island of Corsica. Ordinary Corsican-pine is quite at home in England and North-West Europe.

There are many varieties of *Pinus laricio,* and it is quite possible that the poor results obtained in South Africa may be due to a suitable strain not having been tried. In any case this has to be remembered—that the Laricio-pine, though a fine timber as regards heart-wood, matures very slowly. I doubt if the sapwood, though stronger than Insignis-pine, would be much more generally useful, and the Laricio-pine has not the antiseptic absorbent qualities of Insignis-pine.

Pinus mitis (*P. echinata*).—This tree is worth planting in a cool, moist situation; but in South Africa the growth was not equal to *Pinus taeda.*

Pinus muricata ("Bishop's Pine").—For practical purposes this tree may at first almost be regarded as a variant of the Insignis-pine, but the growth soon falls off, and though the timber is more highly esteemed in America than Insignis timber, that may be simply an accident of its growing under better conditions in close forests. In a cold, wet situation in South Africa it is growing nearly as fast as Insignis-pine. I recommended its being planted in the Insignis-pine plantations of South Australia, where the latter has been attacked by fungoid disease. It is worth trial planting in boggy ground in Western Australia. It has not been long enough planted in South Africa to afford reliable results regarding its rate of growth and natural regeneration. It is grown as a wind-break in New Zealand, and I saw 17 acres of it in the cold south-east corner of South Australia, but the growth there averaged only three feet high in three years.

Pinus pinaster ("Cluster-pine"), better known, perhaps, as "Maritime-pine." This pine is seen in all forms and sizes in the south-west of Cape Colony, where it finds its correct temperatures and winter rainfall. It is the common wild pine of the country. In the east of Cape Colony, under a summer rainfall, where it ought never to have been planted, it has suffered badly from disease. It fails decidedly, with only so much summer rain as there is in New South Wales. But in all the south-western districts of Cape Colony it is the common pine of the country, exactly as is Insignis-pine in Australia. For particulars of its growth in South Africa I may refer to the various published accounts, among which are my "Cluster-pine at Genadendaal"; also the *British Association Handbook*, entitled "Science in South Africa."

Better, however, than the growth in South Africa is that at Leiria, in Portugal. The private forests of Cluster-pine are considerably more extensive than the Government, and, as already mentioned, there is a very lucrative trade with England in mining timber. Almost all the forest between Lisbon and Oporto is Cluster-pine. There are altogether close on 2,000,000 acres of Cluster-pine in Portugal.

It is very possible that much of the poor growth of Cluster-pine in Australia may be due to a bad strain of seed. The ordinary Cluster-pine seed of the European markets is French seed, gathered in the Landes. In South Africa the seed has been obtained from three sources: (1) the Landes, the cheapest; (2) from Italy, only a trifle higher in price; (3) seed of South African trees. When I was purchasing seeds in South Africa I was not aware of the extraordinary fine quality of the timber in the Leiria forests of Portugal. For planting in Australia, all future supplies of seeds should be obtained from Portugal, on application to the Portuguese Government; and I was assured, when there lately, that seed of this finest strain of Cluster-pine would be supplied at no higher price than that from the much inferior Gascony trees.

It is unnecessary to say more about Cluster-pine here. Being the pine of the country in the south-west of the Cape Province, it is described in the page dealing with Softwood planting (p. 81), in the section on "Forest Management" (p. 121), also p. 79, in Appendix II., "Forestry in South Africa."

Pinus pinea ("Stone-pine").—The Stone-pine grows well in Western Australia. By far the finest specimens of these trees which I have seen in Australia are those near Government House, Perth. In the Albany Park it shows the best growth of all the conifers there, better indeed than *Pinus insignis* apparently of the same age. It is growing well there, as it does in South Africa, on a poor sandy soil. Climatically, that is what one would expect, as the Stone-pine is seen at its best in Southern-Portugal, where the climate is identical with that of Perth. The Stone-pine is found scattered throughout Portugal, coming up self-sown in the Cluster-pine forests of the country, and being cultivated in the fields. In

Southern Spain it is the pine that stands the greatest heat; but not drought and heat together. It is in warm, moist valleys that the Stone-pine is seen at its best, though it is true it extends far north of the central plateau of Spain, where there is a rainfall of only 12 inches, and where it is as cold as London in winter and as hot as Calcutta in summer. Even at Valladolid, a day's journey north of Madrid, it grows to a good-sized tree yielding fair timber and a good supply of nuts. This climatic range will indicate the possibilities of growing Stone-pine in Western Australia.

And it is a most profitable tree to plant. The seed is in the form of a large stony nut, and the kernels inside this nut are an important article of commerce. At Valladolid I went over a nut-cleaning factory which, dealing only with the local supply, sent away yearly 1,000 tons of the cleaned white kernels. These are worth 8d. per lb. wholesale for confectionery, Marseilles being the chief market of Europe. There is an increasing demand for them in Europe by the manufacturers of chocolate and other confectionery. To my taste there is no sweeter kernel than Stone-pine.

In Western Australia, both in Forestry and Arboriculture, Stone-pine is a most useful tree to plant. In the Jarrah forest it may spread naturally with the Cluster, Insignis, Aleppo, and Canary pines, and greatly improve the present half-empty forest. It should be introduced at various points in the indigenous forests on the chance of its spreading naturally amongst Eucalypts, for it has a strong natural reproduction. The kernels give the seedlings a supply of stored-up plant-food, and they assist in the distribution of the species, being taken and dropped by birds and animals. In Portuguese forests the wood is somewhat better than Cluster-pine, but it does not grow so tall and straight. In the old days of wooden ships, in Spain and Portugal, it used to be preferred to Cluster-pine as being harder and tougher. Now, it occurs in the forests of Portugal, coming up self-sown, and it is taken as it comes with the Cluster-pine.

In the south-west of the Cape Province this pine was introduced over 300 years ago, and has become completely naturalised, though recently a fungoid disease has killed many of the old trees and prevented its being planted by the Forest Department. That disease seems now abating.

The European Stone-pine is not confined to Spain and Portugal, but extends throughout the Mediterranean, planted for the sake of its nuts, though in the dry, severe climates of the Eastern Mediterranean it will only prosper on deep, dampish soil. It is the common "Umbrella Pine" of Italy, so often seen in Italian pictures and scenery.

From the above it will be seen that Stone-pine should be a valuable asset for Western Australia, both in the arboriculture of farms and the forestry of the State forests.

And as regards arboriculture on farms, the Stone-pine seems quite one of the most promising trees to plant, especially on the dry sandy ground about Perth. Possibly the planters of the fine trees near Government House, Perth, knew this.

I should recommend everyone who has ground of any sort about Perth to plant Stone-pine. Forest ground will be improved by it, open grazing ground will give better pasture under sparsely planted Stone-pine. And, as mentioned under "Arboriculture," Stone-pine is one of the useful trees to be planted as a "field tree" over crops, this planting, of course, being quite sparse so as to allow a full supply of sun to the pasture or crop on the ground.

And as regards labour difficulties, one may say that gathering the fruits of the Stone-pine costs nothing, because both the big cones and the kernels have only

to be swept up from under the trees, and the cones are such excellent things for fires that they will pay the cost of sweeping up. The Gum-wood of the domestic hearth of Perth gives a dull fire: the cones make a bright blaze like a fire stick.

The kernels, as mentioned, are worth 8d. per lb. in Europe. They are worth more than that in Australia, because there is a considerable importation of nuts and kernels from Europe to Australia for confectionery. The Melbourne and Sydney sweet-makers would, I am informed by a man in the trade, take large supplies of kernels or nuts.

The timber from these sparsely grown trees would be a coarse softwood, useful for packing cases: and the "lop and top" would give bright-burning resinous firewood to mix with the dull-burning Gum firewood.

"The Soft-shell Variety."—There is a well-known variety of the Stone-pine where the kernel, instead of being enclosed in a hard shell requiring a hammer to crack, is enclosed in a soft one. This variety comes fairly true from seed, although Spanish writers have maintained that the thin-shelled variety is merely a natural sport, and that, actually, thin-shelled nuts and hard-shell nuts can be seen on the same tree. In the Botanical Gardens, Hobart, is a thin-shell tree which has evidently come true from seed—the only one I saw in Australia. The thin-shell seed is supplied separately by Vilmorin, the Paris seedsman. The French name for this variety is *"à coq tendre."*

Pinus ponderosa ("Yellow Pine").—This tree has been little tried in South Africa, but has not, so far, showed much promise of competing with the Mediterranean pines, Canary and Insignis; but in the cooler parts of Victoria I saw such well-grown trees that it seems worth mention for cool mountain areas in Western Australia. It would be useless elsewhere. Says Mr. Mackay, the Victorian Conservator:—

> It grows vigorously in Victoria, its annual increment in some instances being nearly equal to Insignis-pine. With fair elevation and moisture it will grow on poor soil, such as sandy loam, sandy clay, deep granite drift, and the softer shales and slates. Owing to its hardiness and large yield of timber it is well worth the attention of the Australian planters.

The trees is one of the largest, most vigorous, and wide-spread in the United States of America. When its cultivation is attempted in Western Australia, care should be taken to obtain a specially gathered seed from the suitable part of its habitat.

Pinus sylvestris ("Scotch Pine").—Of no practical use for forest work in Western Australia, not even as a mountain-top tree. It would not begin to be useful below an elevation of 2,500 feet.

Scotch-pine and Douglas-pine both failed at Hamel.

Pinus strobus ("Weymouth" or "White-pine").—This tree is a shade-bearer, and has other valuable qualities for introduction to sparse open Eucalypt forests. It grows naturally a good shape; it is particularly useful in enriching the soil with a good layer of pine needles; its timber is like Spruce—white and light, and suitable either for making paper-pulp, for use indoors, or for impregnating with an antiseptic. It weighs only about 24 lbs. per cubic foot. In Western Australia it is suitable only for planting in high, cold, mountain forest. Great caution would have to be exercised before bringing it down to the level of the ordinary Karri and Jarrah forest. It has not succeeded generally in South Africa, and in Europe it suffers from fungus trouble.

In ordering seed from Europe or America the most southerly or warm country seed should be specified for Western Australia, and the species given cautious trial.

Pinus taeda ("Loblolly-pine").—This is largely a summer rainfall pine, and one of the Pitch-pines of the southern United States; the one that has given the best results in South Africa. It should be tried in Western Australia only where there is a good rainfall, particularly a little summer rain, or where there is subsoil moisture.

Though *P. palustris* is the best Pitch-pine, *Pinus taeda* is one of the four commercial Pitch-pines of the Gulf States of the United States of America, and is a timber of first-rate value. In a cool mountainous situation in South Africa it has shown a growth nearly equal to Cluster-pine, and it is worth growing if only for the name of "Pitch-pine." In Western Australia it would grow best just where Insignis-pine would grow best, and, if *Pinus insignis* were attacked by disease, would probably escape, for its home is in the damp summer rainfall area of the United States, where fungoid diseases may be assumed to be at their worst. For South Africa I endeavoured, with some success, to get seed from the drier Texan side of this tree's habitat.

Pinus Thunbergii ("Japanese Cluster-pine").—Here we have a pine flourishing with a heavy summer rainfall; though, planted experimentally, it has shown a fair growth in a purely winter rainfall in South Africa. As a summer rainfall tree it is out of place in Western Australia. But it is so hardy a tree that there may be damp situations where it will flourish well in Western Australia, and, being a summer rainfall pine, it is probably immune from fungoid disease. It has shown fair results as a young tree, even in winter rainfalls in South Africa, but there is a marked improvement in its growth as it gets into summer rainfall areas.

This has been well termed the "Cluster-pine of Japan." Like the Cluster-pine in South Africa, barren sandy soils good for nothing else are planted with this pine in Japan and yield a good timber. It is the common "Matsu" of the Japanese, growing to a large size and yielding a good timber.

In Australia it has been little planted. There is little Forestry in New South Wales and less in Queensland, the two States where it would naturally have been planted.

Growing often with this in Japan is *Pinus densiflora,* the "Akamatsu-pine" of Japan, but where the two have been planted together in South Africa *Pinus Thunbergii* shows a better growth, while I have visited two localities in Australia where the reverse was stated to be the case.

Pittosporum bicolour ("Tasmanian Box-wood").—I mention this here because this tree is wide-spread in South-East Australia, and forms one of the best Box-wood substitutes with which I am acquainted. There is a continuously increasing demand for Box-wood which the real tree is quite unable to supply, and Box-wood substitutes are being more and more used. *Pittosporum bicolor* seems a very good Box-wood substitute, somewhat better than the Box-wood substitute which has been exported successfully from South Africa for many years. Having such an extended habitat in Eastern Australia, it may extend naturally, and accommodate itself to forest conditions in Western Australia.

Prunus amygdalus ("The Almond").—This tree has an arboricultural interest for the farmer, and also as a road-side tree in a suitable situation. It can be planted to yield a valuable crop of nuts, without the pruning, manuring, and spraying and other care bestowed on cultivated fruit trees, and when growing large enough it is one of the most beautiful of road-side trees, being leaf-shedding and the first tree of the extra-tropics to be in flower in Spring.

It would grow anywhere in Western Australia where there was subsoil moisture, or some means of giving a little water in summer. In the island of

Teneriffe I have seen a stony valley literally white with the blossom of Almond trees in spring, a valley of desolation turned into a valley of delight. There was no appearance of anything but volcanic stone at the surface, but there must have been subsoil water, and the Almond tree roots are able to travel far in loose stones in search of it. In better watered parts of the Canary Islands it grows as a semi-wild fruit tree.

In South Africa it grows luxuriantly on the plateau country, wherever water can be spared for it. There is, of course, an unlimited market for the nuts. There are many different varieties under cultivation, some not at all hardy. For the warmest parts of Western Australia it would be advisable to get seed from Teneriffe. Mr. Alfred Perry, of Orotava (Puerto), would probably be able to supply it. As a hardy roadside tree the small delicate cultivated trees have of course to be avoided.

Livingstone's historical Almond tree in South Africa, a giant tree, large enough to shelter a congregation under its far-spreading branches, is growing at the edge of the Kalahari desert, in country like Kalgoorlie, but it has a spring of water at its roots.

Pseudotsuga Douglasii (*"Douglas-pine"*).—It is scarcely necessary to refer to this tree here. It is only on a few mountain top localities where it is of any practical use in Western Australia, though there are apparently southern forms of this valuable pine that might be of great use in Western Australia, if seed could be obtained.

Quercus ilex ("Holm Oak").—The Ilex one sees everywhere in Spain and Portugal and Italy. It meets the traveller at every turn, and is seen everywhere, from the public parks and the gardens of princely houses in Rome to the last vestiges of tree vegetation left on the devastated mountain ranges of Spain. The tree is planted for ornament and the production of acorns. There is nearly 1,000,000 acres of Ilex forest in Portugal.

With a good rainfall it is a fair-sized tree, but on dry mountains has very small foliage and runs into scrub. As the jolting, uncomfortable, very broad-gauge train crawls over the country in Spain and Portugal, one sees the distant barren mountains dotted over with tiny green specks. Almost invariably these green specks are Ilex. Cork Oak only grows on the lower mountains. The Ilex is seen on all soils, but seems to prefer those that contain lime. The timber is a hard-wood, and therefore not of much use in the Eucalypt forests of Western Australia. In Portugal it furnishes a first-rate firewood, but its chief value in the forest and rural economy of Portugal lies in its acorn for pig feeding. One-third million pigs, according to the Agricultural returns, are fattened yearly on acorns in Portugal. Details will be found in a work (which is in French, and therefore more accessible to most Englishmen) entitled "Le Portugal Agricole." 690 litres of Ilex acorns are required to fatten one pig, against 830 litres of Cork Oak. It is added: —*"Le trafic des porces represente pour l'Alemteje* (South Portugal) *une commerce d'une haute importance."*

In Cape Colony the farmers grow the British Oak, *Quercus pedunculata*, for acorns. After having been in Portugal I am convinced that farmers, both in South Africa and in Australia, have much to gain by the planting of Ilex on rough ground on the mountains. There are Ilex trees in every Botanic Garden in Australia.

A variety of *Quercus ilex* termed "Ballota" produces acorns which are nearly as sweet as Chestnuts. They are sold roasted like Chestnuts in the streets of Spanish cities, a handful for one penny; there are localities in Portugal where all

the Ilex is of this sweet-acorn variety. It comes true from seed, and seed acorns are easily procurable in Europe from Vilmorin or other reputable seedsmen.

Quercus lusitanica ("Portuguese Oak").—In Portugal it forms a large handsome tree with massive heavy timber, at one time much in demand for ship-building, the branch wood and waste wood furnishing first-rate firewood; it has thus come to be nearly exterminated on the plains of Portugal, where it is said to be the hardiest of all the leaf-shedding Oaks, and to grow well in every situation and on every kind of soil.

It may almost be regarded as a southern form of the English Oak. In Portugal it takes the place of the English Oak in the middle and south, where the mean temperatures are those of Albany to Perth. Its very good qualities have led to its destruction over a large part of Portugal in the old days of misgovernment and bad Forestry. It is a favourite road-side tree in Victoria, and I heard nothing but praise of it there.

Climatically *Quercus lusitanica* is as much at home in the coast districts of Western Australia as in Portugal. It is a strong-growing tree giving the densest shade and bearing good crops of acorns, but only when older than most of those which have been planted in Western Australia. The tree which goes by the name of *Quercus Hodgkinsonii* in Western Australia is nothing more than a very slight variety of *Quercus lusitanica.*

Quercus mirbeckii, the Algerian Oak, is practically, too, only a variety of *Quercus lusitanica,* the difference being small and botanical only; as the two trees grow side by side no difference is readily apparent. Seed acorns of either of these trees are easily obtainable in Europe or from the Botanical Gardens, Melbourne. They are both trees which should be largely cultivated for shade and ornament, as well as for the profitable acorn crop useful for fattening pigs and for adding to the rations of horses or mules. Like all leaf-shedding and thus summer-growing trees, it will not grow well where there is no subsoil moisture. It requires a soil which is fairly good and quite deep and moist below.

Quercus pedunculata (the common "English Oak").—This is nearly useless as a forest tree in Western Australia, and in Eastern Australia it grows slowly and suffers badly from the attacks of a small green scale, though trees, very beautiful in Spring, are occasionally seen in cool damp localities.

In the South-West of Cape Colony it has long been planted as a farmer's tree for its rich beautiful foliage and the abundant crops of acorns. The Oak Avenue of Cape Town is one of the sights of that city. There are few finer spectacles offered by trees than the tender green of these Oaks in early spring time For two hundred or three hundred years, on the old farms near Cape Town, the English Oak has been planted, both for shade and the value of the acorns. They are sometimes dried, but more usually kept soaked in acorn pits. This has the effect of removing much of the tannin.

No doubt other Oaks could have been planted to yield better crops of acorns, and to grow more vigorously, but this was not known at the time. For most purposes in the extra-tropics *Q. lusitanica* and the other Oaks of South Portugal and Spain are to be preferred. There are 171,200 acres of forest under leaf-shedding Oaks in Portugal. The leaf-shedding Oaks are mostly in the north of Portugal, the evergreen Oaks in the south.

Quercus suber ("Cork Oak").—The Cork Oak is a slow-growing tree, not at all encouraging to the grower when first planted, and liable to fail in certain soils, but it yields a most valuable product, and is climatically at home all over the south-west of the State of Western Australia. Practically all the cork of commerce comes

from this Oak or the closely allied *Q. occidentalis* of the French Landes. The Cork Oak is planted freely in Portugal, Spain, and Italy, and there are large forests of it in Algeria. There are 827,000 acres of Cork Oak in Portugal, mostly open forest or scattered trees. The Portuguese exportation of cork, which has been rising steadily for many years now, reaches a value of over one million sterling, and this high figure is nearly all the value of the cork in the raw state. The traveller sees the Railway Stations and the docks piled high with the great flattened discs of the cork. Formerly this was chiefly exported from Portugal in a manufactured state for bottles, but now nearly all the countries of the world (except backward free-trade England) have taken the manufacture to themselves, with heavy duties on manufactured cork.

Besides the value of the cork, the Cork-tree (*Quercus suber*) has advantages and disadvantages which I can only briefly mention here. As mentioned, it is suited to the climate of the whole of the south-west of Western Australia, and it will grow in any soil, except the poorest, although limestone does not produce the best trees. There are some trees at Perth which are quite good, judged by Mediterranean standards.

To the small grower, the picturesque tree for shade and ornament, and the acorns for pig-feeding, will be of more value than the cork. But if any area were to be planted by Government the cork would be worth stripping for export. If, however, it were found to grow well in any particular locality, and Government, in conjunction with private owners, were to undertake the planting of a sufficient area, a continuous supply of cork for a small local factory would be established. But to prevent disappointment it will be desirable to proceed cautiously with the Cork Oak tree. Though it grows in Spain and Portugal in every variety of soil and climate, it has not shown the same vigour in South Africa, and on even the Mediterranean it is often a slow-growing unhealthy-looking tree.

To avoid disappointment, too, it must be remembered that the Cork Oak at its best is a very slow-growing tree. For some years after being planted it may only grow a fraction of a foot a year. The Cork Oak planter who wishes to get any return should select good soil and favourable conditions. Even then it will be some 15 or 20 years before the rough (so-called male) bark can be taken off, and the smooth bark of commerce can only be stripped at intervals of five or six years. Otherwise the trees are injured or killed. But with the acorns bringing in something yearly it is considered quite worth planting in Portugal, where the value of land averages higher than in Australia; in fact, the little kingdom of Portugal supports a population nearly equal to that at present in Australia, and, as mentioned above, from the planted trees and the trees in the forests Portugal sends away yearly cork to the value of a million sterling. This is a figure that has been gradually rising with the progress of Forestry and Arboriculture in Portugal, exactly as the £44,000,000 forest *importations* into England has gradually risen with the continued neglect of State Forestry there.

I saw Cork Oaks in Melbourne, both in the Botanic Gardens and in private gardens, better than any I can remember to have seen in Spain or Portugal. At Macedon in Victoria I saw some very poor ones, but they were on bad soil and in a climate too cold for them.

Apart from the want of a Mycorhiza at the root or some other obscure trouble, Cork Oak should grow as well anywhere in Extra-tropical Australia as on the Mediterranean, wherever the average yearly rainfall is not below 15 inches, and the elevation not enough to take it out of a warm extra-tropical climate. In the south of Spain it does not grow above some 2,000 feet, the ordinary Ilex being hardier and growing on the mountain-tops.

Quercus Tozae ("Tozae Oak").—Is the last of the five Oaks of Portugal worth mentioning here. It is of medium value for timber or acorns, but is hardier than the British Oak, which it looks much like. It would be worth introducing to the Jarrah forests as it spreads well naturally from both seeds and suckers, and would form a good undergrowth to the tall Eucalypts, furnishing firewood and Oak tan bark in the future, and, of course, if it were to spread vigorously, valuable panage or pig-grazing. It is usually cut as coppice in Portugal and Spain. When allowed to grow up it has much the appearance of the English Durmast Oak.

Sequoia sempervirens ("Redwood" of California).—In its natural habitat this valuable tree (probably the most valuable of all extra-tropical forest trees) extends south as far as the latitude and climate of the Karri country in Western Australia. It is a most valuable tree, whether we consider its soft easily worked, durable timber, or its fine forestal qualities of growth, reproduction and stand of timber. It is the largest tree in the world, and few trees, if any, give denser or heavier stands of timber. It should be introduced, therefore, on damp, deep soils in the Karri country, or, better still, on the mountains where the climate may be nearly as damp and somewhat colder. It is making a good growth in one locality where it has been introduced into the indigenous forests of South Africa.

In Australasia its natural home is in the damper parts of Tasmania, New Zealand, and the Victorian mountains; but with the poor forestry that has hitherto prevailed in these countries, it has remained neglected—an unrecognised gem. In the recent New Zealand Royal Commission on Forestry Report, its fine growth was reported by a private planter. Little has been grown in the State plantations. I saw some well-grown trees in the small but very interesting arboretum at Macedon, North-East of Melbourne. Says the Victorian Conservator (Sydney Conference):—

> At 34 years the best trees are 6ft. 9in. in girth and 66ft. in height, the soil being a poor schistose clay. This tree must be grown at a fair elevation with shelter from wind and in fairly deep strong soil, This means nearly half-inch rings and a rapid growth.

In Europe the Redwood grows from the Mediterranean through the West coast of France to the South-West corner of England, where it grows well, but is said to produce inferior timber. It reproduces itself freely from seed, and shoots again when felled if anything more vigorously than the best of the Eucalypts. On the cooler, damper side of Australasian Forestry, it is undoubtedly an asset of the first value.

Division VII.

ARBORICULTURE—PUBLIC AND PRIVATE.

CHAPTER I.

Stimulating Arboriculture by State Assistance and State Nurseries.

454.—*Distinction between Arboriculture and Forestry.*

By Arboriculture I understand the growth of single trees or scattered trees for beauty, shade, or their fruits, as contrasted with Forestry, the growth of trees in masses for timber. Arboriculture considers the single trees; Forestry the acre or cubic foot of timber.

A sketch of the present position of Forestry and Arboriculture in each Australian State is given at pages 280 to 301. Everywhere in Australia Arboriculture is very backward, except in the one State of South Australia, and even there the traveller sees little sign of tree-planting. The country roads are absolutely bare of trees; the streets of the towns nearly so, and there is not a Government Arboretum throughout the length and breadth of the land (p. 152).

455.—*Growing trees for profit.*

The wealth to be made out of trees is far greater in the extra-tropics than in cold countries. To prove this we have only to turn to what has been done in the extra-tropics of Europe on both sides of the Mediterranean. In middle and northern Europe the sun power is about sufficient to ripen the field crops. In northern Scotland it will barely do that; but in southern Europe the sun's power is sufficiently strong for what is practically two crops running at the same time, one over the other. There is a double-storey of productiveness. The winter, instead of the summer, is the growing season, and with the low winter and spring sun, there is sufficient direct side-light both to ripen the crops on the ground under the trees and to produce the first part of the growth of the fruit on the trees which will mature later under the hot summer sun, when all surface vegetation is scorched up, but when the deeper-rooted vegetation from the trees can still draw on subsoil moisture.

456.—*Fruit-trees grown with the field crops.*

The productiveness of fruit trees grown with the field crops is well worthy of notice. The little island of Cyprus has in a broad sense, two articles of export, barley and carobs, each bringing in about £80,000 yearly. Carob and olive trees are scattered over the fields, and do no harm to the barley crop. Cyprus supports itself on its wheat, barley, carobs and olives, and has a surplus for export of £80,000 worth of barley and £80,000 of carobs. Other familiar fruit trees grown over the fields in the Mediterranean region are Mulberries, Almonds, Walnuts, Chestnuts, Stone-pine, and particularly in Portugal, the Cork-oak. The Cork-oak in Portugal, grown both in the fields and the forest, produces cork for export which is now exported to the value of just over £1,000,000. And these are the old world trees only. There are many similar extra-tropical trees in Asia and America. Some of these I have mentioned in speaking of Arboriculture in New South Wales and Queensland.

Such trees want very little care when once planted, the Olive an occasional sawing out of the centre branches, the Almond sometimes a little pruning back of a too luxuriant growth in some situations. The rest need no more care than the wild tree of the forest.

We must be careful to distinguish these field and roadside trees from the more delicate and highly cultivated trees of the orchard and garden. In extra-tropical countries there are trees of the field, exactly as Acacias and Pines are trees of the forest, and as Apples, Pears, and Apricots are trees of the orchard and garden.

With labour at its present high rates, there seems something peculiarly attractive in a class of trees that once they are planted and grown up out of harm's way from cattle, will yield their fruits without further labour for 100 or 200 years; or, in the case of Olives, for 1,000 years.

If every Englishman who came out to Australia spent a few *years* in the Mediterranean region on the way out, tree-planting in Australia would have a different aspect. An Australian farmer can hardly be expected to have much faith in trees which he has never seen. When, however, Government issues the trees at cost price from forest nurseries dotted over the country, and when there is an experienced Forester not far away, who will talk and advise the farmer about the trees; and when there is a national arboretum in which every valuable tree suited to the district can be seen growing, the position of the farmer is altered. He falls naturally into taking a *double crop* off his land; *and when one crop fails has a second crop to fall back upon.* It often happens that in times of drought field fruit trees bear their heaviest crops. And the Carob is an insurance against drought as surely as payments to an insurance office.

457.—*Government aid to Arboriculture.*

In every country where Forestry is at all seriously considered, it is usual for the Government to assist as far as possible, the owner of private forest (p. 289) and the private tree-planter. In the various European countries the Government give away young trees either free, at half-cost, or bare cost price to the private tree-planter. It is on record that in one year, the Prussian Government gave away as much as 10,000,000 trees. The Canadian Government have recently established a large nursery on a prairie State for the distribution of free trees. The United States Government have long raised trees in the various State nurseries, and distributed them to the public. In 1910, it was reported that the State of New York had 11,000,000 young trees in the State nurseries to distribute to the public at 16s. per thousand. The Japanese have huge Government nurseries and distribute trees

from them. The assistance given by the Belgian Government has been already mentioned (pp. 158 and 204); by the Danish Government (p. 161); in fact every European Government, except the English, gives substantial assistance to the private tree-planter.

In Australia, excepting Queensland, all the States (even Tasmania) raise and distribute young trees *free,* on a small scale. In Victoria I heard it remarked that when an Australian State has an ambiguous Forestry policy, it throws dust in the eyes of the public by importing a nurseryman from the other side of the world, pays him a salary two or three times what he has been used to, and gets him to write articles on tree-planting in the local newspaper. This is rather like burning down a man's house behind him and giving him a meal on the doorstep.

In Australia there has been a distribution of free trees from the Government nurseries in nearly all the States for many years, South Australia being first with this work 33 years ago. The subject came up for discussion at the Inter-State Conference on Forestry held at Sydney, November, 1911. It was stated at the Forest Conference, and I gathered when travelling in South Australia with Mr. Gill, that the distribution of trees in South Australia, though a most useful work in itself, has not been entirely successful. "In many instances," said the Conservator at the Conference, "the trees have been totally neglected, and no good results have followed."

"In Victoria," said the Conservator, "considerable supplies of trees, amounting in some instances to about 80,000 plants per annum, were distributed from about the year 1890. The distribution of trees became very popular, but as time went on the privilege was abused. During recent years it has been found necessary to restrict the issue." Mr. Mackay concluded by saying that he had taken up the position that the people must find their own trees as he could not undertake to supply them. I understand that the distribution in Victoria at present is, that trees issued from the Government nurseries go mostly to Government institutions. Queensland has no Government distribution, New South Wales supports the raising and distribution of young trees if it does not do much in its own nurseries. In Tasmania there is a small State Nursery in place of a former distribution from the Botanic Gardens.

Western Australia distributes trees free, with certain restrictions, aimed at not competing with private nurserymen. I was much pleased with the nursery which has been established for many years at Hamel, and an account of my visit to it in June last was given in the *Western Mail* (Perth) of 31st July.

In South Africa, where the climatic conditions are like Australia, there is a universal distribution of trees from the various Government nurseries throughout the country. The system followed there is distribution, *not free, but at cost price.*

Aid to the private tree-planter is an important administrative matter. In South Africa it used to crop up nearly every year in the Parliamentary debates on the Forest estimates. Almost from the first, the position was taken that plants should not be supplied free, but at cost price. And I was able to maintain this position throughout, though it was criticised on more than one occasion, members of Parliament wishing that for so obviously meritorious a work as tree-planting, Government should supply the young trees free. Once a Minister issued a large quantity of trees free on his own authority, and here the Comptroller and Auditor General ruled that he must pay for them himself.

458.—*Free issues of tree plants lead to abuses.*

My reasons for considering that the trees from the Government Nurseries should be issued, not free, but at bare cost price, are these:—

(1.) People will not value, or properly take care of trees which they get for nothing. Said the Conservator for Victoria at the Forest Conference:—"Many absolutely neglect to give ordinary care to proper methods of planting, even although full and lucid instructions are issued to them." In the distribution of trees from Victoria and South Australia, it has been customary to couple the issue of trees with conditions regarding their care and upkeep. Reading some of these conditions through they appear so hampering that probably a good many people would prefer to pay for the trees, or to disregard altogether, what they must be tempted to consider as mere red tape. In South Africa, trees are paid for (at bare cost price) and are issued free of all restrictions. The tree-planter has only to send his money; and in a few days the trees are waiting for him at the nearest Railway Station.

(2) There is another consideration against the free distribution of trees. Not only is it liable to be abused, and to encourage waste, but it is a serious strain on the too often slender resources of the forest budget. The Conservator of Forests, South Australia, has estimated that, from first to last, some £65,000 has been expended by his Department on the free issue of trees. If, on the other hand, the young trees are issued at cost price, the amount paid for them not only prevents the Forest Department from being out of pocket, but it assists in the upkeep of the large, well organised nurseries which have been established in South Africa and in British East Africa.

(3) As soon as the Government tree nurseries are successfully established comes the cry that they are competing with private enterprise; and if the trees are issued free there is something in the complaint. If, however, the trees are issued at cost price, there is no ruinous competition with the private nurserymen, but rather a healthy rivalry; and very soon the nurseryman comes to the Government nurseries for large supplies which he retails to small purchasers.

I understand that in Western Australia there has been trouble with the nurserymen, and the free issue of trees from the Hamel Nursery is interdicted in the area where they are most wanted, viz., in and around Perth. There seems little doubt that the correct position for the Government to assume is the issue of trees at bare cost price from the nurseries, thus affording the maximum of encouragement to tree-planting and avoiding any unfair competition with nurserymen. It must be remembered, too, that under normal conditions there can really be no rivalry between the large Government nurseries and the small private ones, any more than between a private carrier and the Post Office.

459.—*Nurseries for flowers and shrubs distinct from Nurseries for trees.*

As far back as 1883, when the Government Nurseries were first started in South Africa, there were complaints from the nurserymen, and, no doubt, if there had been free distribution, the difficulties that have occurred in Australia would have cropped up in South Africa.

What has happened there is that the growing and distribution of forest trees has passed almost entirely to the Government nurseries, while the flowers and

ornamental shrubs remain with the nurserymen. It is long since there have been any complaints on the subject. It is recognised that the Government, working on a large scale, and having at its command *accurately named tree seeds,* is best fitted to supply the public with the low-priced young trees required in quantities for forest planting.

The distribution of trees from Government nurseries in South Africa has been of the utmost benefit to the cause of tree-planting and Forestry generally. When a country Member of Parliament, as so frequently happens, is drawing regular supplies of low-priced good trees for the planting on his farm he may be counted on as one of the first to champion Forestry in that district. To many men this is the beginning and end of Forestry, but to them it means a good deal, and farm tree-planting has gone far to form that public opinion on Forestry which now exists in South Africa, and (excepting in Victoria and South Australia) is almost absent in Australia.

460.—*The correct guiding principle of Government distribution of seeds and trees.*

The general principle guiding the distribution of trees from the Government nurseries in South Africa is that surplus trees are issued, but care is taken to raise sufficient trees in the nurseries to meet, as far as possible, the wants of private planters; and then there comes this advantage, that any trees left over can, as a rule, be utilised for planting somewhere in the Government forests. The packing and delivery on to the railway is done by the Forest Department, and there are no restrictions such as those which are enforced in some Australian States, limiting the issue to certain days in the week, and requiring the purchaser to make special arrangements for packing. The ordinary trees sent from the Government nurseries are the same as those used in the Government tree planting, viz., a transplant, securely rooted in a flat kerosene tin tray, 25 plants in a tin (p. 128), but Oaks and a few leaf-shedding trees are sent out up to 8ft. or 10ft. high, and with roots packed in damp sacking.

The private tree-planter has another assistance from the Government nurseries; he is supplied, not only with transplants, but with seedlings from the Government nurseries. Transplants securely rooted in tins run about 4s. per hundred; seedling in tins are also issued at a cost of about 4s. per thousand. Everything is raised in tin trays in South Africa, and to be certain of a sufficiency of plants for picking out, a margin is allowed in the sowings. In a good year this margin turns out a large one, in a bad year a narrow one. Instead of throwing away the surplus seedlings, they also are issued at cost price, and often come as a precious boon to a farmer who wishes to increase the beauty and value of his farm by economical tree-planting. The railage on 1,000 plants rooted in one-half kerosene tins is very small, the weight being only 25 lbs., while any intelligent countryman can pick these out and nurse them till they are ready for planting out.

Thus, the tree-planter in South Africa gets young trees true to name and free from disease, and he pays the bare cost of raising the trees, plus railage from and to the nearest railway station or siding. The Railway Department undertake to water tins of trees in transit. Over five million trees are supplied to the public yearly in South Africa, valued at nearly £12,000. The mean cost is raised by the supply at special prices of large trees in large single tins. In 1912 some 30 tons of tree seeds were sold, valued a little inside of £3,000.

In South Africa farmers are assisted, not only with plants in various forms and sizes from the Government nurseries, but with what is equally necessary—seeds guaranteed true to name, and at cost price from the Government Seed Store (p. 117). Seeds bought in large quantities at wholesale rates can be supplied in

variety, in quantitiy, and at prices that no private seedsman could touch. The South African Government handles from 25 to 30 *tons* of tree seeds yearly. Most of the distributing is done from the central seed store at Cape Town. Here, and in the adjoining nurseries, the seed is tested for germination and being true to name.

It is almost impossible in the open market to buy certain seeds true to name (Eucalypt, for instance), and for many seeds the South African Government has had its own collectors getting seed at a fraction of the shop price of such seeds.

With the issue of plants and trees to encourage tree-planting, it is, of course, incumbent upon Government to afford advice and instruction on tree-planting. This is done in two ways: (1) There is a small treatise on tree-planting, which has been specially prepared and is issued free to tree-planters; (2) farmers and private tree-planters generally, can obtain advice at any time and under all circumstances from the nearest forest office or forest official. Parties are encouraged to visit the larger plantations and nurseries, and facilities afforded for showing them round and explaining the virtues and failings of the different trees.

Thus the South African farmer has the choice of seed, of tiny seedlings, of strong transplants, or of saplings 6ft. to 10ft. high. Seed at so much a pound, seedlings at so much a thousand, transplants at per hundred, and tall young trees at so much each. Every want is cared for, and the trees are at prices within everyone's reach. And there is scarcely any extra-tropical tree worth planting that is not obtainable at one or other of the 163 nurseries scattered throughout South Africa.

461.—*Arboriculture involves continued attention after planting.*

Both in South Africa and Australia it has been sought to stimulate private planting by the offer of prizes and bonuses. In neither country has the system met with success. Private planting is usually a matter of taste, convenience, and opportunity, and any bonus that the Government can offer is usually difficult to judge.

It is not the mere planting of trees which is much use; it is the *after-care* which is more important. *That is the weak point with the Arbor Day planting.* No doubt there are special cases in which prizes for tree-planting may be useful, but on the whole it seems better for Government to give reasonable assistance and advice to the private tree-planter, and to expend its tree-planting funds on public tree-planting which will benefit the public from start to finish.

462.—*Municipal Arboriculture.*

It is important to encourage municipal tree-planting, and it is equally important that there should be some Government supervision over it. Both of these results were achieved in South Africa under a special Act (No. 4, of 1876), wherein it was provided that for every £1 spent on tree-planting by a municipality another £1 would be added by Government *if the tree-planting were of an approved character.* Certain rules were laid down for the guidance of those municipalities availing themselves of the Act. The working of this Act gave some extra work to the Forest Department, but it was of undoubted benefit. It gave a very tangible assistance to those municipalities that were sufficiently enterprising to plant their roads and parks, and the advice of the Government tree-planting experts had a great deal to do with keeping the work on the right lines.

And there was another useful effect: All trees in the planting of which Government had given assistance could not be cut down without Government sanction,

nor unreasonably pruned. It has often happened that a municipality, under the temporary dominance of some scheme for street improvement, or perhaps only to oblige a shopkeeper who wanted to get a more prominent appearance for his wares, will cut down trees that have taken half a century to establish! When the trees were gone everyone would lament their disappearance—when it was too late. In practice the Government permission acts only as a useful drag on hasty tree-cutting. The Government permission naturally would not be withheld in the case of any genuine requirement to cut down trees for town improvements, or in case of real danger to a building.

463.—*State distribution of trees to farmers.*

Particulars of the yearly distribution of trees to the public in Australia will be found at page 184. South Australia has a small distribution of 280,000 trees yearly; New South Wales and Western Australia, smaller distributions of from 80,000 to 100,000 yearly; Victoria is very poor, with not much above half this. Said the artless "Minister in charge of Forests" in Victoria to a recent deputation:—

"Farmers might do a good deal of useful work by planting trees on their property."
Mr. Cumming.—"The farmers do not know where to get the trees."

In South Africa, where excessive town political influence is absent, more is done for the farmer by the Government than in Australia. All the South African guano goes at a nominal price to the farmers. And there is very substantial assistance to farmers in tree-planting. Up to now Australia (with the sole exception of South Australia) has failed the farmer as badly in Arboriculture as it has the Commonwealth generally in Forestry.

464.—*The national importance of Arboriculture.*

The Commonwealth, it is estimated (p. 176), stands to lose £588,500,000 over Forestry during the next 30 years. What the Australian farmer has lost owing to neglect of Arboriculture it is impossible to estimate. But anyone who travels through Portugal, Spain, Southern France, Italy, and Greece, and Algeria in spring, and then over the bare Australian fields, as I have done recently, can form a good general estimate of the magnitude of the loss over Arboriculture!

What has to be remembered is that when the bush is cleared and a ploughable field formed, that field is only yielding a fraction, one-half, two-thirds, or three-quarters, as the case may be, of what the same field would if extra-tropical arboriculture were as well understood in Australia as agriculture. And the study of Extra-tropical Arboriculture is absolutely neglected in the schools and Universities of Australia. There is not even a school primer on Extra-tropical Arboriculture in Australia!

CHAPTER II.

Roadside Tree-growing and its control.

465.—*Roadside Fruit-trees in Europe.*

In the arboriculture of a country the planting of trees along the road-sides and the formation of groves of planted trees at the side of the road is a matter of the first importance in every country where the summer sun is warm and shade grateful. Thus, in India, it is part of the duty of the local authorities throughout the country to plant and to care for the roadside trees and the trees in groves which are there known as topes. In Europe the planting of roadside trees has long had the special care of the best governed countries. The trees lining the French roads in their Spring flowers and Autumn tints and fruits are often wonderfully beautiful. And in some parts of the country, where the public sentiment in favour of trees is most advanced, it becomes possible to plant fruit trees, such as Apples, Pears, and Cherries, with little loss of the fruit to the owners of the adjoining land who plant the trees. This is strikingly the case along the Rhine. The traveller passes along roads, mile after mile, in Spring masses of brilliant blossom and in Autumn laden with fruit. Little, if any, of this fruit is stolen; the public conscience in this matter is excellent; every roadside tree has a recognised owner and the fruit is not appreciably stolen.

466.—*Roadside trees for shade.*

In England, with its mild, short-lived sunny days, trees are beautiful, but of less use for shade purposes; but they grow up fairly abundantly from the hedges so that although road-side trees are neglected in England, any striking bareness of the landscape is usually avoided and the south of England has the general aspect of a fairly wooded country.

In South Africa there has been little planting of trees along the roads generally but many of the streets and suburban roads are well-planted with trees, the work being done by the various municipalities. In the drier parts it is only in the town streets, with the water running down each side, that any good growth of trees would be possible. In the more fertile parts the chief cost in the planting of road-side trees is a cheap, durable fencing post; that South Africa has not got, but it will be abundant in Australia with the fire-protection and regulation of grazing in the forests.

The general position with regard to road-side trees in South Africa is that the Government, under a special Act, reimburses half the cost of planting, provided the planting is done to its satisfaction. The Government, at the same time, takes under its special protection all road-side trees, excepting those on private property. This seems to be the correct position. Road-side trees beautify the land, they are a comfort to travellers, and the Government, acting for the public, should along with the local body, have a joint interest in the preservation of road-side trees.

In South Africa, under the Forest Act, no tree alongside a road or stream of water is allowed to be cut without the permission of Government. The local body

is encouraged to plant trees by having half of its expense refunded; and, at the same time, the felling of trees is made difficult by the rule requiring Government permission before any road-side tree is felled. Before this, hasty action on the part of the local body (Divisional Council in South Africa or Shire Council in Australia, or Municipality in both) had often deprived the public of useful or historical trees. It has sometimes happened that trees have been planted in the streets of a town or the roads outside a town, and after a time, with the change of councillors or because the trees have not grown as well as expected, they have been hastily cut down and their loss afterwards regretted. Hence the usefulness of allowing the Government, through the Forest Department, to have a say in the culture of road-side trees.

467.—*The English neglect of roadside tree-planting in Cyprus.*

In Cyprus, however, our one extra-tropical possession in the Mediterranean, the Englishman's neglect of trees has come out in a painful manner. During the 30 years that the British Government have held Cyprus a splendid system of macadam roads have been made. In this little island there are over 800 miles of Government roads, graded and metalled, and 106 miles of Government bridle tracks; and the roads are maintained in excellent order. One can take a heavy comfortable carriage and pair and drive over the whole island!

But then comes a curious feature: The roads have been made mostly by engineers from England, and they are left without road-side trees; 97 per cent. of the roads remain to be planted! And in Cyprus, where some of the best shade trees are also fruit-bearing, the road-side trees can be planted to yield a profit.

I did not recommend for Cyprus the planting of quick-growing trees such as Australian Wattles or Eucalypts, because they would injure the crops beneath them:—

> The slow-growing Carob and Olive trees take less moisture out of the ground, and, as one may see on all sides, do not injure the crops of barley, etc., grown beneath them. If three-year-old Carob trees were supplied by the Forest Department, together with tree-guards, in ten years these trees would be grown up and yielding fruit. Olives can be transplanted as large trees from the forest, already out of the reach of animals. A stock of Carob trees should be laid down at once in the forest nurseries to be used in two years for road-side planting. (Rep. on Cyprus Forestry.)

Over £250,000 have been spent on roads in Cyprus since the English occupation, so that what is now required to make a complete and comfortable road in the climate of Cyprus would form but a small addition to the cost of the roads, and the shade trees, yielding fruit, would repay cost of planting.

In Australia the general position seems to be like Cyprus, *the Englishman comes into quite another climate and has not been able to change his habits* to fit the climate. It is only very rarely that I have seen anywhere in Australia any sign of road-side trees. What has been done and what remains to be done is referred to under Arboriculture, in speaking of Forestry in the various Australian States.

468.—*Australian climatic conditions demand roadside trees.*

Obviously the beauty of the country and comfort in travelling in Australia demand more attention to road-side trees. One of the measures recommended in the 14th Final Report of the Victorian Royal Commission on Forestry, 1901, was:—

> The reasonable protection of all timber, scrub, or brushwood along the water-side, whether fresh or salt, also on drift sands.

The Forest League, during its short existence, has frequently urged that action should be taken to plant shade trees along country roads. Says the *Age* of the 22nd August, 1914:—

Shire Councillors have come to look on our beautiful native trees as their natural enemies. Country farmhouses bake in the summer sun without a yard of welcome shade. The Philistines of the catchpenny Municipal bodies have allowed mile after mile of the fine trees fringing the roads in arid districts to be destroyed for firewood. Some years ago a fine natural avenue of Red gum, about nine miles in length, was growing between two Gippsland townships. As a breakwind, a protection against dust and a source of landscape beauty, the trees were invaluable. Some of the land-holders cast covetous eyes on the timber, and on the plea that its removal would promote a better growth of grass, obtained permission to slaughter. Now the mid-summer sun glares upon the traveller and he is choked with dust.

I recommend that in Western Australia the South African practice should be taken over, an Act passed reimbursing local bodies the one-half of all their expenditure on approved tree planting, and that there be a general provision in the Forest Act placing all roadside and waterside trees under special Government protection.

In the notes (p. 246) on the most desirable trees to introduce to Western Australia, indications have been given of those which are best suited for roadside and ornamental planting.

469.—*The choice of trees for roadside planting.*

Treating the subject generally, it may be said that the trees selected for road-side purposes should be—(1) Long-lived; (2) leaf-shedding; (3) ornamental.

1. *Long-lived.*—They should be long-lived because there is inevitably a considerable expenditure in establishing a road-side tree. It has got to be protected for many years with a more or less costly tree-guard, and trees exposed, as road-side trees are, to wind and dust, are far more liable to die when young than other trees. Thus the object should be to obtain trees which, when once established, may remain for a century or more without expense or particular care.

2. *Leaf-shedding.*—The indigenous trees of Australia are practically all ever-green, but that in the better watered parts is an accident more than any necessity, for in the northern hemisphere, in the same climate, are many hardy trees which are not ever-green. Leaf-shedding trees cannot flourish in a dry climate of only light winter rain, such as the drier parts of the Mediterranean, because not enough moisture is left in the ground for growth during the warmer seasons when the trees are in leaf. But in a climate such as that of Perth, Albany, and the South-West there is enough moisture in the ground for a good growth in spring and early summer. In my tour in the Jarrah country I saw planted Portuguese Oaks, growing as vigorously as any Oak tree in England. Leaf-shedding trees have the advantage that they renew their leaves periodically, and trees exposed to dust, as roadside trees are, and often to the smoke from towns, are never so satisfactory as leaf-shedding trees renewing their youth and their growing organs every year.

Another reason for preferring leaf-shedding trees is that evergreen trees are liable to render dwellings near them damp in winter and in wet parts of the country to cause trouble with the road engineers. A road engineer has no objection to a leaf-shedding tree, it rather helps to keep the surface of the road together in summer, but in a wet climate, he often objects to an evergreen tree as liable to make the road wet in winter.

3. *Ornamental.*—With the native trees, evergreen and sombre-tinted, it is useful to have leaf-shedding trees for ornamental planting on account of the contrast with the ordinary vegetation. One has only to travel from the northern hemisphere, where the majority of the trees are leaf-shedding, to the southern

hemisphere, where the great bulk of the trees are evergreen, to realise the superior beauty of the leaf-shedding tree. There is nothing in Nature to equal the fresh tints of spring, or the varied tints of autumn in leaf-shedding trees. During the long northern winter of Europe there is naturally a liking for trees that remain green during the winter, and this sentiment has been imported unreasonably into Australian literature and sentiment. The evergreen tree may have its place in cold northern latitudes (even that is a very doubtful matter considering the beauty of the leaf-shedding trees in spring and autumn), but in extra-tropical climates, the beauty of the leaf-shedding trees is unsurpassed. I may instance the Oak Avenue of Cape Town, the first sight which visitors there go to see. A reference may be also made to Darwin's "Voyage of a Naturalist," conveying in glowing language his impressions of leaf-shedding trees when he returned to the northern hemisphere and got once more among leaf-shedding trees after his long voyage in the southern hemisphere.

In view of these three considerations, it was disappointing to find in Perth that Wattle trees had been planted as *road-side* trees. It is true that they have a fugitive beauty when in flower, but they only partially fulfil the last of the three conditions and are scarcely shade-giving trees at best. At Narrogin I noticed the road-side trees planted by the municipality were Insignis-pine and Sugar-gum, the first a short-lived tree and the second scarcely ornamental. Canary-pine would have been at its best when Insignis-pine was dying, and it did not appear too dry there for *Quercus lusitanica,* or *Q. mirbeckii* in place of the Sugar-gum.

It may be asked what trees should be planted to satisfy the three conditions mentioned above. The group of trees that first suggest themselves are the leaf-shedding oaks of Southern Europe and *Quercus mirbeckii* of Algeria; some of these have been described in "Some useful trees for Western Australia" (p. 264). There are three fine leaf-shedding oaks in the damper parts of Cyprus, *Quercus infectoria, Q. pfoeffingeri, Q. inermis.* There are some good leaf-shedding and other trees to be obtained from California and the southern portion of the United States of America, though it must be remembered that only those from California are well-fitted to stand a long, dry summer.

470.—*Private forests not usually commercial investments.*

Private forest ownership, like climatic influences, is a large subject and can be only referred to here.

Naturally Government will use every endeavour to encourage private Forestry, but it is to be feared that for many years there will be no great help to the timber resources of the country from private forests. The tendencies of new democratic countries are against it. As a rule capital can find a better return from other investments; and always a more rapid one. It is the genius of democratic communities to look to Government for many matters which are left to private enterprise in older communities with their leisured classes. Private forest ownership is the privilege of the leisured class more than the class who have to invest capital and look for a rapid and remunerative return.

The alienation of Government forests that has taken place has left a certain area not yet destroyed, and some that the owners intend, for the present at any rate, to keep as private forest. It is held by the owners temporarily as forest for various reasons, such as the development of roads and communications, and the expected rise in the price of timber. Where such forests have not been too badly

destroyed by fire, the cause of Forestry in the country generally would be helped by assistance from Government in making Working-plans for such forests.

To private owners who may wish to preserve their forest as such and are cutting according to a Working-plan prepared by a competent person, it would seem advisable that grants of seed and plants should be made, either free or at a reduction, on the ordinary rates. The terms of such grants would be governed by the Working-plans.

471.—*Private forests a relic of feudalism.*

In Europe private Forestry is supported by the remains of feudalism, primogeniture, and the law of entail. These are still in force in England, though they have disappeared from the more democratic countries of Western Europe, such as France, Spain, Portugal, Italy, Switzerland, etc. In Italy, with its history of small States and Princelings, practically the whole of the forests of the country had passed into private hands, but protected by a general servitude, which prevented the owners from easily deforesting. With the rise of modern Italy the servitudes were abolished. But it was soon found that with the abolition of the servitudes went the destruction of the forests, and it has been found necessary to partly re-establish the servitudes and in cases of absolute necessity, such as Alpine forest, to purchase them for State ownership.

A curious feature about Forestry in modern Portugal (Extra-tropical Forestry in Portugal, British Association), is that with the rise of the republic and the absence of a number of country gentlemen and forest owners of the leisured class, there has been a great extension in the area of private forests placed under Government control and management. It speaks greatly in favour of the good work of the Portuguese Forest Department that last year, when I visited Portugal, I found that the total ownership of private forests that had been brought under the "régime forestiére" amounted to close on one million acres.

In South Africa the experiment of private forest ownership was naturally tried, under the dominance of English ideas, but only with the usual result. The one South African baronet was presented by the Government with a fine forest estate; I fear, however, there is little chance of much of this remaining as forest, the descendants of the grantee finding it necessary to obtain a more rapid return by selling the timber and putting the land under crops.

472.—*Private forests need State aid and oversight.*

It is necessary to clearly distinguish between the Government assistance which is advisable to arboriculture and to forestry; to arboriculture the issue of plants and seeds at cost price and in addition to municipalities a grant on the £ per £ principle; but to owners of private forests there should be more active assistance since the private forest benefits the country at large and may in the end be redeemed for the country.

The assistance that should be granted to private forest owners would be:—

(1.) The preparation of Working-plans for the forest.

(2.) Grants of trees and seeds free or on such terms as the provisions of the Working-plans may seem to warrant.

(3.) Government management at a low scale of pay. This plan exists in various countries and is successfully followed in Portugal (where the climate and conditions are the same as Australia) to the extent of above 1,000,000 acres of forest. This is the procedure in Europe and Japan, and more or less in the United States. Grants of forest to private owners with servitude against forest destruction are not to be commended; forest in the extra-tropics is too easily destroyed by fire. When grants of forest are made to municipalities for water supply, etc., it should be with the proviso that the municipal forest remains either under Government control or the control of accredited forest officers in the employ of the municipality.

Division VIII.

PRESENT CONDITION OF FORESTRY IN EACH OF THE AUSTRALIAN STATES.

CHAPTER I.

Forestry in Western Australia.

473.—Forest area less than proper proportion.

The forest area of Western Australia is estimated as comprising about 20,000,000 acres of merchantable timber (Ednie Brown); the Karri forest about 1,250,000 acres (Richardson); the total area of the country being 624,640,000 acres. The merchantable timber forest of Western Australia thus occupies 1/31st the area of the country. Thus, reckoning in the whole state, the proportion of forest in Western Australia is very small indeed.

The computation, however, is more practical if we consider only the timber wants of the fertile extra-tropical area and make an allowance for the rest. Assuming that there are 10,000,000 acres of fair timber forest still unalienated in Western Australia, and that the fertile extra-tropical area is about 80,000,000 acres, that would leave the forest area one-eighth of the area of the fertile extra-tropical part. This is about one half the proportion (¼) of those European States which are held to have the normal proportion of forest area (p. 12); and the State forest area sinks lower still if one considers that the fertile extra-tropical area may have to provide the larger part of the timber required in the dry, semi-desert and tropical parts, for it is only in a small area of the extreme North that the rainfall is enough to grow good tropical timber. It seems, therefore, that the Government forest area in Western Australia is already less than is required for a well-organised State.

474.—Vitality of the Karri forest.

In 1899 Mr. Ednie Brown stated the timber concessions at about 500,000 acres. In protecting forest from alienation and in working up the matured timber these timber concessions have been of undoubted benefit to the State. The value of the capital they have attracted and of the forest opened up is incalculable. I understand that the greater part of the forest worked is regularised rather than destroyed, and that with suitable arrangements all the worked forests could have been left

permanently improved. It certainly takes a good deal to destroy the Karri forest. It (Karri forest) does not readily burn, and burn or no burn, shoots up again with abounding vitality. In the yearly report of the Forest Department for 1913 is an interesting photo showing a 35-year old natural re-growth of Karri on an area from which it had been extirpated. The area had been trenched, planted with vines, and then abandoned.

The future historian will touch a note of sadness when he relates that the area has again had the Karri forest destroyed. The forest demarcation has not yet been done here, so that no one is really in a position to say whether the area should properly be agricultural land or part of the future State forests of the country.

The return at page 9 of the Annual Report for 1913 shows that there were then 28 saw-mill permits issued for areas varying from 1,000 acres to 58,000 acres in the big-timber country (or to 75,000 acres at Kimberley), and that the total of these sawmill permit areas now amounts to some half a million acres (498,110 in 1913).

475.—*The beginnings of a working forest policy.*

The beginning of Forest Demarcation in Western Australia is thus described in the Yearly Report for 1912:—

> The indiscriminate surveying of large areas of land for selection carrying quantities of valuable Karri has been put a stop to, and parties of surveyors are at present classifying the Karri forests.
>
> Each party is now accompanied by a forest ranger, who points out to the surveyor the land which carries valuable or marketable timber, and instead of splendid timber country being surveyed into blocks for settlement as in the past, such land is now reserved for forest purposes, and only the poorly timbered lands suitable for successful settlement subdivided into blocks.

The Forest Department of Western Australia has been in existence since 1896, or for 19 years. It has cost some £124,000 and collected a revenue of nearly half-a-million. The forest expenditure now is under one quarter the forest revenue, instead of being four or five times the revenue, as it should be while the national forest estates are being organised. In South Australia the expenditure is three times the revenue, and a similar proportion is promised for Victoria. In South Africa also it is three times the revenue, the figures for 1912-13 being—revenue £57,000, and expenditure £119,000 (Yearly Report).

The Forest Department of Western Australia has carried out the police work of the forest and made a beginning with softwood planting and the distribution of young trees to the public.

476.—*Constructive forest policy not yet inaugurated.*

Nearly the whole work of *constructive Forestry* in Western Australia remains to be undertaken, viz.:—

(1.) Demarcation (not necessarily survey).

(2.) A Forest Act giving *fixed tenure* to the demarcated State forests and the usual statutes for the regulation of fires, grazing, timber-cutting, etc.

(3.) Survey, with the classification of the forests and production of a forest map of Western Australia.

(4.) Organisation of the individual forests with a resident (preferably hill-top) Forester in charge of each of the more accessible forests, roads, buildings; fire-protection; introduction of valuable exotics for self-spreading.

(5.) Large plantations of softwoods.

(6.) Arboriculture throughout the State; issue of young trees at cost price from the various forest nurseries; help and advice to the private tree-planter; protection for road-side and stream-side trees throughout the country.

(7.) Forestry education permeating, as in Japan and in other countries, the whole teaching system from the elementary school to the University; arbor days, arboretums and suburban forests being the practical side of forestry education.

My recommendations on these and various minor points have been given in the previous pages of this discussion.

Most of the inspection, travelling and police work which has occupied the Forest Department would have been accomplished automatically or with less cost if the forests had been organised. The small forest expenditure which has taken place has thus been rather of a make-shift character in the direction of more solid, permanent work.

477.—*Forest revenues appropriated to general State purposes.*

A sad misconception of the Forestry question in Western Australia is brought to light by the existence of an accumulated forest surplus of one-third of a million pounds. This, or a large part of it, should have been spent in organising the forest estates, roads, buildings, fire-protection and planting. The interest on this expenditure would be repaid by the improved growth of timber and the easier working of it. The second-growth timber would be better shaped, more even-aged, and stand closer. It would be better for the State and better for the miller. Japan, which set its forests in order at about the time that Western Australia should have been doing so, spent over £250,000 yearly on the work for many years. Portugal, which is reconstructing its forests, spent £232,000 on them last year. Before beginning the work Japan sent missions abroad and made the most searching inquiries into the theory and practice of modern Forestry. £250,000 with the cheap labour of Japan would be equivalent to double or treble that sum in Western Australia. To-day Japan supplies its own timber requirements, and is beginning to export to China and less well-governed countries. Australia took £62,552 worth of Japanese timber for the last year of which I have returns.

478.—*The crisis in Westralia's forest policy.*

The forest problem in Western Australia to-day is how to develop the remaining area of Government forests to the present needs and future development of the country. There is the choice, either to preserve the forest and the great rural industry it represents, together with all the wealth and beauty that forests bring to a country, or to allow the forests to be gradually wasted and destroyed, bringing Western Australia down to the present position of Tasmania and New South Wales, where, as the delegate from New South Wales told the recent meeting of the Forest League in Melbourne, the position of Forestry is the saddest in Australia.

479.—*Official estimate of forested areas.*

The total merchantable and not merchantable-timbered forest area of West Australia is usually stated at 98,000,000 acres, and very curiously this is almost exactly the same as my figure of area required as reserved forest for the whole of Australia (p. 12). On a 20 per cent. standard Australia requires 98,500,000 acres; on a 15 per cent. standard 74,000,000 acres.

Considering the economic conditions—that West Australia has not gone so far on the wrong road in Forestry as some of the Eastern States; that most of the soil is poor in character, and that when it is well stocked with Jarrah and Pine (p. 79) it will be yielding more than it could under any other crop and carrying more population, it seems reasonable to assume that one third of the total forest area required for Australia can best be found in West Australia. Thus, taking the 15 per cent. standard of 74,000,000 acres, we have an area of 25,000,000 acres required as demarcated forest reserves for West Australia, or, in other words, that West Australia should have an area of 25,000,000 acres of permanent forest reserves or State forest. This is rather more than one-fourth the total forest area of West Australia, which is usually taken at 98,000,000 acres. The present area of merchantable timber is usually stated at:—

	Acres.
Jarrah mainly, with Blackbutt and Redgum intermixed ..	8,000,000
Karri „ „ „ „ ..	1,200,000
Tuart „ „ „ „ ..	200,000
Wandoo „ „ „ „ ..	7,000,000
York Gum, Yate, Sandalwood and Jam „ ..	4,000,000
	20,400,000

(Mr. Richardson at Melbourne Conservators' Conference.)

CHAPTER II.

Forestry in South Australia.

480.—*A false start.*

South Africa and South Australia have both little natural forest, and they began forest planting at about the same time (in 1878). There are now some 17,000 acres of planted forest in South Australia with, I understand, a net area of some 12,300 acres of successful planting, against some 80,000 acres of forest planting in South Africa.

South Australia had a sound system of forestry long before Victoria, and latterly the planting of softwoods has been vigorously prosecuted, with the best results.

But forestry in South Australia suffered for many years owing to the bad organisation and injudicious planting of the late Conservator, Mr. Ednie Brown. Perhaps the best that can be said in defence of Mr. Ednie Brown's work in South Australia is, that he was not a professionally trained forester, and acted according to his lights. Mr. Ednie Brown's friends will share with me the regret that, before undertaking to direct the forestry of three of the principal States of Australia, he did not, in the absence of a professional training, obtain more acquaintance with the scientific forestry of Europe, America, and Japan; or even, indeed, with the trees useful for introduction to Australia. Of the exotics quoted in the misspelt lists at pages 50 and 56 (*et seq.*) of his "Forests of Western Australia, 1899," the greater part is unsuitable. In his reports I see chiefly good intentions, platitudes, and forest truisms, with some faulty arboriculture; of modern forestry,

little or nothing. Of the real forest problems with which he was faced, there seems to have been no perception—the organisation of the forests so as to secure protection from fire, cattle, and illicit cutting; the regeneration of the forest, so as to secure a better stocking and an approach to regularisation, with help to the millers in some directions, and a minimum of extra work for conservative lumbering in another. Of introduced trees to fill up the waste space in the indigenous forest and straighten its trees, I see no suggestion.

481.—*A better position attained.*

With this bad beginning, and the whole public opinion of Australia, so to speak, against him, the present Conservator of forests in South Australia had, for many years, a task of extraordinary difficulty and delicacy. Mr. Gill is the doyen of Australian Forestry. I spent a month going through the forests of South Australia with Mr. Gill, and have come to the conclusion that only a more generous appreciation of his efforts are now necessary to enable South Australia to show the same progress in forestry as South Africa. Quite lately only has there been any adequate provision of funds. I visited young plantations of great promise, though the present plantation sites are somewhat inaccessible. Demarcation has long been done; protection against illicit grazing and felling is effective; and South Australia seems to be lacking only in two particulars to render its forest work complete: (1) more funds, (2) plantation sites that are more accessible.

482.—*Present expenditure well directed.*

The Forest Department of South Australia, which has been in existence for 37 years, has still a revenue of under £7,000, but it has risen in recent years, and if the forest plantations had been in more accessible sites, would have shown considerably improved figures.

The expenditure, which, thirty years ago, in the dark days of Australian forestry, was about the same as the revenue, or something less, is now about three times the revenue. No other State in Australia shows nearly this progress. Last year (1913-14) the expenditure was, in round numbers, £23,000. Classifying the expenditure under (a) salaries, and (b) works, (b) is 19/23rds of the whole! This is a favourable proportion—the best in Australia. Many of the Australian States, with their badly organised expenditure, have all, or nearly all, their forestry expenditure under salaries. And this favourable proportion is really better than it appears on paper. Under (a) salaries, in South Australia, is included, of course, all the forest police work. This is usual; but what is unusual is to include the cost of the Forest School, which, naturally, should be under "Education." It is the prevalence of antiquated methods and British ideals which have excluded Forestry from the general educational programme, when, in a country like Australia, it should be the first subject taught throughout the whole string of public schools.

483.—*Schools for teaching forestry.*

There are two Forest Schools in Australia—at Adelaide, and at Creswick in Victoria, together with a forest class at the Sydney University. The Adelaide University is granting a B.Sc. degree in Forestry, which seems open to misconception, for neither Adelaide nor Creswick have it in their power, at present, to impart a first-rate forest training. The Adelaide forest degree would carry more weight if graduates were required, after leaving the Adelaide University, to have passed a year or two at some recognised European Forest School, preferably extra-tropical, studying the practical application of forestry in scientifically worked

forests. It will be 60 or 80 years before this can be obtained in Australia. The Adelaide Forest School has a competent instructor in Forestry, which it is somewhat remarkable Creswick has not. It was fitting that the pioneer work of Forestry in Australia should be crowned by the foundation of a Forest School in connection with the Adelaide University. The useful statistics brought together by Mr. H. H. Corbin, the Instructor in Forestry at the Forest School—"Forestry in Australia"—I have referred to elsewhere (p. 179).

484.—*Practical investigations and research work.*

In connection with the Forest School a useful series of experiments in timber impregnation is going forward. I should suggest that it would be in the interest of Western Australia to offer a small grant in aid of these experiments, and obtain an early report of the results achieved. They have a direct bearing on the sleeper impregnation work now carried on by the Western Australian Government, since the same plant which it there used for powellising could, with small expense, be fitted for zincing and other processes of more established value.

485.—*Softwood plantations well developed.*

A large area of *accessible softwood* planting is the outstanding feature in the South Australian Forestry of the future. That I think is quite clear. The softwood plantations of South Australia are at present the best in Australia, though the planting programme for the future is more extensive in Victoria; and New Zealand, it should be remembered, has been planting 2,000 acres yearly for some time. The large and increasing importation of softwood to South Australia makes it evident that, instead of planting half a million trees yearly, the planting should be more like ten millions (the old Cape Town figure); and, most important of all, should be more accessible—on the Mount Lofty Ranges for choice. That is the spot where Nature intended the house-building timbers of Adelaide to be grown. None of the other Australian capitals, with the exception of Hobart, have an equally well placed forest area close to the capital city. With the present high cost of labour in Australia, inaccessible planting sites are scarcely to be thought of.

Rabbits are troublesome in all the plantations. The total area enclosed for planting is 19,224 acres.

Only in South Australia is there to be seen any large area of old Pine-planting, and that is nearly all *Pinus insignis,* though enough Cluster, Aleppo, and Canary pine have been planted to show how well these will grow. At Mount Burr there is a small area of *muricata*-pine. The planting of other pines is only in very small quantities, or as sample trees, at Bundaleer and Wirrabara. Their growth is, however, always below that of Insignis.

The net result of South Australian experience is that, for dry-country planting, Aleppo Pine, as in South Africa, is to be preferred. It stands drought that would kill Insignis, and grows with a free, natural regeneration, only equalled by Maritime (Cluster) pine. This shows generally a growth that is considerably inferior in South Australia to that in South Africa and Portugal. It is probable that this inferior growth in South Australia is due to an inferior strain of seed having been employed—the Landes Pine, from which most of the seed of commerce is obtained. The Conservator is now getting seed from Portugal.

486.—*Canary-pine proved best for South Australia.*

Canary Pine is the *valuable* Pine in the South Australian plantations. I scarcely ever saw it growing otherwise than well, and at 40 years, when Insignis

Pine begins to die off, it is looking its best. Three reasons have delayed its planting in South Australia. (1) Its real value was not appreciated. This was only natural, as no account has yet been published in English of Canary-pine growing in the Canary Islands, and the experience with its cultivation in South Africa is quite recent. No English forester had seen the Canary-pine in the Canary Islands till my recent visit. (2) Its rate of growth up to 25 or 30 years is only half or two-thirds of that of the Insignis Pine. (3) There has been a difficulty in planting the Canary Pine. Open root pine-planting is followed in South Australia, and that, though quite satisfactory with a tree so easy to plant as Insignis-pine, does not give good results with Canary-pine. I suggest planting trays used as in South Africa.

One of the best samples of Canary-pine planting I saw in South Australia was in the Bundaleer forest, six or seven miles from the railway at Jamestown—23in. rainfall, 1,500 feet elevation. A small plot of some 300 trees at 30 years averaged 13in. x 50ft. high, looked very well, had few vacancies, with a mast-like growth though planted as sparse as 10ft. x 12ft.

The Insignis alongside is about 15 per cent. larger, but more knotty and branching. As beams in a house, the Canary-pine here is possibly worth twice the Insignis.

There are large plantations of the Insignis Pine in the southern strip of South Australia, where the latitude is similar to Melbourne, but the climate more temperate.

At Mount Burr and Penola I saw plantations aggregating some 3,500 acres: average rainfall 27in. at Penola and 31in. at Mount Burr. Mount Burr is a typical Pine area with its deep white sandy soil, which is yellowish and a better quality below; on the whole, in soil and climate, much like the great Pine forest of Leiria, in Portugal. The finest and oldest Insignis Pines are at Mt. Burr, in an avenue round the Forester's house, at 27 years old averages 17in. diameter x 101ft. The bulk of the Insignis-pine planting in the south-east is recent, and the results attained very promising, though perhaps from 6 per cent. to 10 per cent. of the planting has been attacked by the disease described under *P. insignis* (p. 258), Diplodia pinea.

487.—*Eucalypt planting in dry areas a questionable policy.*

A day's journey north of Adelaide are the old-established Bundaleer and Wirrabara plantations. I can only refer all too briefly to these here.

The mixed planting at Bundaleer affords an interesting study to the Forester; but, on the whole, the Eucalypt planting, like some similar planting I saw in Victoria, is disappointing. Both indicate that Eucalypt planting in dry areas in Australia is financially doubtful. Sugar-gum is the most disappointing at Bundaleer. Western Australian trees—Yate (*Euc. cornuta*) and Tuart (*Euc. gomphocephala*) —*grew fairly for twenty years,* and then took to dying off. *Euc. viminalis* should never have been planted. The comparative failure of Sugar-gum in plantations I have referred to at page .

At Wirrabara is the oldest of the South Australian planting, and it is to here that the student of arboriculture in Australia should direct his steps as soon as he has seen something of the natural forest. I cannot attempt to describe the varied planting at Wirrabara. The pick of the planting is at Whyte Park. The average rainfall for the last 28 years at Wirrabara is 23 inches, which is too low for the best growth of timber in this latitude and elevation (1,800 feet). Work began here in 1876. Bundaleer has the larger planted area, but Wirrabara the

greater variety and the largest Pine area. But the softwood area in the northern plantations is far below that of Mount Burr. Work began at Wirrabara in 1876, which, curiously, is exactly the same date as the first forest plantations in South Africa.

A South African forester will mark the absence of a regular forest arboretum, but that is a failure not confined to here, nor to South Australia; it is general in all the forest work of Australia.

488.—*Magnificent pine growth at Whyte Park.*

The finest growth in any forest plantation on the Australian Continent is to be seen at Whyte Park, a few hours' drive from Wirrabara. The ground is gentle mountain slopes, elevation some 2,500 feet, latitude 33deg., and rainfall something over 30 inches with about one-fourth falling in summer. Here we see Insignis-pine and the Mediterranean Pines growing to perfection. It is cold enough and wet enough for the Corsican variety of Laricio Pine to do fairly well—a good straight growth, at 13 years averaging 15 feet high; but there were some 40 per cent. failures which have not been replaced. Aleppo Pine at 13 years averages 4 inches diameter and 26 feet high, planted 6 feet by 6 feet; there are practically no failures, and the side branches are cleaned off or dead up to 10 feet. It is the best Aleppo Pine planting I have seen in Australia.

Altogether 1,153 acres have been planted at Whyte Park, of which the major part is Eucalypts. Why so much hardwood should have been planted here and elsewhere in South Australia is not clear to me; but possibly local demand may justify it. The greater portion of the softwood planting is Insignis, as that gives *about double the cubic content of Cluster and Aleppo.* I saw some Aleppo planted 8ft. x 8ft. which, it is admitted, planted 5ft. x 5ft., would have given much better results.

Below the Whyte Park hut, from which a fine view is obtainable (an ideal site for a Forester's cottage), is to be seen the finest Insignis Pine planting in Australia. The trees have an absolutely straight, perfect growth, and at 25 years average 20 inches diameter and 100 feet high. I hope I shall never lose the vivid recollection I have carried away with me of this fine growth. I hope that before long a systematic valuation survey will determine the yield figure (Acrim). It may possibly be the highest in the Southern Hemisphere as there is very little doubt it is in Australia—for a pine forest. It was originally planted 8ft. x 8ft., and is practically that still.

The only criticism one could apply to the softwood planting at Whyte Park is its inaccessibility. Probably equally good results would have been obtained on the Mount Lofty Range, and that, economically, is where this planting should have been.

489.—*The economic position of forestry in South Australia.*

Across the Mt. Lofty Range and some 30 miles from Adelaide are the Kuitpo plantations; elevation 1,400 feet, 30 inches rain more or less throughout the year. Here I saw Cork Oak, Camphor, Insignis, Aleppo, Canary, Cluster-pine, and hardwoods. But the feature of the day's run of 60 miles in a motor car was the quantity of Pycnantha Wattle, planted and natural.

Particular notice must be taken of a successful Wattle plantation got by simply sowing the seed below an old sparse Gum forest. This is well worthy of attention for imitation in the Jarrah forests. Where Jarrah grows, South African experience has shown clearly Pycnantha Wattle will grow, and Mr. Gill is emphatic

that Pycnantha Wattle is essentially a shade-bearing species. That is also my experience in South Africa. But, just now, it will not pay to strip Pycnantha, and this is the richest bark known. In the Kuitpo plantation was young Insignis, showing a faster growth than the Whyte Park trees, but this very rapid early growth cannot be expected to be maintained. At 10 years the Kuitpo Insignis averages 8 inches diameter and 70 feet high.

South Australia has not got much to improve in its forestry. It has long been a model to the other Australian States. But it should buy up every piece of ground that can be had on any reasonable terms, adjoining or near the railway where it passes over the Mount Lofty Range, and, I should say, put the National Park under good forest. It is a lamentable fact that half the population of South Australia, and most of the industrial population, is in Adelaide; but that being so, it only remains to *grow the timber on the nearest spot to Adelaide* where there is a good rainfall, viz., the Mount Lofty Range. That softwood growing there should be done as a mere matter of business is clearly shown in the useful pamphlet of statistics, issued by Mr. Corbin, the Forest instructor at the Adelaide University. South Australia is now paying over £1,000 a day for imported timber, mostly softwood. South Australia has paid altogether nearly £4,000,000 for imported wood, the great bulk of this softwood, since 1905. These figures are quite sufficient to support a forest loan, and possibly a forest loan could be had on easier terms if it were sought for the specific object of which the necessity is disclosed in these figures.

The planting of *Pinus canariensis* should be greatly extended; I found it growing extraordinarily well in the Adelaide Parks, but the exact value of the tree was not known.

490.—*Extending the forest areas by purchase.*

The area of the State forests is returned at only 154,000 acres, 0.03 per cent. of the total area of the State. Efforts as in Victoria are being made to extend it by buying back favourable areas that were alienated in the bad old days. For this purpose there is a special Act 1082/10 in South Australia. During the four years that the Act has been in force, a total of 18,417 acres of forest has thus been redeemed. On the other hand, 8,537 acres were surrendered in 1912-13, being land let on perpetual lease with right to purchase. The corresponding figure the previous year was 5,329 acres.

491.—*Fire precautions.*

Though so apparently inaccessible, there may be something to be done in the regularisation and extension of the native Cypress-pine forests, so well illustrated in the last Yearly Report. This is a more valuable timber in itself than any of the pine timber now being imported, but it often requires the forester's art to produce it sufficiently long, straight, and free of knots. Usually it is too slow-growing for economical planting.

Fire-protection has fire-paths and special watchers in the dry season, but not the watch-tower business (p. 22). I visited all the important planted areas and found them well protected with fire-paths. The total planted area (now about 17,000 acres) has been successfully fire-protected from the beginning with only small casualties. The fire-paths are ploughed lines, as in South Africa, and represent about 10 per cent. of the protected area, while the cost of ploughing is from 6s. to 10s. per acre. Some 14,000 or 15,000 acres of Eucalypt forest (Stringy-bark) is also being fire-protected, some of the fire-paths here being as wide as three chains. Fire-stations with outlooks over the forest are being put in hand.

492.—*Pine planting in the Coorong sand waste.*

The desert of sand-drift and shifting sand at the mouth of the Murray River, termed the Coorong, concerns both South Australia and Victoria, but is perhaps more accessible from South Australia. It is said to be some 100 miles long by 10 or more broad; to be white barren sand, dry and brackish in summer, partly water-logged in winter. As such, it is an ideal area for reclaiming by planting Cluster-pine. It seems to closely resemble the desolate Landes of the old days in France, except that there is no malarial fever. (And the malarial fever in the Landes would not have existed now, whether the area had been reclaimed or not.) To-day the Coorong is a trackless desert, like the worst of the Landes in the old days.

It differs somewhat from the Landes in latitude and rainfall. The latitude is better for the growth of Cluster-pine than the Landes, the rainfall not so good; and it might be advisable, in any scheme of pine-planting on the Coorong, to use both Cluster and Aleppo Pine; the Cluster-pine in the wetter portions, the Aleppo-pine in the drier parts or wherever the sand turned calcareous. This often happens with the coast sands of South Africa. It is probably due to marine shell deposits. The whole Coorong area seems suited to the growth of Pines, and to nothing else but that, and Marram grass.

It would probably be best to begin with sheltered areas, starting the growth of Pines there with the chance of their spreading naturally, as shelter increased, with their up-growth, and as the Marram grass fixed and raised protective dunes. On the shifting dunes it would be only necessary to introduce Marram grass, and thus fix them and raise them. I have raised a dune 30 or 40 feet high in three years, in the midst of a bare flat of drifting sand, by merely planting a patch of Marram grass. On the Cape Flats near Cape Town, and elsewhere on the sandy southern flats of South Africa, this work has been going on for a quarter of a century. The growth of Pine trees on the Coorong would not at first be equal to that of Pine on the mountains, but on the other hand the cost of planting would be much less, since there would be no clearing to do and little ploughing or cleaning, perhaps only sowing seed broadcast.

In exposed areas, where the sand had to be fixed, the work would be more costly. Exactly what would be the growth secured, and the cost of the work, could only be determined by experiment. The planting of the Coorong is a work which should be put in hand at once, for there is here, apparently, about 1,000 square miles of shifting sand, useless for anything else, and the two States concerned, South Australia and Victoria, are those which have no softwoods in their indigenous forests, and are paying the most for imported softwood. This Coorong area might by itself supply enough pine timber to meet the whole of the present importation of softwood.

493.—*The fostering of Arboriculture in South Australia.*

In Arboriculture, South Australia is the most advanced State in Australia. The Conservator estimates that in South Australia between £60,000 and £70,000 worth of trees have been given away. I have referred elsewhere (p. 117) to what I consider the mistake of issuing these trees free instead of at cost price. The tree-planting in the parks and streets of Adelaide, though leaving much to be desired, is the second best in Australia, after Melbourne.

One must hope that Adelaide in time will outgrow the ideal of dreary expanses of glaring and dust-swept asphalt, and take to the beautiful trees one sees in the boulevards and streets of southern Europe. To suppose that these trees would be any impediment to the comparatively small traffic in the streets is merely

nursing a local conceit. It is true that unsuitable trees (Moreton Bay Fig) were planted in King William Street, but that is no reason for having no trees there now. There is plenty of room for a double, or treble, row of trees on each side of King William Street, or, at any rate, a single row like upper Collins Street, Melbourne.

Among the attractions of Adelaide, one misses the suburban forest and two arboretums of Brussels, and the suburban forests of other towns on the Continent of Europe (p. 157). The Adelaide parks are so beautiful that one cannot but wish that their tree-planting should be more skilful and varied, and the trees in the Botanic Gardens and streets improved.

South Australia has eleven forest nurseries whence young trees are issued free to applicants under certain conditions. *This is more forest nurseries than there are in the whole of the rest of Australia put together*—that huge Continent of bare farms, half-empty Gum forests, and lost wealth in extra-tropical arboriculture on the fields. The able and well illustrated report of the Forest Department for 1913-14 concludes with these words:—"It is now 32 years since free distribution of trees commenced, and during that period 44,239 persons applied for them and received 8,727,000 trees.

And, for comparison only, I may mention the South African figures. In the one year 1912-13 as much as 5,250,000 young trees were sold at cost price to the public for £14,000, from 163 regular nurseries, besides smaller temporary nurseries. And in the same year 50,000lbs. of tree-seeds were sold by the Forest Department to the public for £2,618.

CHAPTER III.

Forestry in Queensland.

494.—*An ill-defined position.*

On January 1st, 1915, Queensland had barely 1,000,000 acres of permanent State Forest, and 3,000,000 acres of temporary timber reserves. The year's progress in effective Forestry may be almost summed up in the statement that the area of permanent State Forest was increased by 82,600 acres and of temporary forest reserves by 3,523 acres.

There was no alienation of valuable forest during 1914, and there is ground for hoping that the era of reckless forest alienation without demarcation has come to an end in Queensland; but unfortunately much of the area reserved was put on the reserved list without demarcation, and like so much of the amateur Forestry of Australia will have to be revised. The experience of Queensland shows clearly how unwise it is even to reserve forest without a properly conducted forest demarcation.

495.—*Nature's bounty to Queensland.*

Queensland has been termed the softwood forest State of Australia, as Western Australia is the hardwood forest State. I heard of 80 to 90 million cubic feet of Hoop-pine timber, above the felling limit of 24in. diameter in some 30 or 40 reserved forests in the Dawe's Range, and of a similar quantity in private forest, not yet destroyed. This is about equal to four years of the present timber importation

Regrowth of *Eucalyptus pilularis*: Queensland.

Photo: D. E. Hutchins.

to other Australian States. There is said to be 40,000,000 acres of forest with timber of *commercial* value in Queensland, and some three times that area of timber useful for local purposes, but these figures are only rough estimates.

There has been no survey of the forests, and though there has been for long a forest office in Brisbane, no forest map of Queensland, I believe, has yet been produced. Indeed, for many years in the past a purely ornamental Forest Office was maintained in Brisbane, while in the forest all was waste and confusion.

Queensland had a "Director of Forests" from 1905 to 1911, but this had little to do with any real executive Forestry. There was scarcely any working Forest Department. Forest, containing not only the cream of the Eucalypts as in New South Wales, but first class softwood—Red Cedar, and good softwood Hoop-pine, continued to be given away to anyone who would undertake to destroy it. No softwood ever to be imported will equal Red Cedar (*Cedrela australis*).

496.—*Scandalous waste of Red Cedar.*

The destruction of Red Cedar in Queensland has been like the destruction of Kauri in New Zealand, a national scandal, and a blot on the civilisation of the 19th century. It will probably never be known whether Queensland or New South Wales has had the greater share in this iniquity. The traveller hears the story of the Barron River Cedar before he reaches Queensland. The foul odour of such deeds remains long.

It was, no doubt, a Federal mistake to commit the destinies of so fair a heritage to the half-educated theorists who once held sway in Brisbane. For mistakes, such as this, Australia is now paying out £10,000 a day as a beginning. It is no use bewailing the past, except as a warning for the future. The burning of the softwood forest of Queensland was like the burning of bank-notes, not gold at the moment, but gold in the near future. The frontispiece to the Yearly Forest Report for 1914 represents a giant Cedar with 2,666 cubic feet of sawable timber and a Royalty value, if sound, of £320. And this was a "selector's" tree.

The best of Queensland's forest is gone, and with it the best of Australia's forest inheritance in softwood timber.

Neither is there much left to the State of the fine hardwood forest between Brisbane and Maryborough, the end of the great coastal belt of Eucalypts, with timber so fine that I involuntarily compared it to the Karri in Western Australia. It is pathetic now to see scraps of this forest along the railway, labelled with boards as State Forest Reserves. Here on the main line of railway near the Capital, and at the industrial centre of Queensland, there should have been carved out the national forest estates, the centre of great industries that might have supplied the world with the cream of the hardwood forests of Australia. Nothing quite like this lost forest is left in Queensland, and not much in New South Wales.

497.—*Boom and delusion.*

The sham of Forestry in Queensland some 15 years back was increased by the appearance of a particularly well executed book on the timbers of Queensland. Our mouths watered as we turned over its beautifully illustrated pages in South Africa. British manhood and money flowed at the time to what appeared to be a well-ordered State. It did not transpire then that nothing was being done to organise and conserve the chief natural resource of the country—its slice of the best Eucalypt forest in Australia; that settlers were being given valuable forest land that ought to have remained to the State, and that they were forced to destroy the forest straight away to make a living out of scanty crops, raised on the ashes of the forest

Government money which should have been spent on organising the neighbouring State forests and assisting them with a little ready money, was directed to other uses, usually to the already overgrown towns.

And much of this forest, after being destroyed, is left to run to worthless scrub. (I use the word "scrub" in its ordinary sense, not in the sense it is understood in Queensland.) There is little more than a nominal tax on unimproved land. Not even milch goats are kept on the forest that has run into scrub.

498.—*Financial phases of present position.*

At present the Queensland Forest Department is selling about 10,000,000 cubic feet of timber yearly for some £70,000 (Royalty on milled timber) or, at an average rate of nearly 2d. per cubic foot. This is about half the South African average, but it is not low for Australia. If the accounts were correctly kept, the timber reserves of Queensland should be shown as having a revenue of some £100,000 a year or more, for at present an official veil is drawn over the Railway timber in Queensland, making the Railway Expenditure to appear on paper less than it really is, and the forest revenue to appear also less. Queensland is not the first State that has done this in early days, but now that both the Forest Department and Railway Department are revenue-producing units to continue the practice is simply bad book-keeping.

The prices realised for timber in Queensland are certainly good for Australia. From some figures I inspected, the timber royalties average about 10 times those in force in Tasmania (not that Tasmania affords any real point of comparison, since Forestry in Tasmania has not yet begun); but, as a fact, the prices realised for timber in Queensland and the mode of selling the timber are excellent. I have a note of Hoop-pine being sold in Queensland for 4½d. the cubic foot of milled timber, plus auction rates. Queensland rates are said to rule higher than New South Wales, but the statistics at page 280 do not show this. Most timber in Queensland is sold by auction. The timber sales have increased from £22,000 in 1907 to £75,000 in 1914.

499.—*The half-round railway sleeper.*

Queensland has the most sensible railway sleepers I have seen in Australia; they are like those on the Continent of Europe, not like the so-called "mathematical" sleepers of England. Queensland cuts these itself out of the local forest, and *does not discard* the half round and wane edge sleepers that are rejected by most English railway engineers, and which, with Eucalypts are often the best and soundest timber. When I was at the State Sawmills at "Big Brook" in Western Australia, I saw perfectly sound wane edge sleepers coming over every few minutes on to the waste heaps and *being burnt*. For many years there was wastage in sleepers from this cause in South Africa, *vide* my *Journal of a Forest Tour* (Miller, Cape Town). This sleeper wastage means much in the end to the forest. I saw, too, in Queensland a good line with light rails secured by putting in these economical sleepers unusually close. Good developing lines on the useful 3ft. 6in. gauge, sleepered in this way in fairly easy country, are said to average only £2,000 per mile.

500.—*Forest organisation still in the incipient stage.*

Good forest demarcation has been done, and is being done in Queensland. It actually began (before Victoria) in 1906, though at that time the demarcation was weak; it was more on paper than out of doors, and is thus not as well able to resist the assaults that are now being made on it.

Queensland has scarcely yet got a working Forest Department. Its field staff, according to the last Official Forest Report (for 1914) is only five inspectors, nine rangers, and four assistants.

Nor has it yet got its forest reserves at all secure. They should be put into a "national trust," remarked a Queensland Parliament man to me. Queensland has not yet begun to organise even its most accessible forests with roads, buildings, nurseries, and a centrally placed Resident Forester, able to drop on to any outbreak of fire in 10 minutes (pages 20-30, 44). Forests so organised are more economically and effectively worked than by *visits* of travelling inspectors.

501.—*Unknown potentialities of Queensland forests.*

We do not yet know what valuable exotic forest trees may not spread like weeds in its forests, when once introduced to the fertile soils and forcing climate of Queensland. Queensland has not yet tested, in well-placed arboretums, its tree-growing wealth, and every day lost in starting the arboretums means something where there is the high growing capacity of so many of the Queensland climates. In this sunny, semi-tropical climate, where it is pleasant to recline in the shade and eat the fruits of the tree, arboriculture, after agriculture, should be the settler's first pursuit.

We have seen how, in the old Mediterranean countries, arboriculture may double the productiveness of the land. Yet, by an extraordinary contradiction according to the last Official *Commonwealth Year-book* (1912-13), Queensland is behind all the other Australian States in practical arboriculture. It is the only Australian State without any forest nursery, for the distribution of young trees to the public. In this respect it is below even Tasmania, which has got one little nursery and distributes yearly some 5,000 trees to the public.

There is a whole range of trees which, without any of the cultivation of the orchardist, will yield useful products, and in a sunny climate can be planted in the fields without the least detriment to the field crops. This one sees all along the Mediterranean. In Cyprus I saw the fields everywhere studded with Carob and Olive trees. Cyprus has a surplus barley crop which is exported and brings the little country some £80,000 a year, while the Carob trees growing over the barley give another £80,000 export a year. But let me take a concrete case nearer home. A vigorous-growing and useful tree might be found to check the Prickly-pear.

502.—*The "Prickly Pear" pest.*

The Prickly-pear (*Opuntia inermis*) is spreading in Queensland as other Prickly-pears have spread in India and some other countries; but in no other country of the world has it assumed so much the dimensions of a national disaster as in Queensland. Mr. Maiden has told the British Association (Federal Handbook) that some 30,000,000 acres have been over-run with this pest in Queensland, and that is rapidly spreading at the rate of something like 1,000,000 acres a year.

But some trees will also spread, and in the fertile climate of Queensland spread rapidly, and almost any tree with a good shade would kill out or stunt the Prickly-pear. The Mesquit (*Prospis juliflora*) when introduced to Hawai spread there as has the Prickly-pear in Queensland. But instead of it being a pest, it is of use for firewood (a first-rate firewood), and furnishes a sweet pod for cattle feeding, thus giving useful country for cattle and goats. Anything in this world is better than Prickly-pear. In one of the Cape plantations (Robertson) Prickly-pear and Mesquit are growing side by side. Mesquit would have to be watched

at first to see that it did not spread too rapidly and become a pest. It has shown no sign of doing this in South Africa.

Better than Mesquit, however, would it be to replace the Prickly-pear with a Pine forest. There may be one or two Pines which would come up strongly over the Prickly-pear, and which the Prickly-pear would help to protect from fire in their youth. And then, when the Pines grew up into a dense close forest, they would kill down the Prickly-pear as nothing else could.

503.—*The "Prickly Pear" dies in shade.*

I know from experience that Prickly-pear (I have seen a good deal of it—I had a Prickly-pear arboretum at one time) is distinctly *not one of the few vegetable species that can survive* under the dense shade of forest trees. And Pines, with their close growth, and falling litter of pine-needles, have the common property of killing down all vegetation beneath them. A clean forest soil is the general characteristic of Pine forests, the world through; whether in the great cold-country Pine belt of the Northern hemisphere; in the Extra-tropics of the Mediterranean, Califonia, or South Africa; or the rare tropical pine forests of Asia and America. For Queensland, the Forester would naturally try first an extra-tropical summer rainfall Pine, properly fitted to the environment, in climate and soil; but, of course, practice is better than theory. If Queensland had begun testing its tree wealth 60 years ago, conclusive results by now would be available. The Forester could walk through the arboretum and plantations, and very soon decide what were the Pines which should be planted amongst the Prickly-pear, to spread self-sown, and kill down the Prickly-pear.

504.—*Nature's hint to kill a pest.*

All that remains to be done now is to form trial plantations in the Prickly-pear areas, and watch the results. And the Pine-planting could be arranged in strips so as to gradually circumscribe the outward spread of the pest. It is certain that under proper advice there would be little risk of final money loss in forming Pine plantations, with £10,000 to-day, and much more in a few years going out of Australia for imported pine timber, not to mention the value of the importation of paper pulp, and even of paper; for one may take it as certain that there would be more paper mills in Australia if good softwood paper pulp were being produced in the country.

I do not know the cost of killing Prickly-pear with the gas treatment, but it is not likely to be as economical as pine-planting, let alone the indirect profits to be derived from pine-planting in Australia.

On the whole, the experiment seems worthy of a trial, as being likely to partially meet a great evil. The trial should be made on the wetter side of the Prickly-pear area, or where the Pine trees are likely to grow most vigorously. I understand that the indigenous Cypress-pine cannot hold the Prickly-pear in check, so it will be only a shade-bearing strongly growing exotic pine that can have much chance of doing so.

505.—*Forest Department a mere appanage to Lands Department.*

The Queensland Forest Department is under the Department of Lands, but the evils that have resulted from this combination in New South Wales, Western Australia, and Victoria, are said to be not apparent in Queensland. Nevertheless it is an anomaly which would be better redressed, as early as may be. I have always considered that until the true position of Forestry in the State is recog-

nised, and until there is a Minister for Forests, forestry is better yoked with the Public Works Department, especially Irrigation, the function of forestry being to produce timber and husband water supplies.

The Queensland Forest Department is on the scale at present of a country without any pretence of being abreast of the times. It consists simply of the Conservator, his office staff in Brisbane, and some 18 Inspectors or "Rangers." There are no resident Foresters or organised forests. The Forest Department is now very properly examining the reserves with a view of having the most suitable of the temporary reserves brought on to the permanent list. The Queensland Forest Department used to be described, humourously, as the Conservator, six men and a girl—a man for each day in the week and the girl for Sunday. The Forest Department is still nowhere near the organisation required to deal with the rich and extensive forests of Queensland.

506.—*Sawmill working of the Forest.*

The present saw-mill production, from private and State forests, is about 8,000,000 cubic feet of soft and 5,000,000 cubic feet of hardwood yearly. There is very little softwood, and no hardwood imported at present. Here Queensland is distinctly better than Tasmania, where, in better class houses, about half the timber is imported from the Northern hemisphere, and nine-tenths of the island is little more than a more or less ruined forest. There are in Queensland altogether some 250 saw-mills, employing about 4,600 hands. It is somewhat surprising that the saw-milling interest have not, as in New South Wales, compelled the shiftless Government to at least take the first step in Forestry with the reservation or redemption of 8,000,000 or 10,000,000 acres of forest.

507.—*Railway sleepers.*

There is an excellent out-turn of sleepers for local use, but more should be done to develop the export of sleepers. It will be several years before the South African forest plantations are old enough to appreciably affect sleeper requirements in South Africa; so that that market has to be thought of. South Australia is still using some metal sleepers; South Africa has definitely tried metal sleepers and given them up. I am not in a position to say whether sleepers might not be sent to the Argentine to compete with Quebracho (Ironwood), or to other parts of South America where there is no Quebracho.

Fires and the over-mature hollow timber of the virgin forest have left a practically unlimited quantity of sleeper timber available in the Queensland forests, and much of it is of first rate quality. If a good export trade in sleepers could be developed, the Tallow-wood, Redwood and Box (but not the Ironbark) could go into export sleepers, while the inferior, more perishable hardwoods could be kept for home use in the developing railways now being made so economically in Queensland.

Such home sleepers could easily be much rougher in shape than the good rough sleepers now employed, for the only real objection to the sleeper which is sound but rough and crooked in shape is that it packs badly on board ships. On the Continent of Europe to-day trains on the State railways are travelling at speeds 20 per cent. or 30 per cent. above speeds of English railways, and using crooked and roughly shaped sleepers that English railway engineers, used to the neatly-squared sea-borne sleeper, would not look at.

508.—*The realisation of over-matured forest timbers.*

It should be the policy of the Queensland Government to tempt private enterprise to work up the large supplies of old over-mature timber, and if private enterprise hangs back to do it itself, as the West Australian Government is now doing; for it is the duty of the State to see that the State Forests are worked and developed in the public interests. This is well recognised on the Continent of Europe where the State does much work in the State Forests. In Germany the State works the timber itself throughout, and spends the best part of £7,000,000 yearly in doing this. No doubt the ideal system is where the State and private enterprise work side by side, as in some of the French State Forests (Resin-working on the Landes), for then each acts as a check on the other. The State's tendency to wasteful working is checked, and the tendency of private enterprise to give too large a share of the profits to the capitalists is checked.

509.—*Three valuable Queensland trees nearly extinct.*

(1.) Cedar (*Cedrela australis*).—One hears still a good deal of Cedar in Queensland. It is the most valuable timber tree of Australia, and Queensland shares with New South Wales the stigma of having nearly destroyed it. The best opinion in Queensland seems to be that now there are but few trees of it left. There is, however, a good natural regrowth of Cedar in places, and it would not be difficult, with fire-protection, improvement-felling, and some planting, to restore Cedar to its original position; while as soon as the forests were organised and regularly worked it would be quite easy to get up a stock much exceeding, both in usefulness and quantity, that which grew in the old fire-swept forest of the "Blacks." Red Cedar seems to grow fast enough to pay the cost of planting. Mr. Jolly's preliminary tests show that Red Cedar is the fastest growing of the commercial dense forest ("scrub") timbers. (Yearly Report, 1914.)

It took a long time to get good Cedar seed to South Africa, but Cedar is now growing apace in several of the native forests. Like many other trees, it does not thrive away from the shade and shelter of the forest. In one of the South African forests (and that not where it is best placed) it is reported growing 10 feet in two years after being planted. Up to the present, more Cedar has been planted in South Africa than in Queensland. A small beginning has been made in Queensland both with planting and assisting the natural regeneration of Cedar. Of course with no funds and only a microscopic Forest Department, little can be attempted.

(2.) Silky Oak (*Grevillea robusta*).—This valuable tree, too, is nearly all done in Queensland. It is only to be met with now in a few localities. It is easily propagated; its value incontestible. It is the well-known tree that has been planted so largely in other countries for the beauty of its fern-like foliage, and produces the valuable "Silky-oak" timber of commerce.

(3.) White Beech (*Gmelina leichardtii*).—This is a timber tree of great value. It seasons and cuts up like Teak (*Tectona grandis*). Mr. Jolly justly calls it the "Teak" of Queensland. It is easily propagated, but it is now nearly extinct.

510.—*Reckless destruction of valuable softwoods.*

As softwoods these three trees are unsurpassed in Queensland, indeed in Australia. In the world's forest literature Queensland enjoys the unenviable distinction of having nearly exterminated its three most valuable timbers. Queensland could hardly have done worse under any form of rule or misrule. I do not think Mexico has suffered to this extent during any 90 years of its history. As mentioned

previously, in the waste of its natural resources, Queensland is only surpassed in Australia by Tasmania, and perhaps by New South Wales.

511.—*Sparseness of the Eucalypt forest.*

The Queensland forest, like nearly all the Eucalypt forests of Australia, is only partially stocked; the Conservator told me that over large areas in Queensland he considers it only about a third stocked. I attach importance to this opinion. It coincides with mine. I should go farther and say that, seeing how the Eucalypts grow in South Africa and in Portugal, the Queensland forest does not at present carry more than one-quarter of its normal timber. This poor stocking, this skeleton condition of the forest, is probably owing to the fires. It is certainly not on the Queensland coast due to drought.

At the same time all Eucalypts are light-demanding trees, some of them very light-demanding, so that, as Foresters know, there is room among them for shade-bearing trees; the effect of such shade-bearers being to clean and enrich the soil, and to clean and straighten the trunks of the Eucalypts. Of such shade-bearers there is no more valuable tree than Camphor.

Seeing the forest as it is, one soon realises that Queensland has two unique forest opportunities which have been neglected for 90 years: (1) The Camphor tree as a shade-bearer, (2) Paspalum grass fire-lines.

512.—*The Camphor tree an unappreciated asset.*

Everyone who has been to Queensland sees how the Camphor tree (*Cinnamomum camphora*) grows. There are incredible stories of its rate of growth in Queensland gardens. It grows in a few years to a great strong avenue tree like an English park Oak; and it is so hardy that it can be put into a hedge and clipped without showing gaps. I have seen a little sordid place of worship, in a dreary up-country hamlet, taking on the rustic beauty of an old English village, because a priest with the noble tree-planting traditions of his calling, had put in a beautiful avenue of Camphor trees. Surely Camphor cannot grow better on the highlands of Formosa where the Japanese making the record in Camphor plantations are planting some 3,000 acres of Camphor yearly. The Japanese started their work soon after Formosa came into their possession. Queensland has slept on it for 90 years.

It does not seem to be realised in Queensland what a valuable asset the State has in this tree, if only it would set itself to adopt Camphor propagation as a matter of permanent forest policy. As far as one is able to judge, if systematically introduced into the forest, the Camphor tree would spread naturally and gradually fill up the forest, giving a future forest out of all proportion, more valuable, than the present forest. Camphor may be seen spreading as a weed into the forest about Gosford, New South Wales, and Camphor grows more vigorously in Queensland than in New South Wales. Birds are fond of the succulent berry, and it is mainly they who spread the tree. Its spread is assisted by the fact that as a young tree, Camphor has the valuable property of growing well in the shade of other trees. In the open it is a bushy growing tree, but in half-shade, in the forest, it grows tall and erect. If the Camphor tree were found not to spread fast enough from scattered plantations in a fire-protected forest, there would be little difficulty or expense in planting it in Queensland in large regular plantations. It plants easily.

There are some huge old Camphor trees near Cape Town. I have had Camphor trees in nurseries and plantations for over 30 years. I had heard how well it grew in Queensland. But it was still amazing to see it. Thus, for 90 years,

since the day when the white-man first walked into the great Queensland forests, there has been this lost opportunity of introducing the valuable Camphor tree in the hope of it spreading naturally in the forest. The Camphor is indeed a valuable tree, both for the timber which it produces and for its Camphor, which is used in making smokeless powder (p. 250). We may depend on it, that in planting 3,000 acres a year the Japanese Government knows what it is about.

One hears, it is true, that Camphor as a product is at the mercy of synthetic chemistry, that chemically it is not far removed from turpentine, that there is actually a factory in New York where Camphor is made out of turpentine. But the Japanese, who are by far the largest producers of Camphor, will tell you that the forester can still make camphor more economically than the chemist, and is likely to continue to do so. Be this as it may, *Cinnamomum camphora* is well worth propagating in Queensland forests for its timber, which commands a higher price on the world's markets than Cedar.

513.—*The Chinese "coffin-tree."*

There is another tree even more valuable for timber than Camphor, the so-called "Chinese Coffin tree" (*Persea nanmu*). It took me twelve years to procure this tree for Africa. It is a shade-bearing tree looking rather like Camphor. It has no valuable bye-products like camphor, but the timber is held in extraordinary repute by the Chinese (see Brandis "Forest Flora"). It should grow like Camphor in Queensland forests.

514.—*The position can be restored.*

With the semi-tropical luxuriance of vegetation in Queensland, the making and keeping clean of fire-paths appears at first sight a costly operation; but the luxuriant growth of Paspalum, of Rhodes grass, and of some other grasses, seems to open up great possibilities in making permanent fire-paths. The growth of Paspalum grass is one of the marvels of this fine country. It is procurable in quantity at 2½d. per lb., and will probably get cheaper as the people outgrow British habits and settle down to the more comfortable, effective lives of people in Mediterranean countries.

Paspalum grows luxuriantly, choking down other vegetation. And it would furnish such good feeding along broad fire-paths made through the forest that probably such fire-lines let out for grazing would pay the cost of making. Permanent fire-lines are always preferable if possible (p. 25). They, or their equivalent, have been used to a considerable extent in South Africa, particularly in the south of the Cape Province where is most of the forest work in South Africa; but it is too cold there for a strong growth of either Paspalum or Rhodes' grass; indeed, the Rhodes' grass that Mr. Rhodes himself planted at his residence Groote Schuur was a failure. I grew both grasses experimentally for some years near Cape Town.

In Queensland the easy growth of these grasses should come as a great help to the forester, and there is the fact that for 90 years this opportunity has been lost, the opportunity of checking the devastating forest fires and opening up the country with broad grassed roads, for grassed roads often make very good pioneer roads. On the sole condition that the grass grows strong the cost of upkeep is nil (p. 56).

The beautiful timbers of Queensland are well shown in a fine collection in the Conservator's office at Brisbane. *Dysoxylon Muelleri* is surely one of the best-grained timbers in the world. Most of these timbers are rather rare hardwoods, and they have up to the present been not much worked. An exhibit such as that

in the Conservator's (locally Director's) office is well calculated to bring them into notice and working; and this, under a Conservator who knows his forests, will ensure their propagation and extension in the forest.

In Queensland, Forestry to-day enjoys these two advantages:—

1. It has expert direction. Mr. Jolly, the Chief Forest Officer, is the only professionally-trained head of a forest administration in Australasia, and the only one that there ever has been. (Very curiously the first professional man at the head of the little budding English Forest Department is an Australian, a Rhodes scholar).
2. Queensland has the advantage, possessed by no other State in Australia, of having still a good supply of accessible softwood. In Tasmania, the supply of softwood, though of first-rate quality, is small and is mostly burnt before the country is opened up; and but little softwood is still left in New South Wales. Writing off its losses, Queensland has still within its ample boundaries forests of first-rate value, and, like Western Australia, has its future Forestry before it—to *make* the national forests estates, by redemption, good demarcation, organisation, and fire protection; or to *mar* them by a weak, vacillating policy, as has happened in the neighbouring State of New South Wales. A forest loan and a strong policy of forest redemption is the first step to take.

515.—*The public immorality of the present position.*

With the forests in their present state a forest expenditure of only £7,000 a year stamps the present forest policy of Queensland as simply disastrous, in a national sense. Rather than continue such a policy it would be better to borrow money on any terms—even 10 per cent. But the present forest revenue of Queensland is some £100,000 gross (£63,000 only shown on the accounts) and £56,000 net. *It is, I understand, at date the highest net forest revenue in Australia.*

Using the term immoral in its correct sense, the present net forest revenue of Queensland can only be described as immoral, since the Queensland Government of to-day is robbing the State's richest asset for a comparatively paltry temporary gain. When these facts become generally known, Queensland must appear before the world in sorry guise, its fair credit dragged in the mud. This is not the language of exaggeration. I am taking the Forestry standards of the civilised world—Europe, North America, Japan.

516.—*Area of forest reserves required for Queensland.*

The State of Queensland has an area of 429 million acres. If we go so far as to assume that half the area of Queensland is too dry to carry much population, and neglect this altogether, the remaining half of the State, on the 20 per cent. standard (p. 12), will require 43,000,000 acres of permanent forest reserves for its wants in timber, forest produce, and timber exports. The best European States have 25 per cent. of their areas forest, or are working up to this standard (see the Official *Year-book of Australia*, No. 7 of 1914, page 386).

Queensland to-day has about 1,000,000 acres of permanent and 3,000,000 acres of temporary reserves. And when I was in Queensland it was actually seriously proposed to reduce the utterly inadequate area of forest reserves by cutting off the "Good night scrub," which is, not as its name would imply, a scrub, but high-timbered forest containing a good stock of softwood—Hoop-pine.

The total present stock of mature softwood in Queensland may be equal to about five years of the present importation of softwood to Australia, which, when the war broke out, was about 50,000,000 cubic feet.

It would not seem difficult to make arrangements, while keeping this area of 43,000,000 acres as National reserved forest under the Forest Department, to provide for its utilisation till fully required for forest purposes. Temporary leases would allow for the best land being temporarily cultivated and afterwards gradually planted up, as the fertility of the land declined, while the area available for grazing on the grassed fire-lines, etc., would be very large. To the forester, grazing, like fire, is a good fried, but a bad enemy. In India 25 per cent. of the area of the country is in forest reserves controlled by the Forest Department, so that 10 per cent. of the total area of Queensland would, in comparison, be small. A much smaller area, planted with selected trees on good soil, would answer the requirements of the country in timber and forest produce; but good soil is required for settlement, and with the high price of labour in Australia plantations are costly.

Water supplies have also to be thought of. It is doubtful if Queensland can fall much below the 20 per cent. standard without imperilling its future, viz., 43,000,000 acres of Forest Reserve (p. 12), the larger part of Queensland being tropical, I have not included it in my general estimate of the area of forest reserves required for extra-tropical Australia. How much of the 43,000,000 acres, even with a liberal expenditure for redemption, could now be obtained, I have not heard. But every endeavour should be made to get as much of it as possible. It is the foundation of all future Forestry in Queensland.

517.—*Queensland arboriculture.*

It is not necessary to repeat here what is said under arboriculture in speaking of Forestry in New South Wales. I have referred to the special loss in Queensland of so much wealth in extra-tropical and semi-tropical trees. Actually Queensland is the most backward State in Australia in Arboriculture. There appears to be no Government Manual on Queensland arboriculture, a subject so important to the settler and others; certainly there is none supplied to the public by the Forest Department, or young trees, or seed.

Brisbane city, where the sun is tropical for a large part of the year, has streets which are generally as bare of trees as is Sydney, Melbourne, Adelaide, or Perth. Queensland when it separated from New South Wales seems never to have broken away from the bad Forestry traditions which it took over from New South Wales, and which New South Wales inherited from the England of 100 years ago.

CHAPTER IV.

Forestry in New South Wales.

518.—*The fatal dual control over the forests.*

New South Wales is the oldest and has by far the largest fertile extra-tropical area of any Australian State. And it had originally the largest area of good timber forest—estimated at about 20,000,000 acres in 1907.

But New South Wales has gone the farthest on the wrong road in Forestry, while scarcely the elements of modern constructive forestry have been yet attempted:—fire-protection, "working plans," organisation of the forests with resident foresters, roads and buildings, regulated grazing, plantations of softwoods. There is little final demarcation worked out on the ground, so as to eliminate areas more suitable for settlement. There has long been a nominal area "reserved for Forestry purpose," but it is at the mercy of the shifting lights of political parties. It was 7,593,165 acres in 1907. It has recently been declared at 5,000,000 acres under the Forest Act, of 1909. Will this 5,000,000 acres be maintained?

In his last Annual Report (1913-14), the Conservator says:—"*In addition to the wastage of timber resources under settlement,* the reserved forest area was reduced during the year by no less than 98,649 acres."* One is inclined to wonder whether under these circumstances it would not be as well to abandon the semblance of Forestry in New South Wales and to declare frankly that, as regards Forestry, the State of New South Wales is in the position of Tasmania or the Negro Republic of Hayti. This would mean that New South Wales was abandoning its third most important rural industry, and which might in the future be its second most important rural industry. Such a policy savours of national bankruptcy for New South Wales.

In spite of an able field-staff and a well-organised Forest Office in Sydney, under an experienced and enthusiastic Conservator, there is a *fatal dual management* of the forests. Dual management is bad in any business concern. It is destructive in New South Wales Forestry, since the regulation of grazing is not under the Forest Department.

There is an energetic working of the forest by enterprising saw-millers, and hardworking paling-splitters, and sleeper-getters. The timber-working is the second best in Australia, but there is no road-making and organisations of the forest estates to help the forest-workers. And, as I have mentioned, no "working plans" to systematise and direct the work towards the regularisation and improvement of the forest.

It seems so easy to do a great deal in New South Wales; actually often at less cost to the State than the present thriftless Forestry. When one goes into the forest and sees what there is to be done to put the national forest estates in order, and the golden prospect of their improvement; and when one realises that this golden prospect is vanishing, year by year, the Forester quits New South Wales with a feeling of despair for Forestry in Australia, and of all it means to the Commonwealth.

* A forestry Bill is at present before the New South Wales Parliament; when this becomes law, forestry will be raised to a higher level in New South Wales than any other State in Australia [C.E.L-P.]

519.—*Defects of the New South Wales system.*

There are three sinister features in the Forestry of New South Wales that it is impossible for the most optimistic Forester to overlook:—

1. The absence of permanent boundaries to the State Forests and consequently the impossibility of organising and working them for improvement.
2. The accumulated forest surplus of £500,000, at a time when in other countries with wild forest money is being borrowed to put the forests in order and render them more productive. Japan is spending £1,000,000 yearly on this, Russia £3,500,000, South Africa about £1,500,000 every ten years. The Conservator, New South Wales, points out (Annual Report, 1914-15) that during the last 12 years for every £1 of net forest revenue the State of New South Wales has spent directly on the forest—2d. (instead of spending £4 or £5).
3. The absence of a trained forest staff. Russia has 800 trained forest officers (a University training) employed solely on making forest "Working Plans" throughout its huge forest area. There is not one in New South Wales.

The stranger is left wondering how, in a free country, the third most important rural industry can be allowed to be so neglected. Why, with political parties so evenly balanced, the forest interest and some other rural interests do not combine to form a third political party. The stranger wonders, too, how public opinion, in a State where education is well advanced, can, on one point, be on a level no higher than that of England to-day, or of the Europe of 200 years ago. Public opinion in Victoria on Forestry is certainly in advance of that in New South Wales; that seems quite clear from various conversations I had with well-informed men, in both States, during the recent meeting of the British Association.

520.—*Appalling Government ignorance of scientific forestry.*

Why does New South Wales not follow the example of Japan when it took over Western civilisation, and send a Commission abroad to study the forest question? £6,000 was wasted on the New South Wales Forest Commission in 1909. Not a soul on the Commission had ever seen a scientifically managed European forest, and most of them never heard of one. New South Wales Forestry is indeed behind some of the most backward European States. It is certainly behind Portugal, where I had a forest tour shortly before leaving for Australia, *vide* my paper on Portuguese Forestry read at the meeting of the British Association in Sydney, September, 1914. Portugal and New South Wales have similar climates, and the same forest trees grow in both countries, so that when one goes from one country to the other it is easy to see how they compare in Forestry.

521.—*Softwood importations in 1913 nearly £4,000 daily.*

The last Annual Report of the Forest Department (1913-14) states:—"The importation of softwood during the year amounted in value to £1,505,779, a daily expenditure of £3,851 from the communities' earnings." All this, and much more required for the industrial growth of the country, would be produced in New South Wales if it had scientific Forestry on modern lines. Forestry in South Africa during the last 30 years has proved this.

Nevertheless the New South Wales yearly forest Blue-book appears in better guise than the two-barrelled forest Blue-book with which the public is mystified in Victoria, but that is probably an accident of the moment. New South Wales,

judging from the public prints, has a more capable Minister in charge of Forestry. One hears less in New South Wales of amateur meddling in the technical details of Forest Administration.

Forestry in also better placed in the public administration; being in New South Wales directly under the Minister of Agriculture, as in France, Spain, Portugal, and the United States of America.

522.—*Disastrous consequences of following wrong ideals.*

The history of Forestry in New South Wales has been a chequered one. At various times there has been a consciousness that all was not right; but, as in Natal, the prevalence of British ideals and a reckless disregard of the future have always succeeded in choking progress. Natal, the one all-British Colony of South Africa, had as bad a forest history as any Australian State before its absorption into the "Union of South Africa."

New South Wales began Forestry in 1871; certain forest reserves were made and certain restrictions placed on cutting timber in them, but for nearly 20 years following Forestry in New South Wales was only nominal, the forest administration a public scandal.

It was exceedingly unfortunate that when Forestry in New South Wales had its great chance under Sir Henry Parkes, the fatal mistake was made of not confiding the work to a qualified man. When Forestry began in India and South Africa, the services of professional Foresters were obtained from France and Germany. The grandiloquent New South Wales Forest Department, abolished in 1892, seems never to have had any conception of the work before it—the demarcation and fire-protection of the forests, their organisation with roads, with forest buildings, and resident Foresters: or the improvement and regularisation of the forest by regulated cuttings with carefully studied "Working Plans" for the difficult forests.

In 1900 the timber industry took alarm and after a conference held in Sydney, passed resolutions urging on Government the following, among other useful points:—

1. The forest lands represent a national asset, present and prospective, of £150,000,000, and the necessary attention cannot be given to them except by an expert administration.
2. There are between 30,000,000 and 40,000,000 acres of forest land which should all be reserved from sale. (They should have added, "pending demarcation."—D.E.H.).
3. An import duty should be imposed on foreign timber. (This has since been imposed, but it is not enough for the Australian forests in their present poor state.—D.E.H.).

The Forest Department, at that time, had revenue of only £10,000 a year (it is now nearly £100,000); and its method of working the forest was criticised in the relief-work ring-barking, and in the girth-felling limits for timber. I have shown elsewhere that under modern Forestry methods, with regular "Working Plans," these two measures would cease to be generally applicable. New South Wales has not only starved its forests, but the little money spent on forestry has been largely wasted expenditure. I have a strong suspicion that the ring-barking has done more harm than good; and it is certain that the Eucalypt forests would be better without hard and fast girth-felling limits.

Judging by the Administration Reports that were regularly received in South Africa, there was little beyond quackery and rule-of-thumb methods in the adminis-

tration of the forests. There was one treatment for the open Eucalypt forests, the dense "brush" forests, and the "Pine" forests of the interior. It was like one pill and potion for measles, scarlatina, and cholera—the heal-all medicine of the quack. And how could it be otherwise since no one in the State had seen a scientifically worked forest, and Forestry is not to be learnt from books alone.

No doubt, the forest-workers, millers, splitters, etc., have been harassed in their operations by measures which were intended to be of benefit to the forest, and quite as often were not.

523.—*New South Wales once had the premier hardwood forests.*

New South Wales was once endowed with the cream of the hardwood forests of Australia. New South Wales occupies about the centre of the best Eucalypt area, with all the four Ironbarks, and huge trees of Blue-gum (*Euc. saligna*), of Blackbutt (*Euc. pilularis*), of Tallow-wood (*Euc. microcorys*), of Forest Mahogany (*Euc. resinifera*), and of various "Boxes" and other good timbers. But the best of the hardwood forests are gone; the greater part destroyed under what is officially termed "improvements" in settlers' land. Says the Conservator of Forests (locally Director) in his last Annual Report (1913-14):—

In addition to the wastage of timber resources under settlement, the reserved forest area was reduced by an amount equal in timber to one year's consumption.

The loss in timber is a cash loss, the loss of the forest area is the serious matter. The most valuable forest, the accessible forest, is ever being hopelessly alienated. Only in Tasmania is the position quite equalled.

As a natural result the export of timber is diminishing; it was £299,802 in 1909 and £261,607 in 1914. The import of timber is increasing; it was £1,011,934 in 1909 and £1,405,779 in 1914.

524.—*The lesson of the Dorigo forest.*

The Dorigo, that ideal State forest, of which Mr. Maiden, the Government Botanist, wrote such an interesting account in 1894, is now nearly all squandered under the poor excuse of settlement. The greater part of it is not suitable for settlers, *and the settlers have experienced failure.* I heard the whole sad story when I was in New South Wales. It would be in vain to plead that the Government Botanist's opinion on the Dorigo was not that of a forest expert. A forest expert's opinion could easily have been obtained. At that time Indian forest officers were reporting on forestry for other Governments in various parts of the world.

The main facts of the case are simple. Here was a good area of accessible forest, left to a large area of denuded country. It was, I should say, the nearest good accessible forest to Sydney, with its industrial development and timber requirements. It has nearly all gone, and the cost of living in Sydney has been appreciably raised, for all time, by its destruction. I speak now not only of what it was, but of what it might have been under modern methods of working. The accessibility and good quality of the forest, the good rainfall, the inferior quality of a large part of the soil, were all clearly set forth by Mr. Maiden in the Official *Journal of Agriculture.* We read of the Dorigo forest in South Africa and wished we had any forest like it, with its rich stores of Cedar.

I have never heard any semblance of a defence for what followed. I came to New South Wales to see the Dorigo forest; I found it gone.

A large part of the Dorigo settlers are said to be struggling along, living by destroying some of the State's best timber. *When that is gone, they will go.* It

is a pitiful tale for the State and for the deluded settlers. There are loss and failure on both sides. Whereas, if the ordinary procedure of *first demarcating* the forest had been followed, everything would have been in its right place. Forestry in its; dairying in its. There would have been successful settlers; any that were not doing as well as they wished at the start would have found help from the Government development work going on in the adjoining State Forest. The timber worked in the forest would have gone far to repay the State for the improvements in the forest.

No one would advocate that on rich volcanic soil, where dairying and the growth of Paspalum grass are such an important industry, forestry should have been maintained in place of dairying. I was myself, at one time, an enthusiastic grower of Paspalum grass, on a small farm near Cape Town. It is not to be supposed that the Government which could build the Barrenjack Dam would wilfully bring about the waste of public property which has occurred on the Dorigo and elsewhere in New South Wales. But the Government was left without technical forest advice; the Government had no settled forest policy, and the present situation has developed in consequence.

525.—*Reckless destruction of softwoods.*

What heightens the crime of misgovernment in New South Wales is the loss of its unequalled softwoods. New South Wales has not only lost the best of its hardwoods, but almost its entire supply of those softwoods which all Australia is now importing at a cost of £3,500,000 a year. Little remains of its unrivalled Cedar (*Cedrela australis*). It is the most valuable tree in Australia; and, as ill luck would have it, all the Cedar is in the forests of New South Wales and Queensland, two backward Forestry States. Queensland has destroyed very nearly all its Cedar, New South Wales has but little left.

The Dorigo forest was always famous for its Cedar. Sixty years ago it was admitted that there were some 30,000,000 feet (superficial) of Cedar on the Bellinger River, which probably represented some 5,000,000 cubic feet in the log. One of the giant trees of those days is recorded to have yielded some £700 worth of Cedar.

During the year ended June, 1912, 72 "permits" to fell 64,000 cubic feet of Cedar were issued by the Forest Department, the royalty of these being only £1,003, or at the rate of 3¾d. per cubic foot. This may be compared with 53,000 cubic feet of Stinkwood sold the same year from Cape Forests at an average royalty of 1s. 11¼d. per cubic foot, standing uncut in the forest. Stinkwood and Cedar are the most valuable timbers in each country. But in the one case a good price is obtained, in the other (though the timber is scarcer) it is nearly given away for 3½d. a cubic foot.

And probably it must continue to be given away as long as the Government neglects its duty of making roads and opening up the forest. Probably the Australian Cedar-getters make no more than the Stinkwood "bushworkers" in South Africa. They are white men in each case. The Government rate for Cape Stinkwood is 1s. the cubic foot; the further 11½d. being added in the auction sales.

And the same remark applies to other valuable softwoods in New South Wales. New South Wales will soon be entirely dependent for softwood on imported timber or plantations of exotics. Red Cedar is not easy to plant on a large scale. On a small scale its planting has succeeded in South Africa and failed in New South Wales. That is all the more reason for conserving its natural regeneration in the wild forest. No exotic softwood, likely to grow as well, will equal Red Cedar in the quality of its timber. The Conservator of Forests (locally Director) estimates

that at the present rate of cutting the supply of softwoods will be exhausted about 1929. (Interstate Tariff Commission.)

The timber Bolly-gum (*Litsea reticulata*) is shown as one of the precious products of New South Wales in the six or seven museums where timber is shown in Sydney. Millions of cubic feet of this fine timber were destroyed and the ground given for dairying on the Dorigo. And to this day the same waste and destruction are proceeding on others of the northern rivers. Rosewood (*Dysoxylon muelleri* and *D. fraseriana*) have gone the same way. The purposeless destruction of these fine timbers is only less serious than that of Cedar and Australian Teak (*Gmelina leichardtii*).

Cypress Pine.—But perhaps the cruellest thing for the country side is the destruction of Cypress pine! There is something peculiarly inconsistent in the fine work of the Sydney Museums, indicating the advantages of timber preservation, and the wanton destruction of timber that is going on outside Sydney. The Technological Museum has recently issued a superb volume on the "Pines of Australia," particularly Cypress-pine. The Cypress-pine forests are in dry country where wood is particularly valuable. The best of these forests, therefore, should have been demarcated with particular care and preserved for the use of the countryside. But instead of this they have been destroyed wholesale, and the countryside is now crying out for timber.

At a farmer's where I tarried, near Orange, was a house being built of Cypress-pine flooring boards. It makes an excellent flooring board, being durable and not subject to dry rot. It is in this respect far superior to the imported flooring boards. As a timber it is reputed to stand in the ground for 100 years. It is the only wood that is commonly credited with being entirely able to resist the white ant. It is thus of great value; beside it, the imported flooring board, where white ants abound, is mere trash. For many years I have held that the richest-coloured sample of wood in the fine timber collections at Kew and the Imperial Institute, London, was a piece of Australian Cypress-pine (*Callitris calcarta*).

Cypress-pine ranks along with Cedar in the highest class of timbers as a *durable softwood.* It is being planted in South Africa. It has been reproached with being slow-growing and knotty. It is not particularly slow-growing where it can get at any moisture to grow with. That has been shown in South Africa. It is a precious dry-country tree, and instead of dying when moisture fails, simply grows slowly. Its knottiness is mainly an affair of Forestry and fire-protection. As a forest tree the Cypress-pine behaves much as the true pines of the northern hemisphere. It is thus peculiarly amenable to the Forester's science. At a little distance a Cypress-pine forest in New South Wales is indistinguishable from a pine forest in Spain.

It will hardly be credited outside Australia that, after 127 years of occupation, the Cypress-pine forests of New South Wales have never been demarcated; and, as a result all the best of them are now destroyed. "The Government should replant the pine forests," said my friend the Canobolus farmer, at Orange. And he is right. But why did the Government ever destroy them with all their valuable qualities and situated as they were on the edge of the dry, timberless country?

At this time, the Americans are planting up similar country in dry Nebraska at the rate of millions of trees yearly. "The Lachlan Pine," added the farmer, "is growing on sandy soil by the rivers, soil of little use for anything else but pine growing, but it is now all cut out." There were trees along the Lachlan 60 feet without a branch and 100 feet total height.

Fifteen years ago Cypress-pine was 12s. per 100 feet super., now it costs 24s. in Orange (almost exactly the same price as Oregon). It once grew within 20 miles of Orange. Millions of acres of it have been ring-barked and burnt!

The destruction of the Cypress-pine forests remains as a deep stain on the page of Anglo-Saxon colonisation. Amongst all the black deeds of Spanish colonisation I do not think there was anything in wanton and reckless waste to quite equal the destruction of the Cypress-pine forests. They are so precious, from their situation, the only timber to supply all the dry country beyond; they furnished such valuable timber in the very first-class of timber; they were soft-woods in a country where softwoods were very scarce. Their conversion to cultivated forests of immense importance is so easy. All that remains to do now is:—

(1) To demarcate out, not only the scraps of forest that remain, but all good Cypress-pine country where the trees can be re-introduced without too great expense.

(2) Redeem for the nation at whatever cost such good Cypress-pine forest as has not yet been destroyed.

Of the three Australian States that are concerned in the iniquity of destroying good Cypress-pine forest, New South Wales is certainly the worst. There was no forest demarcation to discriminate the good forest from the scrub, and all were burnt together in a senseless orgy of ignorant waste.

526.—*The cost of rectifying a bad policy.*

Timber Importation of One and a half Millions' worth.—New South Wales imports, in round numbers, £1,500,000 worth of timber, mostly softwoods, from the northern hemisphere. This is costing New South Wales at the rate of £4,109 daily. This is what the neglect of Forestry is beginning to cost New South Wales.

The figure is rapidly rising. Before long New South Wales' hideous waste of its rich forest resources may be expected to be costing at the rate of £8,000 per day. All this has been stated by the Conservator of Forests, in season and out of season. But the Government heeds not, and each year gets more deeply involved.

Forest mismanagement in Australia is a gradually-growing evil, like the railway gauges, but the Forestry question will cost very much more to put right, even if it were taken in hand now! Many millions will have to be spent (p. 167) even if all the Australian States were to take the matter in hand at once and do what South Africa is doing now to grow its own timber. But in New South Wales the Forestry question is perpetually shelved. The visitor asks himself how long will it take for Australia to produce a Roosevelt or a Pinchot. Relatively, the United States has faced the forest question sooner than Australia, even if Australia were to arrest its downward course to-morrow. The United States has lost a much larger area of useful forest than Australia, but there was a greater margin to go on, and there is more good forest still left to the country.

527.—*Plantations to produce softwood.*

Forest Plantations.—A commencement with softwood planting has been made in New South Wales, but on so small a scale that it hardly merits mention. According to the last Commonwealth Official Year-book, 1912-13, New South Wales has a total planted area of 195 acres! This is less than an average of two acres per year since New South Wales started its career of forest waste! South Africa, with a smaller area of fertile land than New South Wales, and importing yearly a somewhat smaller quantity of softwoods, is planting some 10,000 acres yearly.

Even the microscopic softwood planting that has been done in New South Wales is not in well selected areas.

There are three small plantations at Hogan's bush, Armidale and Tuncurry, on which some £4,000 appears to have been spent, but strangely enough the usual details of the planting done are omitted from the Annual Report for 1913-14.

A State Timber Yard in New South Wales (which I did not see) is worked at a loss. That there should be a State Timber Yard at all is a curious instance of one-sided development in Forestry. According to the official returns New South Wales has made a profit on various State industries, such as bricks, concrete quarries, etc., but the State Timber Yard is run at a loss: in 1914-15 this loss was £25,145.

528.—*Where plantations may succeed.*

The Centennial Park, surrounded by the city of Sydney, offers a unique area for a national arboretum, but the greater part of the soil now is sandy and inferior. It is capable of reclamation, as one of the parks in Melbourne is now being reclaimed, with town refuse. Extensive work of this nature—reclamation of sandy ground and tree-planting—have been carried out near Cape Town. Few cities have a finer breathing space than the Centennial Park, and the drives and garden portions are excellent. But the larger part of the area remains a waste which might be planted with the beautiful trees of other countries, and which, if arranged in the form of an arboretum, would be an incalculable benefit to arboriculture in the State, and a national work of which the importance would be felt throughout the Australian continent.

Only Sydney and Brisbane, amongst Australian capitals, have climates sufficiently wet for a first-rate tree growth. The soil of the Centennial Park could be reclaimed with house refuse at no great cost, and after a few years, when the artificial soil formed in this manner had had time to mellow, it could be planted with trees somewhat on the lines of the Tervueren Arboretum near Brussels, which I have described elsewhere, and which is a most beautiful spot. And it is as instructive from an arboricultural point of view as it is beautiful.

Then there are the two fine large areas of the National Parks a few miles outside Sydney, some 125,000 acres in area. These offer particularly favourable sites for the class of forest which I have described as suburban (p. 155). Their area is largely poor and stony, but there are valleys with better soils where Pines and Cypresses could be planted, and would then spread naturally over the barren rocky ledges as they are now doing near Cape Town. I am aware that doing this might offend the sentiment with regard to *Nature* preserves. But if one looks at the matter more closely it will be seen that planting and beautifying a portion of the parks with the magnificent conifers of other countries capable of being grown in this favourable climate, *and as a consequence fire-protecting the whole,* would furnish really more natural conditions than the present area, which, from its being so frequently burnt over, is really in an unnatural condition.

We must remember that all the Australian forests, especially coastal areas where the "Blacks" seem to have been more abundant, were frequently burnt over by the "Blacks" in order to make it easier to hunt game; while, since the advent of the Whites, natural conditions have practically vanished owing to the frequent summer fires.

I understand that Kuring-Gai Chase is particularly well supplied with subsoil water: quite commonly shallow wells often only two or three feet deep will yield a good supply of water. This, with the loose nature of the rock, affords ideal conditions for a first-rate tree-growth.

The expenditure required to treat the Centennial Park and the "National" Parks as parks (using the word in the common sense) would neither be possible or desirable. But maintained as suburban forests, where everything would be left to nature except the arresting of fires, the expense would be moderate. I have mentioned elsewhere that suburban forests in Belgium and France yield to the State a mean net revenue of from 1s. to £15 per acre per year; and double the Northern European growth is to be looked for in the favourable Sydney climate.

529.—*"Hogan's bush" the last bit of forest near Sydney.*

Another favourable area for a suburban forest for Sydney, though more distant, would be "Hogan's Bush," near Gosford, or perhaps that forest as a beginning towards a larger area. At "Hogan's Bush" there are now about 2,000 acres of forest. It is true that all the best trees have been cut out of the forest and that it has been repeatedly burned. But, at the same time, it is a real "brush" forest, and in a few years, if properly treated, would be restored. With its restoration, in this favourable locality, would come the restoration of its original fire-proof condition. It would then be like the Soignes suburban forest at Brussels, and thus quite ideal as a suburban forest, where people could see and enjoy the natural wild forest untrammelled by fire restriction. To arrive at this fire-proof condition it would have to be artificially fire-protected for perhaps 20 years, and for this purpose would require to be cut up into roads and fire-paths and to have a resident Forester. The system of fire-paths and inspection-paths would render it a charming resort. There is nothing now left like this forest, I believe, near Sydney.

At the same time a certain amount of planting would be required in order to make good the ill-treatment of the past. This would add to the beauty of the scenery, for the Australian forest, beautiful though it is, lacks that diversity which is usually seen in the forests of other countries. And "Hogan's Bush" is so accessible that every penny spent on it would certainly bring in a good return. The astounding thing is that such a work should have been so long delayed. It would require no great expenditure to turn "Hogan's Bush" into an easily accesssible forest, which every visitor to Sydney would love to see as a sample of the unique "brush" forest of the northern coast of New South Wales. The expenditure would be trifling compared to its value to Sydney as a suburban forest, or compared to the value of the forest itself in later years.

530.—*Forestry and the sawmillers.*

Sawmilling.—In spite of the neglected state of its forests, the working of them in New South Wales is excellent. It is only more active in one State—Western Australia.

In 1913-14 there were 665 licensed sawmills, five-sixths of this number paying royalty on log measurement. These sawmills in 1913-14 were valued at £619,000; they employed 5,799 men and turned out 124,292,000 super. feet of hardwood, valued at £819,933, and 40,596,000 super. feet of softwood, valued at £320,398. During the last 10 years the average yearly output has increased at the rate of 6.2 per cent.

Here is an excellent record of energy and progress, but owing to the ignorance of modern forestry methods, instead of improving the forest it has hastened the burning which has destroyed so much of the forest.

531.—*An efficient staff effectually muzzled.*

The Good Forest Staff.—The New South Wales Forest Department is credited with being the best in Australia. Its cost has risen from £5,000 in 1900-1 to £40,000 in 1913-14. With devoted men on its staff, it has had a heart-breaking work to perform. The Government has pretended to wish to conserve the forest, but has been perpetually destroying and giving it away. Few men have had a more thankless task! Few men will better merit that recognition of their services which must come when New South Wales' Forestry takes its proper place amongst that of other civilised countries. The Conservator remarks pathetically in his Yearly Report for 1912:—"The dual control leads to a conflict of interests. . . . In the main the Department has made little progress in carrying out its more important functions." And again, in his Yearly Report for 1913-14:—"The forest position has not improved during the past twelve months." The forests, practically throughout their whole extent, are under dual control, and the Forest Department cannot attempt the rudiments of modern forestry. I saw this even in the fine Lansdowne forest near Coopernook, on the Manning River.

532.—*Low royalties.*

The New South Wales forest revenue has risen rapidly with the improvement of the Forest Department. For the official year 1913-14 the gross revenue amounted to £99,332, and the net forest revenue ti £59,331. About eight-ninths of the forest revenue is from royalties, which are very low and could probably be easily doubled as soon as the forests are organised and improved.

533.—*Valuable timber museums and poor library.*

With this dearth of forestry out-of-doors, Sydney shows indoors the forestry resources of a well-ordered State. It is extraordinarily well provided with timber museums. One cannot help thinking that its unique Technological Museum should be a Federal Institution, since all Australia benefits by its labours.

And the same remark applies to the museum and herbarium presided over by Mr. Maiden, the usefulness of which is limited, not even by the wide Australian continent. Indeed it is no exaggeration to say that the success achieved with Eucalypts in South Africa is largely due to the advice given by Mr. Maiden. This has been repeatedly acknowledged in various publications by the South African Government, and again in the last report of the South African Forest Department (1912-13).

It is true that popular works on Forestry are missing from the shelves of the Sydney Library. That is a fault discernible in Australian public libraries generally. The selection of the books was perhaps dominated by the low standard of British Forestry. ,

In reflecting on the goodness of indoor forestry in New South Wales, and the badness of out-of-door forestry, one is reminded of the British Governors of Cyprus who, for a quarter of a century, have been penning well-turned phrases regarding their forests, while on the mountains outside their windows the forests were ablaze; and an average of about the Governor's salary has been lost yearly (in the value of burnt forest) to that interesting but dry and barren little island. Tasmania, which, like New South Wales, is weak in "constructive" Forestry, is particularly strong in indoors paper Forestry—the Forestry of pamphlets and guide books.

534.—*Arboriculture in New South Wales.*

Arboriculture is as poor as Forestry in New South Wales! The few nurseries for the distribution of trees to the public can be counted on one's fingers (in South Africa there are 163 regular nurseries besides smaller ones), and the largest of the tree nurseries in New South Wales appears not to be under the Forest Department. Gosford shows a good forest nursery and an interesting collection of trees, but it is far from being in any sense a national arboretum (p. 153), neither is the distribution of young trees adequate to the wants of the country.

In the fine tree-growing climate of eastern New South Wales a pamphlet on "Tree-planting and its profits" should be on every farmer's table, an arboricultural pamphlet especially written for farmers; an improvement on the South African 1899 pamphlet. It should set forth in plain language (no botany or botanical terms) the growth on the Mediterranean of farmers' trees; the possibility of a double crop off the fields. It should tell of the valuable Walnut tree, with the chance of £300 for an old log from the piano people, and in the meantime an unfailing market for the fruit. It should tell the story of Cyprus and Carob beans, the beans which, instead of fattening cows in Cyprus, go to help the farmer in England.

535.—*Tree planting for profit.*

Why should dairying in New South Wales not have this second string to its bow, a string happily at its best in times of drought, for no drought kills the Carob trees and they bear heaviest in times of drought. I do not say that the Carob trees will always grow in New South Wales. The rain is not quite right. That is where the utility of arboretums (scattered over the country) comes in—to test these points.

Then there is the Chestnut, with nearly the same feeding value as wheat, and better than potatoes. While, after these, there rises to mind a long list of wild fruit-trees, such as some species of wild Guava (*Psidium spp.*), wild Pear, the Cherry Haw (*Crataegus azarolus*), and other edible Haws (*Crataegus spp.*), the Mulberies. There is the Gooseberry Guava with a fruit that is like, but rather better, than the English Gooseberry. New South Wales has not many English Gooseberries: the climate is too warm. The Gooseberry Guava I have found to grow and fruit freely of itself when once planted on the highlands of equatorial Africa. Stone-pine (*Pinus pinea*), Almonds and Walnuts are most valuable wild fruit-trees (p. 259) in climates similar to many in New South Wales. What is their exact value in New South Wales? Test-arboretums would show.

These are not the trees of the orchardist. They yield their fruit as an *addition to the field crops* without any trouble beyond the initial expense of planting them. New South Wales fails in Arboriculture as badly as in Forestry. Trees of this sort should be brought to the farmer's door, and the pamphlet explaining their uses put on his table. Other countries think it is the first duty of Government in a new country to assist the cultivator of the soil. Why is New South Wales a quarter of a century behind other countries, both in Forestry and Arboriculture. And Sydney, that in this Italian climate might be such a beautiful town! If only Sydney could elect two or three mayors that had studied extra-tropical Arboriculture in their school-days!

536.—*Shade trees.*

In shade and avenue trees Sydney, with the best tree-growing climate in any Australian capital (it is slightly better than Brisbane), is the barest of trees. The traveller passes mile upon mile through glaring, unlovely streets, with not a tree to

relieve the prospect. The best of the few large trees growing about the Domain have been recently cut down. This, I heard, had caused an outbreak of public protest, but the real trouble in New South Wales is wider and deeper: the State for over a century has ignored its potential tree-growing wealth—the wealth, the beauty, and the restfulness of trees.

537.—*Sydney University and Forestry.*

There is a good forest class at the Sydney University which perhaps might form the nucleus of a wider instruction, particularly in extra-tropical arboriculture; but there is no regular Forest School in New South Wales or Queensland. Possibly Armidale would be a suitable centre for a secondary Forest School, supported conjointly by both New South Wales and Queensland. See pages (Creswick 322, and Adelaide 284.

The chief function of such a Forest School at first would be to teach the arboriculture of New South Wales and Queensland.

CHAPTER V.

Forestry in Victoria.

538.—*A correct start made at last.*

It was unpleasant, during my tour through the various Australian forests, and in my discussions with the Forest Officers, to be constantly brought back to the reflection that Forestry in Australia to-day is about where it started in South Africa a quarter of a century ago. But I had not been long in Victoria before it became evident that there was less to say about South Africa there. Happily, the history of forestry in Australia has now another and a brighter side.

Nearly all the essentials of modern forestry were reached, in Victoria, with the passing of the Forest Act in 1907 and the *initiation of a working Forest Department on 1st January*, 1908. This is a red-letter day in the history of Australia. The next generation may make it a flower festival. It marks the dawn of happier days for the outraged countryside.

As illustrating what the Victorian Forest Department has accomplished it may be mentioned that, while during the last five years the quantity of timber worked in Victoria and Tasmania has been about the same, the forest revenue of Victoria is about thirteen times that of Tasmania, where there is no Forest Department. Thus, the *Official Year Book* shows, for 1912, timber sawn and hewn, forests of Victoria 60,000,000 super. feet, and, similarly, Tasmania 63,000,000. But Forest Revenue: Victoria £51,146, and Tasmania only £4,414!

The demarcation of the bulk of the forests remaining to the country has been carefully worked out and the boundaries settled. Four million acres of State Forest in Victoria have been definitely set aside as inalienable national forests. They, and the timber reserves, are well shown in a forest map prepared during the five years assigned by the Forest Act for the demarcation of the forest. The State Forests of Victoria are between one-twelfth and one-thirteenth the total area of the State. But, if one considers only the fertile area, which alone can carry a dense population, the proportion more nearly approaches the normal—one-fourth. No time must now be lost in organising and improving the productiveness of the

State Forests and at the same time making every addition possible to their area, for they are as yet too small for the timber wants of Victoria in the future, assuming that industrial progress is to continue on present lines.

Much remains to be done with the 4,000,000 acres of State Forest. They have to be organised, as working forest estates, with "Working-plans," roads, buildings, fire-paths, planting, and a resident forester on the perpetual look-out against fire in summer; though what has been spent on the forests in doubtful thinning and unsuccessful fire-protection would go far towards putting the forest estates into good working order.

539.—*The valuable work of a Royal Commission.*

In 1887 Mr. Vincent, an Indian Forest Officer, and in 1895 Mr. Ribbentrop, the Head of the Indian Forest Service, visited and reported on some of the Victorian Forests. Mr. Vincent's report is commonly said to have been promptly *suppressed.* Their warnings (says the 14th Report of the Royal Commission on Forestry, 1901) have been fully justified. Indeed, Forest demarcation in Victoria is 66 years late! The want of it and of a forest policy in the past has cost Victoria millions. Data do not exist for calculating the figure, but few men in Victoria to-day doubt the loss. It is useless deploring past errors, especially when the right path has now been taken.

Matters came to a head in the Royal Commission of June, 1897, which was a Parliamentary Commission, to examine the forest lands of Victoria and take evidence as to their most economical disposal in the interests of the State. This inquiry lasted for over three years and was concluded with the issue in March, 1901, of that classic of Australian Forestry, the 14th (and final) "Report of the Royal Commission on Forestry in Victoria." For comparison it deals also with the Forestry of other countries.

The man who drafted this final Report, the man who has done so much to make Forestry a living force in Australia, is Mr. H. Mackay, the present Conservator of Forests of Victoria. This Report is far beyond the usual dry-as-dust Official Blue Book. It is a beginning of forest literature for Australia and has an enduring historic value. But it lies pigeon-holed and neglected among other official publications which have had their day and now cease to interest. It should be rescued from this position; and I strongly recommend the preparation of a condensed summary, brought up to date and issued either by the Federal Government, the Australian Natives' Association, or the Australiain Forest League; or, failing these bodies, it is quite worth the attention of the Government of Victoria in the Educational Department.

It marks the beginning of scientific Forestry in Australia; and no patriotic Australian who does not wish his country to sink to the level of the mountain lands of South Europe should be ignorant of its contents. Mr. H. Mackay, the Victorian Conservator, has travelled widely in the great wild forests of North America, and in the smaller but more productive cultivated forests of Europe, and has acquired by close study that practical acquaintance with modern Forestry methods that few men really obtain thoroughly after their school-boy days.

The Forest Department is now endowed with nearly all the necessary powers for the protection of the forest against fire, hurtful grazing, and wrongful cutting. Victoria and South Australia are the only two Australian States with properly organised and working Forestry; and Victoria, with more rain and more funds than South Australia, is beginning to show what Australian Forestry is, though as yet Forestry in Victoria is still behind South Australia in fire-protection and soft-

wood plantation. The one thing wanted for the active prosecution of Forestry in Victoria was more ample funds, and these have now been promised.

540.—*The definiteness of the future forest policy.*

The State Premier of Victoria, in his pronouncement regarding Forest policy on the 11th November last, stated that *from* £300,000 *to* £400,000 *would be provided for the proper development of Forestry during the next five or six years.* An expenditure of anything like half a million on Forestry is an entirely new departure in any Australian State. The fact should become known in every corner of the British Empire. It is no longer necessary to be always preaching German Forestry. Fire-protection, where the want of funds has been mostly felt in Victorian Forestry, will now become more effective; and it is proposed, the Premier announces, to spend some £10,000 per year on planting softwoods, though the estimate for doing so—£3 per acre—is too low, even for the mere cost of laying down plantations. "We will have from 6,000 to 10,000 acres a year," he added enthusiastically. This is the conception of a statesman who knows what he is talking about. It recalls the utterance of Mr. Lloyd George in his celebrated Swindon forest speech shortly before the outbreak of the war. It is quite possible that, after the war, Forestry in England may make a start like Forestry in Victoria. Before the war broke out Victoria was importing considerably over £1,500,000 worth of softwoods yearly.

541.—*The growing public interest in forestry.*

Even more remarkable than the placing of Forestry in Victoria on modern lines has been the development of public opinion on Forestry there. Forestry has been ably championed in the public Press of South Africa, but in no country with which I am acquainted in the Extra-Tropics has it been so consistently and strenuously advocated as by the public Press of Victoria. Public opinion on Forestry in Victoria is, I hope, sufficiently formed now to guard the country against a reversal of forest policy with a change of Government, as happened so conspicuously in New South Wales some years back. When the British Association came to South Africa in 1905 there was naturally an article on Forestry in the Hand-book prepared for the visit. But among the bewilderingly numerous hand-books prepared for the meeting of the British Association in Australia last year (1914), Victoria alone of the Australian States had an article on Forestry, and a most useful one too.

542.—*The remnants of splendid Victorian forests.*

Back in the history of Victoria lies the sad tale of splendid forests squandered and lost by Government misdeeds, not even equalled in the dark ages of European history; for in those days the Church, the King, the nobles, and the free-towns had each their patches of private forest carefully preserved. And the first foresters were monks.

There is the fine tall-timber forest on the Otway Mountains, much of it alienated for only sheep-grazing.

There are the once fine forests of Red-gum. And to-day it is reported that the State possesses only some 1,300 acres of this choice timber in the whole of Eastern Gippsland; and, incredible though it sounds, the State is now spending money in replanting the very hardwood forests that were destroyed so recklessly only a few years back, and, as a fact, are still being destroyed in the annual fires. To a great extent these past forest losses can be repaired by the planting of softwood

in well-chosen accesssible localities, for softwood is, and always has been, the great want in Victorian forests. Victoria never had the softwoods of Queensland, New South Wales, and Tasmania.

543.—*Melbourne a city without a forest.*

And there is the scandal of the Monbulk forest, priceless as a suburban resort for Melbourne, destroyed under the utopian idea of settlement—good forest which could easily have been developed to yield £1 per acre net forest revenue now, and £2 or £3 at no distant date. It has been *given away for destruction at £1 per acre in fee simple.* If ever there was a case of grasping at a shadow and losing the substance it was here. This fine forest should have been a suburban forest for Melbourne.

Melbourne, with all its fine parks, its trees, and planning of an imperial city, was laid out too much on British lines, and forgot the "suburban forest," which is so notable a feature at Paris, Brussels, and Berlin. The nearest suitable area should be selected now to repair the mistake (p. 156), and with it could be combined an arboretum in a favourable mountain climate. Brussels has its fine suburban forest, Soignes, at its very gates, and in the forest two arboretums of great interest.

544.—*Victoria's giant trees.*

It may be possible also to repair that other blot which has come down from the dark days of Victorian forestry—the biggest trees in the world destroyed, and destroyed even before their dimensions were accurately recorded. It is more than probable that the largest trees in the world were amongst those which have been allowed so recklessly to be cut in the mountains a few miles from Melbourne. I may refer to the paper by Mr. Hardy, of the Forest Department, printed in the Victorian Forest Blue Book for 1910-11.

I have made independent measurements of some of the largest trees in Victoria and in the Karri forests of Western Australia, and I have come to the conclusion that there existed, and may still exist, in Australia the tallest trees on the face of the earth!

The actually biggest trees in the world, considering both height and thickness, are among the giant Red-woods of California, *Sequoia sempervirens.* I am sure that every patriotic Australian will agree that an attempt should be made by the Forest Departments in Victoria and Western Australia to find out the actually biggest trees, measure them, and place them under special protection. They will remain as a matter of scientific interest in the history of the world; and more, it is quite possible that a further search may reveal the existence of some bigger trees than any yet recorded. It is now admitted that the time allowed for the search in 1888 in connection with the Centennial Exhibition was too short.

The album of photos. of the big trees cost £600, and a reward was offered to anyone who would point out a 400ft. tree. The 400ft. tree was not found; but the Conservator of Forests, Victoria, has assured me that there may be larger trees in the forests than any of those yet discovered. He believes that there are, and he has the best means of knowing. If so, they will be the largest living trees in the world, and as such the greatest living monuments which Australia can produce.

There should certainly be a search for such trees; not so much for the idea of having in Victoria the tallest tree in the world, but of finding such trees and protecting them, as grand natural monuments of world-wide interest, from any further injury by fire or axe. It is probable that the numerous fires that have been

through the mountain forests of Victoria have greatly reduced the possibility of finding such a tree, but fire does little mischief in the Karri forest of Western Australia.

There is a fairly authentic story which was told me long before I came to Victoria, of a surveyor (after the manner of land surveyors) cutting a splendid forest to pieces, and leaving one monumental giant tree outside a holding which eventually passed into the possession of an elderly lady. She coveted this piece of waste Government ground adjoining hers, and applied for it. She was refused on the ground of the monumental tree. Not long afterwards the monumental tree was burnt! The world lost one of its monuments, a monument to which devotees had made pilgrimages for many years! But the old lady got her scrap of ground; she was the richer, the world the poorer!

No one now believes the tree-height figures quoted by Baron Von Mueller. He was not a forester, and stumbled into other errors when he strayed too far into the forest! Mr. Maiden's note of 1904, originally printed in the *Sydney Morning Herald*, should be consulted. He perhaps goes to the other extreme and throws doubt on quite good evidence.

545.—*The record heights established.*

In the course of my short forest tour in Australia I have found trees easily of about 300ft. in height, measured with an angular instrument. Probably I saw even higher trees, but could not get a clear sight of them, from top to bottom, for measurement purposes. *I am persuaded that trees over 360ft.—the American record—still exist in Australia.* My time was not long enough to search for them, or to clear the forest for measuring them. The work of thoroughly exploring the *Regnans* and Karri forest areas, of cutting tracks to the tallest trees, and measuring them with a theodolite, would occupy one man, with the assistance of an axe-man, for a year or more. The work of getting into out-of-the-way parts of the forest is necessarily difficult where there are no natives or elephants or other big game to make cross tracks as in an African forest. When I went through the Mount Kenia forest (the second highest snow-covered mountain of Equatorial Africa), we were mostly on elephant paths for two months. In Australia the biggest trees are generally in damp valleys where the forest is thickest.

It is usually difficult to say what are the tallest trees till a track is cut up to them to measure them. All this takes time, much more time when the month or two that elapsed while the Centennial Exhibition album was under preparation. The work, at that time, was not conclusive; it should now be brought to a conclusion.

Though the big Karri trees have probably best escaped fire it seems probable that the tallest trees of the world remain still to be measured in some of the damp valleys where fire has not reached the Victorian mountains. Mr. Hardy's paper gives the record of a tree, measured by Surveyor Robinson, that was 360ft. in height. Says Surveyor Robinson, who lived for eight years in the Dandenongs amongst the splitters who were cutting these big trees, and he spoke after referring to his notes made at the time:—"I have no doubt that some of the earlier cut-down trees would have measured quite 400ft." Mr. Hardy writes me: "It is almost a certainty that there were many trees taller than Robinson's measured monsters." Mr. Hardy's father surveyed the Dandenong State Forest in 1856.

The girth measurements recorded for the big trees are of little account, since they indicate not the average thickness of the trunk prolonged to the base, but the thickness of the basal bulge which is an accident of buttresses at the base of the tree and of wind-pressure at the top. But if we consider height only *the record*

is in favour of the tallest trees in the world having been cut on the Dandenong Mountains. They were taller than the American record by just the "die back" length. Here is the evidence on both sides:—

Says Professor Sargent, the highest authority on American Arboriculture:—

The Redwood (*Sequoia sempervirens*) probably occasionally attains a height of 400ft. or more. *The tallest specimen I have measured was 340ft. high.*

Says Surveyor G. W. Robinson, who resided for eight years in the Dandenongs:—

The longest (*Regnans* Eucalypt) I met with *was 342ft. to the commencement of the die-back.* He estimated the die-back length at about 20ft. so that gave 362ft. for his tallest measured tree. But like Sargent, he had no doubt there were 400ft. trees. He says:—As the paling-splitters invariably cut down the longest barrelled trees first. . . . I have no doubt that some of the earlier cut trees would have measured quite 400ft.

A "die-back" at the top of tall trees is what one would expect when the shelter of the surrounding forest was removed by the paling-splitters, and it would be only in the forest thus opened that Mr. Robinson would be able to get at the tall trees, which, generally speaking, is not easy.

Mr. G. Perrin, late Conservator of Forests, Victoria, has left record of a tree that was 303ft. measured as it lay on the ground, plus 100ft. estimated length of broken top, or 403ft. in all.

546.—*Woodcraft policy versus political relief works.*

There has been considerable expenditure on thinning, pruning, and "cleaning-up" in Victorian forests, estimated to have cost from 5s. or 6s. to £1 per acre. Ordinary practical fire-protection would cost a fraction of a penny per acre, and as long as there is fire-protection the forest would be better in its soil without the "cleaning-up" (pages 28 and 41). The man in the street associates "cleaning-up" with fire protection. The State Premier, in his forest speech of 11th November last, stated that 100,000 acres had been thinned and 400,000 acres still awaited treatment. I am not in a position to say what is the exact value of this work. It has been freely criticised as valueless by many of those best able to judge in Australia. There is a suspicion of politics about it! As in New South Wales, much of it has been relief work.

The last yearly Forest Report for Victoria (1913-14) mentions that during the previous six years as much as 60,000 acres have been "thinned, pruned, and cleaned up" by paid labour. If we average this to have cost 10s. an acre, that will represent a total of £30,000! This is a large expenditure on a work which has been questioned both inside and outside Australia, and which most foresters would question, while such absolutely essential works as the complete fire-protection of the forest and the planting of softwoods remained in the back ground.

A generally sparse forest does not lose much in cubic content of timber per acre if left to thin itself, as in Nature; and there is no doubt of the general sparseness of the Australian forest. I have seen something of nearly every type of forest in extra-tropical Australia. Not 5 per cent. wanted thinning! And as to pruning, Foresters as a rule do not prune. It may pay its expenses here, and it may not. Time will show. Looked at any way the work is doubtful, while as to the necessity of the planting of softwoods and complete fire-protection by ordinary methods there is no doubt. I have discussed the question generally at pages 29 and 41. It has cost them from 5s. 6d. to £2 or £3 per acre in New South Wales; the Minister in charge of Forests in Victoria stated recently that he was spending £1,000 a week on this work!

547.—*Extent of present cutting areas.*

Victoria has timber cutting going on over 500,000 acres though the bulk of the forest revenue is derived from about 250,000 acres. This is exclusive of a further area where cuttings are going forward for mine-props and fuel. At an average of 20,000 or 30,000 acres of forest per Forester 250,000 acres would represent the charge of from eight to 13 Foresters. And, similarly, to organise the total forest area in Victoria where timber-cutting is going forward would require from 16 to 26 Foresters, with their hill-top cottages, small nurseries, fire-paths, and approach roads (page 43). The cost of this work would be light compared to the cost of less effective fire-protection, viz., the actual cost of patrols and the loss of time, money, and efficiency with visiting inspections.

548.—*Fire-protection the crux of Victorian forestry.*

And on top of the administrative loss and weakness of non-organisation is the fearful damage to the forest from ineffective fire-protection! *Fire-protection is the crux of Victorian Forestry.* I do not think fire-protection will ever be on a sound basis in Victoria till the accessible forests are organised in Victoria as they are in South Africa. Victorian forests are very beautiful and, happily for their popularity, much frequented. This makes it all the more necessary to have strong, effective, fire-protection. To the most accessible, and therefore the most valuable forests, visitors come in crowds! They spend a large part of their time in "boiling the billy" for tea-drinking. Foresters might wish they drank something else, less harmful to themselves and to the forests, or that there was no smoking. We may proclaim the prohibition of smoking during the dry season; we may provide safe places for picnic fires; and the average visitor will be careful about matches and fires; but, when all is said and done, the practical way to meet the position is to have a resident hill-top Forester always on the spot with a watchful eye on the forest, and so placed that, with roads and inspection paths, he can summon *assistance and run down on to any outbreak of fire in* 10 *minutes or a quarter of an hour.* If the fire lookouts are well placed the tea-drinking habit may actually come to the Forester's aid in letting him know who is in the forest—pic-nickers, graziers, or bush-workers. With good glasses smoke can be seen a long way in clear weather, and in bad weather campers make big camp fires.

I have spent thirty years in organising forests in extra-tropical Africa where the fire-protection is at least as difficult as in Victoria, and I am convinced that for permanent and successful fire-protection, Victoria must organise its more accessible forests on the same lines. And, fortunately, these are the forests that will best pay the cost of organisation.

To the organisation of the forests, with a hill-top Forester (having a good look-out against fire, with roads, with buildings, fire-paths, inspection paths, and grassed areas as grazing for the forest cattle, has to be added the useful addition in remote parts of inspection quarters at Foresters' cottages. To Victoria this work is especially interesting, for two reasons:—(1) Its mountain forests have suffered more than others from fire; (2) the mountain scenery of Victoria is beautiful but requires developing. It should attract tourists from every part of the world, but until the country is opened up it is a closed book. The tallest trees in the world are probably here and the valleys are extremely beautiful with the rushing stream and the sun glittering through the giant trees on the varied tints of the Blackwood, Evergreen Beech, and Tree-ferns.

549.—*Water carriage not now favoured in organised timber forests.*

There is nothing more attractive from the scenery point of view (p. 43) than the contour inspection paths of a well-kept forest. I could mention a score of localities in the Black Forest which owe their chief attraction, as tourist resorts, to the winding paths of forest mountain scenery. In the Black Forest and in the Vosges forest, on both sides of the Rhine, there are no lakes, no snow-clad mountains, nothing but the eternal beauty of the forest. It is this that has attracted tourists to the forest resorts of Europe and is attracting them every summer in increasing proportions. The French and Germans flock to them as the Englishmen to the seaside in summer. In the Australian climate as in France and Germany, it is the forest that presents the greater attraction.

The growth of the German Spas in the Black Forest has been in this way. Roads are made to work the forest. In the Black Forest and in the Vosges, contrary to what is generally supposed, floating is practically a thing of the past. There has been a revolution in the matter of working the forest and forest transport! In the old days it was floating, and great expense has been incurred in rendering the mountain streams floatable. Rocks have been removed and higher up the mountain, where the rivers were too shallow to float timber at ordinary times, dams were made and timber rushed down with the flood waters. Now the delicious trout of the Black Forest are undisturbed by the grinding and rush of logs and the flats behind the water dams now dry are planted with pine forest! In place of the water carriage there is a splendid system of metal roads abutting on to light railways that feed the standard gauge railways lower down. The modern macadamised road as now understood is the cheapest form of timber transport. As mentioned in "roads," the dearness of labour in Australia could be met, to a great extent, by only metalling a strip of road. This is an inconvenience, doubtless, but in the matter of roads half a loaf or a fraction of a loaf is better than no bread, and when it comes to forest work the first necessity for roads is economy of construction.

The Germans in the Black Forest have sunk a lot of capital in making the rivers floatable as have Australians in making forest tramways. The real thing with the improved forest of modern days is to give it a frame work of roads.

All this applies nowhere so much as to the mountain forests of Victoria. They must (1) either be left in a degraded condition, overrun by fire; (2) opened up and destroyed by fire as has been the case so much during the last 50 years; or (3) organised, fire-protected, and rendered fully productive from a forest point of view, as well as being opened up from a tourist point of view.

And last, but not least, there is the settler's point of view! Open up the country with timber and towns and the settler has something more than savagery and uncertain crops at his door—if the Government do their duty in restoring the forest, a share of the £10,000 a day that is now going out of Australia for imported timber!

550.—*Considerations affecting Victorian "working-plans."*

The present position of Forestry in Victoria is criticised in that while four millions of acres are locked up for timber the revenue is only being drawn from one-sixteenth of the area and that nothing is being done to improve the remaining 15/16th. It seems possible that unless the remaining 15/16th is protected from fire, worked and organised, that its retrocession will be demanded, and where so little is being done to improve the wild forest, it will become difficult to meet this demand. In the British Association Handbook of Victoria the Conservator of Forests states that timber cutting is being carried out over half a million acres,

but the "bulk" of the forest revenue is derived from a total area of about 250,000 acres, the trees being felled under the "selection" system of treatment.

What is required is—(1) Working-plans for the whole system of forests, dividing each forest unit up into working areas; (2) a forest loan for the purpose of opening up the country with roads and forest development generally. If these greatly improved facilities cannot tempt saw-millers to work the forest the Victorian Government should do as the Western Australian and many other Governments are doing, and work the forest itself.

Over most of the four million acres I have little doubt that the Working-plans will substitute "clear-felling" for "selection felling," making the work easier for the saw-miller and (I have no doubt) better for the forest (pp. 69, 70).

Naturally there are high lying areas where "jardinage" or "selection felling" is desirable, and this will be the chance for the small men, the splitters, hewers, and perhaps pit-sawyers. War conditions and unemployment give a unique opportunity for taking seriously in hand the organisation and opening up of the forest.

551.—*Political intermeddling not quite obviated.*

Political control, the amateur meddlings of Ministers, has not been entirely got rid of in Victorian Forestry, but public opinion and the Press are sufficiently strong to keep the meddling in the background.

No doubt any statesman of average capacity would know that amateur Forestry came to an end in Europe 170 years ago; but the Annual Report of the Victorian Forest Department for 1912 is calculated to convey the impression that the present Minister in charge of Forestry has other views. It is a curious sort of double-barrelled Blue-book! It appears as a dual production; Part I. by some other person who must represent the Minister if he represents anything; Part II. by the Conservator. The "other person's" report consists mainly of tabular statements, one of which is in duplicate (see pages 3 and 10).

Tabular statements are the curse of official reports even over a responsible name. Here they appear as floating and loosely attached excrescences, and it is not very clear what they represent, and who is responsible for them! The largest of the statements, filling one-third of a page, might just as well be omitted for all the information it conveys. It is called by the vague name of "Improvements" and may be either a solid forest improvement, such as planting, or a quasi-improvement such as burning *débris*, or otherwise making bonfires in the forest which I have seen being done!

552.—*Softwood plantations and softwood importations.*

The two important features in Victorian Forestry now and for many years to come are fire-protection and softwood-planting; but the usual planting-return and fire-statement are both omitted from this report. Note the complete planting statement in the South Australian Forest Report. Victoria has more softwood planting ahead of it than South Australia if it is to meet its importation of soft woods!

Victoria imported £1,500,000 worth of timber for the year ended 30th June, 1914, while the average yearly production of the forests during the previous four years was £750,000 worth of timber (Premier's speech as reported in *Age*, 12th November, 1914).

Thus before the war broke out Victoria was importing just double the value of timber that was being produced in the forests. The imported timber was largely softwood from the Northern hemisphere. Fire and this imported timber

are the main features in the Forestry of Victoria. Last year Victoria imported more timber than the whole of South Africa.

553.—*Forest sowing of softwoods not yet begun.*

It is sad to see that with this heavy importation of softwood, the Victorian Forest Department last year only raised 3,500,000 young trees in the three forest nurseries, and of this a large proportion was hardwood. The softwood planting in Victoria was confined to the coast plantations, and only reached the diminutive figure of 1,500 acres. The turning loose of softwoods into fire-protected forests (with the hope of their spreading like weeds) has not yet begun.

A year ago I was in the Portuguese forests where Busaco Cedar was spreading itself everywhere among the Australian Eucalypts and Wattles. Busaco Cedar is more valuable than any pine timber, and if it spreads self-sown in Portugal it should do the same thing in Victoria. If the Victorian hardwood forests were organised and fire-protected they are large enough to supply every possible requirement in hardwood, but the present softwood planting is not one-twentieth of what should reasonably be done. Ten years ago some 7,000,000 softwood trees were being planted yearly in the forest plantations near Cape Town alone; and New Zealand is planting some 6,000,000 trees now yearly; while South Africa, which compares with Victoria in agricultural wealth and white population, is planting some 40,000,000 trees yearly, and has not far short of 200 forest nurseries and plantations.

The pines planted in Victoria last year were Insignis, Laricio (two varieties), Douglas, Cluster, Densiflora and Resinosa.

As mentioned, a remarkable omission in the Victorian Forest Report for 1914, and previous years, is the plantation return. Nowhere in the report, not even in the general financial statement, is the expenditure on plantations given!

The great pine-planting area, the Coorong, I have mentioned under South Australia. It seems sufficiently accessible to both States (p. 289) to invite immediate planting; or at any rate, sufficient well-organised planting to obtain a good average figure of timber increment, and see how that compares with the interest curve at four per cent.

554.—*Permanent dedications of areas annually increasing.*

The pith of the last Victorian Forest *Blue-book* (for the year ended June, 1914) lies in the statement (page 6) that during 1913-14 only 109 acres were excised while 5,384 acres were brought on to the area of the national forests. It is added that there is a prospective addition of 200,000 acres which has been inspected jointly by officers of the Forest and Lands Departments, while two further areas of 66,000 and 67,000 acres respectively, are going through the official mill "in process of dedication as permanent forest." This fine progress in real Forestry must be greatly assisted by the drafting and mapping branch of the Forest Office.

No remark is necessary on this. *It marks the new era of Forestry in Australia.* Those who, like myself, have had the privilege of conversation with some of the higher officials, and the friendship of others, know that these are not mere paper reservations, like those that have been deluding the Australian public for 40 years past. These are the beginnings of State Forests that will go on improving and improving till they become many times their present value, and will endow Victoria with a tangible offset to the public debt of the State.

555.—*Royalties too low.*

The payments for standing timber in the forest, the so-called "royalty," seem originally to have been low and not to have been advanced with the recent rise in the prices of worked timber. The report for the year ended 30th June, 1914, states that the market value of the total output of forest produce during the year was approximately £600,000, viz., *between* 14 *and* 15 *times the royalty* of £40,394 shown at page 4. Page 4 is in the part of the report for whom no one in particular seems responsible, but it seems difficult to avoid the conclusion that timber royalties in Victoria are low.

In the United States the value of timber in the forest is stated to average rather less than one-fifth the value of the sawn or worked-up timber; in South Africa this figure is about one-sixth.

556.—*Creswick Forest School.*

The Creswick Forest School presents some difficult problems. It could not, for half a century at least, aim at an adequate training for the higher grades of forest officers. That teaching too would naturally go to a Federal Forest School. But as yet the Creswick Forest School is not even equipped for training the lower grades of forest officers. As a matter of fact, the professor of Forestry has not yet been appointed, though the school has been in existence some two years; and the visitor is left to wonder how these things can be done. Is it political control again? That was bad enough in New South Wales. Is it still corrupting the life of Forestry in Victoria? The critic would say that as things are now, the sciences subordinate to Forestry—Geology, Botany, Surveying—might as well be learnt anywhere else, while the arboretum and forest plantations are not yet large enough to count for much.

The legitimate aim of the present Creswick Forest School should be the teaching of elementary general Forestry and more advanced Extra-tropical Arboriculture; as is now being done at the secondary South African Forest School at Tokai, near Cape Town. The head of this school is a professionally-trained forest graduate of the Yale Forest School, America—a South African sent abroad by the Government for his training. Sending students abroad for training is the only course possible for the higher forest training in Australia at present. It may be assumed that a qualified Forestry professor will be appointed at Creswick without much more delay, and the smallness of the arboretum might perhaps be met by arranging an exchange of students with Cape Town. A year's insight of the more advanced extra-tropical Forestry in South Africa would be of immense benefit to an Australian student; and a year in the great natural Eucalypt forests of Australia would be equally beneficial to a South African student.

I might also suggest the advisability of considering a union of the South Australian and Victorian forest schools as a step towards a Federal secondary Forest School. At present Creswick has equipment, while South Australia has a Professor of Forestry with considerable forest qualifications. There is scarcely room at present for a Forest School in each State, whereas a strong Forest School formed by the union of two States would attract students from outside; it would also be more economical. It is not clear at present whether the Western Australian Government, for instance, could best send its students to Creswick, to Adelaide, or to Cape Town. Similarly there might be another secondary Forest School at or near Sydney, preferably Armidale, for training the subordinate forest staff of New South Wales and Queensland.

The cost of the Creswick Forest School is somewhat curiously debited not to education but to Forestry, the view taken apparently being that Forestry should

not form part of general education in Australia. This is a very unfortunate view, considering the mass of antiquated rubbish that is taught at many schools, and the usefulness of some knowledge of Forestry and Arboriculture to every one in Australia.

The equipment of the Creswick Forest School is excellent. It would be hard, I take it, to find a better site for a Forest School in Victoria. The days I spent there on my two visits I reckon as among quite the pleasantest of my Australian forest tour; and the British Association members are not the first visitors who have been aroused to enthusiasm on visiting the Creswick Forest School. I look forward to seeing it again some day, with its pine forests stretching to the horizon, and an arboretum worthy of the tree wealth of its favourable tree-growing climate.

557.—*Forest revenue and expenditure.*

In round numbers the gross expenditure shown for 1914 is £61,000, and the revenue £68,000. There is thus a credit balance of £7,000 odd. This includes expenditure on the Forest School (properly Educational Department), on the Newport seasoning kilns, since transferred to Public Works Department, and exceptional expenditure (on both sides) on the Kilmany forest.

If one takes the ordinary expenditure and revenue of the State Forests of Victoria, one gets (in round numbers)—revenue, £58,000; expenditure, £45,000!

Either way, the figures are not satisfactory. To the man in the street they look well enough. Here is a Government Department doing good work and showing a surplus. But a moment's reflection shows that the Forest Department, through want of funds, has not fulfilled its functions. It is the starvling child of the State. An expenditure equal to the revenue *at this stage* of its work is an absurdity! The Forest Department has not yet entered upon its real work. The 4,000,000 acres of Victorian State Forest represents a huge capital returning little interest and deteriorating until fire-protection becomes effective.

The sum of 10s. per acre per year is a low rate for an extra-tropical forest to yield; but even at that rate the State Forests of Victoria should be returning at least £2,000,000 yearly. And 10s. per acre is a very low estimate. To-day over a large area in the Black Forest in Germany the revenue ranges from £2 10s. to £5 per acre, and there the growth of the trees ceases for about half the year. The market for timber in Australia and in the Southern Hemisphere is good enough, but the Victorian forests require population and organisation.

The State Forests of Victoria have to be organised, fire-protected, and have softwods introduced. They have to be developed with roads, a rural population, and the utilisation of the huge stock of over-mature timber deteriorating in the *comparatively* low-grade, fire-swept, virgin forest. If private enterprise hangs back in working off the mature timber, Government should do it itself: as the Western Australian Government is now doing, and as Germany has done for over a century. The German forests are models of good management, and yield £15,000,000 net revenue a year to the German Government.

558.—*Buying Tasmanian timber while over-matured Victorian timber left standing.*

At present Victoria, instead of rapidly turning to money its old over-mature stocks of timber, is importing from Tasmania. It is playing the wrecker to that ill-governed little State, instead of developing its own forests, its splendid inheritance which will always keep it in the forefront of the Australian States. The report itself expresses doubt on this point. In Part I. (the anonymous part) it is

stated:—"It is doubtful if the Department should be regarded as a revenue-producing one."

The State Premier of Victoria, in his memorable pronouncement of 11th November last, promised exactly what is wanted in funds for the State Forests of Victoria, and I hope we shall never again see a forest budget in Victoria better calculated to please the "man in the street" than serve the real interests of the State. In South Africa, with less than 500,000 acres of indigenous forest, where too there is little fire and little over-mature timber, can spend on its Forestry three times its forest revenue, Victoria should spend six times its forest revenue, say one-third of a million pounds yearly, with the certainty that in a few years there will be a great forest industry such as Japan (with its forest expenditure the equivalent of £1,000,000 yearly) is now building up.

559.—*Details of revenue and expenditure.*

In 10 years the gross forest revenue of Victoria has risen from £17,000 to close on £70,000 (p. 10, Yearly Report, 1914-15), and the *increase* this year comes near *to the total revenue* 10 *years ago.* This should be good enough, even for the man who cannot see beyond to-day, the man to whom country and children are nothing, and who cares not should the mountain-lands of Victoria be reduced to the condition of the mountain-lands of Spain and Italy as the traveller sees them now.

Salaries represent under one-third of Victorian forest expenditure, viz., $\frac{19}{61}$ This is a healthy feature of the expenditure. In the more backward of the Australian States, the whole, or nearly the whole, forest expenditure is on salaries.

The Victorian forest revenue shows an advance of £14,000 on any previous year; it is in fact showing a most satisfactory growth under the present regime. In 1899 it was only £12,193.

It is gratifying, too, to note that the Postmaster-General pays for his timber. That is more than the Queensland Railway Department does.

Grazing has yielded £8,000. This shows what a large revenue might be realised with the improved grazing of the regular forest where broad grassed fire-lines would probably be a feature.

Wattle-bark licenses have sunk to £1,000; three years ago the same item was £1,500. No doubt bark is lower than it was three years ago, but it is equally beyond doubt that untold areas of Black Wattle have been burnt in Victoria, and that as soon as the forests are organised and put under efficient fire-protection, Victoria will be able to compete more seriously with Natal, where one hears already of troubles with the Indian labourers and of Black Wattle cultivation being replaced by maize.

560.—*Sawn timber outputs.*

The year immediately before the outbreak of war, the Victorian forests yielded 64,000,000 super. feet (say, 5,120,000 cub. feet.) of sawn timber valued at £322,000; also 359,000 sleepers valued at £60,000 (say 3s. 4d. per sleeper); some 74,000 cub. feet of pile and beam timber; and 367 tons of firewood valued at £74,000. The market value of the whole production of the forest was £600,000 (Cons. Report, 1914). This may be compared with the value of the Tasmanian production, which in *The Statesman Year-book* for 1914 is (at p. 59) returned at £557,000.

561.—*Melbourne water supply catchment area forest.*

The Yearly Forest Report for 1911 contains the statement that 37,760 acres was excised for water supply purposes and vested in the Melbourne and Metropoli-

tan Board of Works. The total area of forest under the Melbourne Water Board is something like 100,000 acres.

I have travelled through a large area of forest fire-swept and deteriorating, which I was informed on enquiry belonged to the Melbourne and Metropolitan Board of Works. It was, in fact, the Melbourne Water Supply gathering ground. Quite properly the Melbourne water area should be preserved under stringent conditions against every chance of contamination of the water, but that does not necessarily mean the locking up of 100,000 acres of accessible forest near Melbourne which should be returning £1 or £2 per acre in forest revenue.

It is quite easy to foresee that at no distant date this forest might be bringing in £250,000 yearly; but to do that in the future, the forest must be cared for *now*, and it is left now in the most miserable condition, fire-swept, and in charge of no skilled management. It might be in England for all the care that it receives. One could not imagine such an enormity being perpetuated on the Continent of Europe for six months.

As soon as the forests were set aside for water supplies a Commission of Experts should have met and "Working-plans" for the forest have been drawn up. That is the ordinary course to have followed. When I asked why the forest was left in its present condition no one seemed to know. It is difficult to say whether the forest is in a worse condition at present for producing timber or water. Fires have swept through it unchecked until now the soil is nearly as bare as a macadamised road. The forest has a park-like appearance. This looks well on paper, and is in fact pretty to look at from the road, but foresters know what that means. It means that the forest is doomed to disappear.

562.—*How forests improve water catchment areas.*

It sounds like a school-board teacher to talk about the water-holding power of forest humus. I will, therefore, only quote what Sir William Schlich's Manual, the English classic, says about humus. In Volume II. it is stated that dry coniferous needles, in other words, the leaf droppings of pine trees, will absorb from four to five times their weight of water. Beech is the common leafwood tree of dense forest in Europe. Beech leaves will absorb seven times their weight in water, and the moss that grows in dense forest six or seven times its dry weight.

In South Africa I collected humus from decaying leaves of Gum trees and Acacias, and the water-holding power of these was determined in the Government Laboratory to be about three times its own weight. Very little arithmetic is required to see the difference in the water-holding power of the Metropolitan area if that be covered with humus, or a clean burnt area like it is at present. Let any one take a dry bath-sponge and see how many times its weight of water it will hold before it begins to run, and then imagine a layer of similar water-holding vegetable matter, the forest humus, spread over hill and dale. Calculate the water which square miles of this vegetable sponge will hold.

It is true that the ordinary soil of the forest will also hold water, but only in a small proportion varying with the sort of rain. The soaking rain will get into the soil pretty well, but the stiff soils which hold it best also run it off best. The average proportion between the "run off" and the "soak in" can be calculated for any locality. It is only the forest humus which holds all the water and runs off none till it is saturated.

A sandy soil will run off very little water, but it will also hold little. A layer of sand at the surface is a fine water-holder, but it is not possible for man to spread a layer of sand over hill and dale and keep it there. A forest vegetable sponge he

can spread and keep. I have known the layer of humus in an European forest to be over two feet thick. One could poke a walking stick into it and not touch the bottom. Usually, of course, it is much thinner. There is in nature a constant process of renewal and decay.

In a Eucalypt forest near Cape Town the vegetable layer of humus, leaves, bark and other débris was observed *in a fire-protected forest* to be accumulating at a rate of two-thirds of an inch per year. I have seen the permanent vegetable layer nine inches thick under an old forest of Eucalyptus and Wattles near Cape Town in a place where it had been undisturbed by fire or anything else for many years.

And this loss of storage, and feeding of the springs, is only part (1) of the story; (2) the open park-like forest that one sees at present as the result of fire, affords little protection against evaporation due to sun and wind; (3) there is the contamination coming to the water when it rushes over bare slopes instead of filtering gradually through vegetation. The discolouration of Melbourne water after rains is now a subject of complaint. It is certain that if the forest was in good condition the water would tend to become clearer and purer. There would be less surface water and more spring water, and the surface water would reach the reservoirs filtered through the vegetable sponge clear and pure.

563.—*Melbourne's catchment area has not suitable forest.*

On the other hand, a better forest might use up more sub-soil moisture. I say it *might*, because the subject is not one which can be explained in a few words (p. 208). As a general rule, the more quick-growing the forest, the more water it uses up: and the more dense the forest the more water it conserves. *Thus what the Melbourne water area wants is dense slow-growing forest.* What is has mostly got is an open, fairly quick-growing forest, and a class of trees notorious for sucking up sub-soil water—the Eucalypts! It could hardly be in a worse state.

When "working-plans" for the forest were drawn up these facts would have to be taken fully into account. Probably the first step to attempt would be the introduction (perhaps by methods more economical that regular plantations) of such trees as the beautiful Busaco Cedar (*Cupressus lusitanica*) of Portugal, which, while not growing very rapidly and not taking much moisture out of the soil, would furnish a good layer of humus and protect the soil against the drying influence of sun and wind. Such a forest would necessarily be a slow-growing one, but the value of so fine a timber as Busaco Cedar would, to a great extent, make up for its slow growth and the ultimate money yield of the forest would be maintained at a reasonable level and repay the cost of conserving the forest, even if it had to be all planted with Busaco Cedar; but in this same climate, in Portugal, it spreads itself like a weed in the forest at Cintra.

At present the forest is yielding nothing; conserving less water from year to year, and deteriorating rapidly from the forest fires of civilisation. The existing forest is Eucalypt which, as I have mentioned, happens as a class of forest, to be the worst to conserve water supplies on account of its poor shade-giving qualities, and of its sucking up moisture from the subsoil.

The question will be asked: "How would such a forest be managed on the continent of Europe?" The reply is: "Automatically it would come under the Forest Department working it in trust for the owners." This is the common practice all over the continent of Europe. I was surprised when in Portugal last year to find that, besides this, the "regime forestiere" had been extended over a large area of private forest. In Portugal over 1,000,000 acres of private forest have been thus

placed voluntarily under the management of the Forest Department. That is the best proof of the practical value of skilled management. On the continent of Europe all forest owned by Municipalities and Public Trusts is compulsorily under the management of the Forest Department.

564.—*Melbourne Botanical Gardens.*

Arboriculture of Victoria.

For instruction in practical Extra-tropical Arboriculture there is nothing in Australia approaching the Botanic Gardens, Melbourne, and these gardens are as useful as they are beautiful. It is quite certain that there is no other 100 acres in Australia, and perhaps in the world, where there is so much condensed beauty of vegetation. The gardens have long been a source of botanical instruction from the time of Von Mueller downwards; but it may not be generally known how useful these gardens have now become in the study of Arboriculture, and this has arisen in this way:

Baron Von Mueller was a great tree-planter. With his botany and love of trees, he came near to making a national Arboretum in the Botanic Gardens area, and when this was transformed to the present beautiful gardens, not many of his trees were sacrificed. Those trees have grown up and we now see the result of Mueller's Arboriculture.

The labelling of trees is singularly good, second only to that of the Botanic Gardens, Kew, London, which has long been famous for its complete and accurate naming. The labelling in the Botanic Gardens, Melbourne, is only comparable with the labelling on the much smaller collection of trees in the Sydney Botanic Gardens. There is little labelling at Perth and Brisbane, while that at Adelaide and Hobart is gravely *inaccurate*, which is perhaps worse.

The only criticism I have to offer on the Melbourne labelling is that the labels might be made more economical and lasting by the adoption of the Kew lead stamped label; or, what is an improvement even on this, the aluminium stamped labels in the Government Arboretum at Tokai, near Cape Town. To the student of Extra-tropical Arboriculture, the utility of the Melbourne tree collection would be greatly enhanced if a special enquiry were now made, and the age of the trees settled, as far as possible, this being then brought on to the labels. This important figure would take up very little extra room on the labels, and it might, in fact, take the place of the botanic author of the botanical names, the latter being a point of no interest out of books, and one which is now often omitted, even in books.

The second point where the Botanical Gardens of Melbourne are pre-eminent is the possession of a singularly able staff, readily accessible to the public, From the Director to the particularly well-informed man who does the labels, every one seems ready at a moment's notice to impart his information to the visitor. If the visitor wants a name or questions a name, he has only to walk into the office, and he can there learn all that there is to be told about it. A useful working Herbarium is attached to the office, so that any plant or tree can be verified at once.

There is one point where, perhaps, the usefulness of the Melbourne Botanical Gardens might be increased. Personally conducted tours, which have recently become so popular in the various museums in England, have been extended to the Botanic Gardens at Kew, London. Melbourne might well follow this example.

There is nothing in Australia to equal the parks and gardens of Melbourne. No doubt the Adelaide parks and the Sydney Botanic Gardens make good seconds;

but a much better water supply and larger expenditure would be required to bring the Adelaide parks at all near to those of Melbourne, and the Sydney Botanic Gardens, on poor shallow soil, have only a fraction of the trees at Melbourne.

565.—*Melbourne street planting.*

Progress, too, is being made in the Melbourne street tree-planting, though this can only be said at present to be quite in its infancy. Upper Collins Street should have a double row of trees, like the boulevards of Paris, and the trees of upper Collins Street should be multipliel so as to clothe and beautify the streets of Melbourne generally. It is easy to see that Melbourne, though more advanced in Arboriculture than any Australian Capital, is still under the predominance of British ideas. Rock gardens are useful in a wet climate, where every glint of sunshine is precious; but in the latitude of Melbourne there is ample light for the more extended beauty of trees and their grateful shade.

The roads, too, have a super-abundant space for tree-planting. The sentiment in favour of broad roads has often carried these to excessive broadness. In a sunny climate broad roads are dusty and glary, and may be very expensive (p. 54); but like the obsolete ramparts in so many of the older towns of Europe, they are capable of being turned into beautiful boulevards. A road so broad as the St. Kilda Road, which is 80 yards broad (actually the side of an acre in breadth) is in its present state neither beautiful nor economical, but filled up with two rows of trees on each side it would be comparable to some of the most beautiful boulevards of Europe. The conceit that this width is necessary for the traffic need scarcely be mentioned. The St. Kilda road is some five times the width of the Corso at Rome, and has naturally only a fraction of the traffic of the chief thoroughfare of Rome.

Melbourne has not the fine tree-growing climate of Sydney or Brisbane; but it has a good water supply, and like the Oak Avenue at Cape Town, it would not be difficult in most of the streets with their gentle slopes, to run water down their sides. How well certain trees respond to a little water is strikingly shown in the Faulkner Park. The Plane seems to grow as vigorously in Melbourne as in South Eastern Europe, provided it is watered; and it is scarcely necessary to refer to the luxurious vegetation of the Elm and the Poplar, particularly the *Populus balsamifera* of Upper Collins Street. *Quercus lusitanica* and its varieties including *Quercus mirbeckei,* and some other Oaks, make magnificent pyramids of verdure in Melbourne, with a little water help. They are the hardy trees of this latitude in Southern Europe and the Mediterranean. The Canary Pine and a few other Conifers will grow without water, but in the central parts of Melbourne the smoky atmosphere is not suitable to Conifers. *Ficus macrophylla,* or Moreton Bay Fig, has been a great deal planted, but this, besides being quite a climatic exotic, has the far-reaching roots of most of the figs so that the roots break up pavements and get into the foundations of houses. There are plenty of better-behaved trees that will not do this, but as far as possible it is preferable to make the matter quite sure by running water down the sides of the trees and thus keeping the moisture-searching roots in the right place.

I had an interesting afternoon with the Municipal Official in charge of the Melbourne tree work, and I saw enough of the success of Melbourne trees to show that they could be extended tenfold and make Melbourne as beautiful generally as it is now in certain beauty spots. It is curious that throughout the Capitals of Australia, one sees arboriculture well attended to in certain spots, such as the University grounds, particularly those of Sydney, Melbourne and Brisbane; but this arboricul-

ture is not extended to the streets where it is most wanted. This may possibly be owing to mistaken ideals. Towns in the thin sun and damp climate of North-Western Europe have been taken as models, instead of those beautiful towns one sometimes sees in the warmer climates of Southern Europe.

CHAPTER VI.

Forestry in Tasmania.

566.—*Tasmania only one-fourth ploughable.*

Tasmania is a mountainous island, the one all-forest State of Australia, rather smaller than Scotland in area; in mountains, waters and climate somewhat like the main island of Japan, the mountains lower, but often volcanic, and clad with snow for a part of the year; the climate somewhat drier, the mean temperature like Japan, but less brusque (less extremes of heat and cold).

The larger part of its area, some 11 million acres out of 16¾, is so mountainous, so stony, or with such poor soil, that it is only fitted for forest or very inferior grazing. It is doubtful if it would even pay to grass it ever so roughly. The neglect of scientific Forestry, the small area of ploughable land, the expense of turning the steep stony and mountainous land into pasture, and the constant emigration of the best men and women to the mainland of Australia, made Tasmania almost stationary for nearly 100 years. Tasmanians talk of this period as the Portuguese do of the 100 years, or so, that they were under Spanish rule.

Then came the apple and fruit boom in the drier areas, the mining boom in the wet quartz west, and the opening up to Agriculture of the rich volcanic soils in the North—lands as incomparable in soil as they are in climate. These three developments were like the three booms of ostriches, diamonds and gold in South Africa. They sent Tasmania ahead in a small way like South Africa, with its three developments, boomed in a large way. But the three Tasmanian developments have not touched the bulk of the land which, as the Government Botanist truly observes (*Brit. Ass. Hand-book*), is only suited to Forestry.

And they have not much increased the area of land under the plough; for while the orchards have increased, the wheatlands, by far the most productive in Australia (about double the yield of the mainland wheatfields) have decreased from 43,091 acres in 1904-5 to 18,432 in 1913-14. (*Statesman's Year-book*, Tasmania, 1914.). Only 1.7 per cent. of the total area of Tasmania is now under crops which may be compared with 7.25 per cent. in the less fertile climate of Victoria, and only over 500,000 acres in Tasmania have been cleared and grassed. (*Official Year-book of Australia*, No. 7 of 1914.). Other returns give the total area under cultivation of all sorts to 1913-14 at 912,658 acres.

567.—*The real land question ignored.*

The real land question in Tasmania has been the Forestry question, and that, under the influence of parochial politics and British ideals, has been persistently ignored. To the travelling Englishman, this devotion to British ideals appeals strongly. Tasmania, this gem of the South, seems like an English county that has slipped through the globe and emerged in the great watery waste of the Southern

Hemisphere. Its population of 200,000 is English to the core, intensely conservative, and with all the Englishman's virtues and failings. There has been no State Forestry in England and there has been none in Tasmania. To talk of Forestry to an average Tasmanian is like talking of Forestry to an average Englishman. They may do these things on the Continent of Europe; we do not want them!

I have referred to the position of Forestry in England (p. 168) where the want of it is now costing the country some £43,000,000 yearly; and far worse, is an important phase in the great social question of rural depopulation. But England has other resources. It easily pays its £43,000,000 out of coal and manufactures. But Tasmania cannot do so. It has to get its wealth, and maintain its population, primarily from the land, though it has so far failed to do so that only 15 per cent. of the bread-winners get a living on the land from Agriculture, Mineral, or Pastoral occupations.

568.—*Tasmanian forestry the worst in Australia.*

Though the home of the Blue-gum and Blackwood, the indigenous forest of Tasmania is inferior, in softwoods, to the forest of Japan. The hardier softwoods of the Northern Hemisphere remain to be planted, propagated, and extended by general forestry measures; and, indeed, when we come to Forestry, all comparison with Japan ceases. The national Forestry of Tasmania is the worst in Australasia; so that what should be the chief source of national wealth in Tasmania remains undeveloped.

There is a Forest League in Tasmania and only three years ago the Premier promised the League that a Conservator of Forests should be appointed. Old records show that 50 years ago similar representations were made to the Government. Perhaps the iniquity of the present position was urged too much on patriotic grounds. Tasmania is hard-pressed for money, but I shall show presently, that taking the experience of other Australian States, Tasmania is losing some £90,000 in forest revenue, and a very much larger sum in loss of timber exports, owing to its neglect of its Forestry and to its out-of-date Government methods. I see a note in the *Indian Forester* to the effect that in 1909, "Tasmania, with all its forest wealth, had a forest revenue of only £3,841 and a (nominal) forest expenditure of £424—a pitiable tale for the home of the Blue-gum and the Blackwood!" This is the position still.

At one time there was a Conservator of Forests in Tasmania, but he was not a qualified man and modern scientific Forestry has never been attempted. For two years, it is said, Tasmania had a Conservator of Forests, a tree-enthusiast, with a journalistic training! But "a little knowledge is a dangerous thing." The tree-enthusiast may be as poor a guide as any other enthusiast. The artistic people and tree-enthusiasts cost the French Government some 14,000 francs (£560) a year in maintaining uncut, over-matured timber in the suburban forests of Paris, though there is some return for this in the expenditure of the artistic people, who come to live there for the beauty of the forest.

It is said also that in Tasmania a few local men are making money out of the destruction of the forest, the ruin of the country, and that their local influence is sufficiently strong to stop reform. If so, it is not surprising. In nearly every country's Forestry history, there has been, at one time, a conflict between local and national interests.

569.—*An ideal area for growing softwoods.*

In the Central and Western highlands of Tasmania is an ideal area for the planting of that coniferous timber now being imported from the Northern Hemis-

phere at such a ruinous cost. But this would be a large and, in the first instance, a costly work.

Tasmania is the strongest instance I have seen in Australia of the advisability of placing national Forestry under the Commonwealth Government. This has been done in the United States of America, and in South Africa too, with the general union of the States. As Australia progresses towards a more complete and economical federation (it is extraordinarily costly at present) it may be presumed that Forestry will be one of the first departments of Government to feel the benefit.

Perhaps, even before this, Tasmania and Victoria are so closely united in many ways, that it may be found possible for Victoria to take over the Forestry of Tasmania. Something should be done and done at once. The Federal Government is now subsidising Tasmania to the extent of £95,000 a year, and at the same time Tasmania is squandering its chief natural wealth (its forests) as recklessly as might, for instance, a Turkish Administration.

It would be preferable, from a national point of view, if, in place of the special subsidy, Tasmania were to receive from the Federal Government a forest loan of from £4,000,000 to £6,000,000. It is probable that the expenditure required to demarcate, organise, and put into good forestal order the unoccupied heavy-rainfall area of Central and Western Tasmania, may prove a task beyond the resources of Tasmania, even with a good forest loan on its own account. The area would be some 9,000,000 acres. Tasmania has the only large unoccupied area of good cold temperate tree-growing climate in Australia. About half Tasmania has a rainfall of over 40 inches.

570.—*No trial plantations yet attempted.*

It is sad that the shiftless Tasmanian Government has never established even trial plantations in a region so marked out by Nature for a forest country. It is worth noting that in a climate like the Central highlands of Tasmania Oregon is growing so well (in certain trial plantations) in England, that the yearly production of timber ("Acrim") is equal to the total stand of mature timber (200 cubic feet) in the best Blackwood forest of the North-West of Tasmania. Here we see, once more, the striking difference between the cultivated and the wild forest; the first producing as much useful timber per acre in a year as the wild forest does in about 60 years.

The "Silver Fir" of Europe (*Abies alba*) and other wood-pulp timbers would probably also grow very well in the cold wet Tasmanian highlands. A scheme of this sort would go far to redress the present anomalous position of the State of Tasmania—the extraordinarily heavy taxation and the small expenditure on necessary public works. See the remarks of the Commonwealth Statistician quoted at page 349. The percentage taxation is two and a-half times the average for the Commonwealth.

A forest scheme for the Central and Western highlands would, of course, mean a considerable but, in the end, very remunerative expenditure, and the permanent settlement with a strong rural population of land that has lain waste for 100 years. The whole costs would be clearly repaid out of the £3,500,000 now (and £6,000,000 presently, page 167) going *yearly* from Australia to pay for imported timber.

The island of Tasmania is still famous for its timbers, particularly for its Bluegum and Blackwood, resembling Walnut—the most generally valuable of the timbers of commerce. Walnut grows luxuriantly in Tasmania when planted.

It has repeatedly been stated that there are 11,000,000 acres in Tasmania only fit for Forestry, representing mining and poor ground, which would barely

carry one sheep to the acre if put under grass, and that the value of the grazing is too small to pay for the cost of grassing. It is quite uncertain what value attaches to this figure. If a Forest Department were in existence, one of the earliest functions would be to elucidate this point by means of reconnaisance and plane-table survey. Secondary surveying is an essential part of the working Forester's duties. The "boussole" to the French Guard, and the plane-table to the Indian Forester, are like the rifle to the soldier. The mapping room is an indispensable part of the Melbourne Forest Office.

571.—*Forest area merely a rough estimate.*

The *Commonwealth Official Year-book* for 1914, p. 386, returns the forest area of Tasmania at 11,000,000 acres. This is confessedly only a very rough estimate.

No one in Tasmania knows within 2,000,000 or 3,000,000 acres what is the forest area. A few days ago the Minister in charge of forests told a deputation that a forest survey was under consideration. Seeing the helplessness of the Tasmanian Government, the usefulness of the information to the British Empire, and its scientific interest, possibly the Royal Geographical Society of London would take the matter up. The Society (of which I am a member) has spent large sums on surveys in Bolivia, apparently of less importance scientifically than would be a forest survey in this lost corner of the Empire. Probably a party of Royal Engineer Plane-tablers could, in a couple of years, get together the essentials for a forest map of Tasmania.

There has never been the smallest attempt at forest demarcation in Tasmania, so that most of the accessible forest has been burnt, though it may have been Eucalypts with trees amongst the tallest in the world, the "Tasmanian Oak" of the timber merchants, or figured Blackwood logs worth over £50 a piece. The ruin and waste are indescribable.

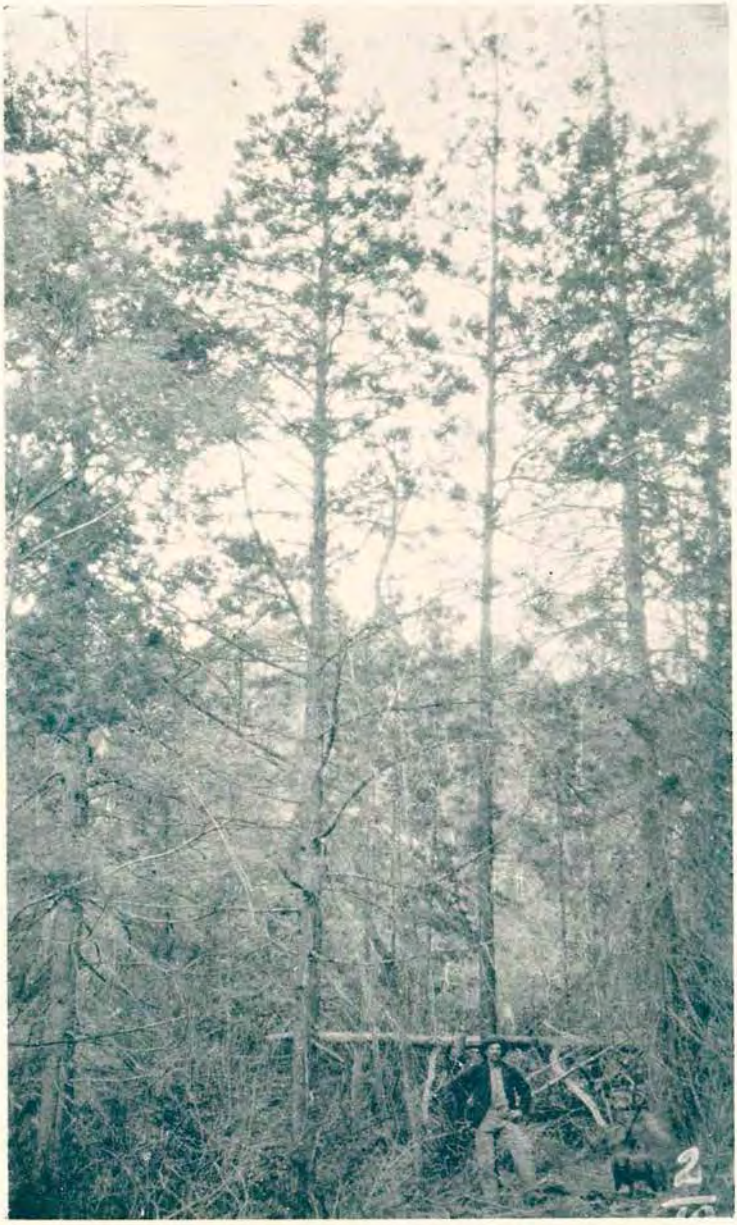
572.—*Reckless timber grants.*

Timber grants (p. 346) have been made recklessly, with little regard to the future and without taking skilled advice as to the conditions required to preserve and improve the forest. Single grants of alienated land up to as much as 15 miles square are seen on the map. Of 16,778,000 acres, the area of the island, not three-quarters of the odd 788,000 acres is cleared or cultivated, after more than a century's occupation! (*Statesman's Year-Book*. Tasmania 1914.) Nowhere has Anglo-Saxon colonisation been such a failure! But millions of acres of good forest have been destroyed: forests containing Celery-top, Huon-pine, King William-pine and Cypress-pine, beautiful and rare softwoods, that are really more valuable than the softwoods for which Australia is now paying at the rate of £10,000 per day.

573.—*High durability of the four chief softwoods.*

These Tasmanian softwoods are indeed of great merit. A Forester would rank them amongst the highest class of the world's timbers—the "durable softwood" class. Three out of the four are considerably more durable than the average of Tasmanian hardwoods. They are all much more easily worked and more easy to season and transport than the hardwoods.

Huon-pine.—Huon-pine is the pearl of great price amongst them. It is the Teak of Tasmania. It is particularly like real Teak (*Tectona grandis*) in its easy working, its seasoning, and its durability. It is indeed more durable than Teak. Huon-pine coffins, buried for forty years, have been dug up with the woodwork discoloured, but still sound. The old Franklin Square drain gave an even more



"Oyster Bay Pine" (*Callitris rhomboidea*): Tasmania.

Photo: D. E. Hutchins.

striking demonstration of its great durability. Huon-pine has a peculiar antiseptic essential oil that preserves it from decay. It is not so strong as Indian Teak, but it is certainly more durable. It is probably unsurpassed in the world for fineness of grain and good seasoning: on the whole I should say a more valuable timber than real Teak. Old houses in Hobart had their joinery made of it; never, they say, was there better joinery. For boat-building there is nothing to touch it in South-Eastern Australia. It is too slow-growing to replant, yet the forests of it have been ruthlessly destroyed. Little timber now remains, and that is obtained with difficulty for special use. Let us hope that, with the dawn of better days for Tasmania, it will not become an extinct species or a mere botanical curiosity.

Celery and King William Pines.—Celery-top-pine, a widespread and very useful species, has qualities intermediate between Huon and King William-pine It gives a first-rate sleeper. King William-pine is comparable with samples of old red Scotch-pine timber. The timber, the least durable of the three, is said to be about as durable as average Tasmanian hardwood, and it is not a very slow-grower. Otherwise, the Tasmanian Conifers are generally slow-growing—too slow-growing to cut down and economically plant again, according to popular notions of Forestry. It would cost the State nothing beyond fire-protection to preserve them if the forests were scientifically worked, and many of them are on land too poor even to pay as grazing. As it is, they have nearly disappeared from the accessible forest, and will disappear from the face of the earth if the present regime continues in Tasmania. "It has been estimated," says the Editor of a leading local newspaper, "that on some of the best and heaviest timbered land in the State it has cost from £15 to £20 per acre to destroy an article (the timber) which should be a chief source of profit." (Pritchard: "Resources awaiting Scientific Research.")

The "Oyster Bay" Pine (*Callitris rhomboidea*).—The fatuous neglect of the forests of Tasmania is nowhere more glaringly seen than in the case of its Cypress-pine—a valuable softwood, as easily worked and more durable than the imported softwood, but often requiring some care from the forester to shape the stems and keep them free from knots. Like the rarer Conifers of Tasmania, it is of slow growth, and once destroyed will scarcely pay to replant, though the growth of the Tasmanian tree is far from being as slow as most of the Cypress-pines on the mainland of Australia. It reaches a maximum diameter of 2ft. 5in. and a height of over 100 ft. in Tasmania. It has the strong natural reproduction and straight growth of the true pines of the northern hemisphere. After seeing the forests of it on the East Coast I can endorse all that Colonel Legge says in its favour.

Five years ago, Colonel Legge published his interesting monograph on the "Oyster Bay" pine. It was printed by the Premier, but nothing has been done to organise the "long-hoped-for Forest Department" pathetically referred to. Colonel Legge is a recognised scientist, and an old and valued resident landowner of Tasmania, and in the preparation of this monograph had expert assistance. He is the President of the local Forest League. Apart, therefore, from the report of a forest expert, this monograph could not carry more weight. Nevertheless, Tasmania still continues to burn and destroy its Cypress-pine furnishing a good durable timber, and its houses continue to be built of the handy but comparatively perishable pine timber from the northern hemisphere. Few seem to be aware that, though the Cypress-pine timber has certain defects, these would disappear in the cultivated forest, nor that it is poor economy to build houses of timber from the other side of the globe when the native hardwoods furnish stronger and more fire-resisting timber for beams. Actually, the Cypress-pine of the island is in a grade of softwood classified by Foresters above that of the imported softwood.

A country which can produce a cheap, durable softwood pole in its indigenous forest is a country blessed of the gods! South Africa is without it. The "Oyster Bay" pine has been planted in various parts of South Africa. In Tasmania valuable Cypress-pine forests could be constituted for the cost of demarcation and fire-protection: instead of this the forest is destroyed, and inferior softwood imported from the other side of the world. No wonder that the country has comparatively stood still for nearly 100 years. and that its finances are deplorable!

574.—*The Tasmanian hardwoods.*

The hardwoods of Tasmania can only be referred to here. In a commercial sense, some four-fifths of the forest of Tasmania is hardwood—useful timber, but (excepting Blue-gum and Blackwood, which are now nearly finished) without the special qualities of durability and strength seen in the best of the Eucalypts on the mainland. There is no Ironbark (properly so called) in Tasmania, nor any durable timber like Tallow-wood, Box, or Jarrah. The Tasmanian commercial hardwoods are Blue-gum and various Eucalypts, chiefly of the Stringy-bark class.

On the other hand, the Tasmanian hardwoods average lighter in weight, and are thus more generally useful than the mainland Eucalypts. The commonest timbers are Stringy-bark, and of this class, in the wetter areas, *Eucalyptus gigantea* has a timber weighing, in some Alpine samples, as low as 28lb. the cubic foot. Ordinary Tasmanian hardwood (apart form Blue-gum) is a little heavier and much stronger than European Oak. Julius gives the following figures:—

	Air-dry Weight.	Transverse breaking-strength.
	Lbs. per c. ft.	Lbs. per sq. in.
Victorian and Tasmanian Stringy-bark (*Euc. obliqua*)	56	14,300
Victorian and Tasmanian Blue-gum (*Euc. globulus*)	57	15,600
English Oak (*Q. pedunculata*, etc.)	52	11,800

The commercial "Tasmanian Oak," in ordinary furniture, has much the appearance of English Oak. It is not quite so ornamental as English Oak cut on the quarter and showing the "silver grain"; it is more ornamental when "fumed" is the ordinary way with ammonia. As a furniture wood, it seems correct to say that "Tasmanian Oak" is equal to English Oak in appearance, is very slightly, if at all, heavier on an average, and is about one-fourth stronger (Julius, 21 per cent.) than English Oak. In house-building it is superior to the English Oak. As a durable timber in the ground it may be somewhat inferior, but on this point comparative figures are not available.

There are many other timbers which skilled Forestry could doubtless turn to account. The abundant Tasmanian Beech (*Fagus Cunninghamii*) is about as useful as European Beech. Lancewood (*Eriostemon squameus*) is probably an undeveloped asset in a country left without any particularly durable timber since the destruction of Huon Pine. There may be difficulty in getting much of it large enough for the standard sleeper, so that in view of its durability a thinner sleeper may perhaps be usefully considered.

The valuable qualities of Tasmanian Blue-gum are well known. But, unfortunately, the suicidal policy of the Tasmanian Government has nearly finished the supplies of accessible Blue-gum. It is estimated that 10 more years of burning and cutting at the present rate will finish it.

The supplies of accessible Huon-pine have long been finished; the supply of accessible Blackwood will soon be in the same position.

575.—*Typical forest country described.*

I may here insert a note of information which was given to me my Mr. Black, of the Agricultural Department, who recently followed the Linda track from Hobart to Linda, near Gormaston and Mt. Lyell.

Mr. Black states that most of the track was through open country or poor forest. He passed through about 65 per cent. of treeless country, mostly button-grass plains. Of the remaining 35 per cent. only about 10 per cent. is now good forest. The party traversed a large area (some 15 miles) on the Raglan Mountains of burnt forest of King William-pine. This fire occurred some years back, and it seems to have swept away the vegetable soil with the forest. It will take many years for the country to recover from this burn—if it ever does.

Towards the West Coast the forest is on poor silicious soil, but the good forest there is so dense that even at mid-day it was sometimes hard to take photographs. The principal tree is the Beech (*Fagus cunninghamii*) growing up to 150ft. or even 200ft. of total height; and with the Beech is Sassafras. There were patches of Huon-pine up to 4ft. diameter and 100ft. bole. This was the most valuable timber tree. Good Blackwood trees were met with now and then, but there were no timber beds of Blackwood sufficient for a sawmill, and pit-sawing is nearly a lost industry in Tasmania. Eucalypts also occurred sprinkled through the Beech forest. Mr. Black noticed *Eucalyptus amygdalina* (Peppermint) in large trees; also *Euc. viminalis*.

The only two valuable trees there are Huon-pine and Blackwood, but there is not much of them. King William-pine they saw little of, while Celery-top-pine was abundant and the most plentiful of all the Tasmanian "pines" seen on the West Coast.

The chief feature in the forest on the Linda track was the Huon-pine, with large trees averaging 3ft. 6in. diameter and 90ft. high, but it only occurs in a scattered state—not more than two or three together.

576.—*Personal experience of burnt forest country.*

The severity of the forest fires in Tasmania has been described at pages . I may here mention my personal experience of them.

When I came to Tasmania from Victoria I was hopeful of finding some indications of a movement towards scientific Forestry following the example set by Victoria. Tasmania is the one all-forest State in Australia, the only one which can grow good trees nearly everywhere, the one State where the woodman can work in a bracing climate, and where Forestry can proceed so easily on European lines.

As soon as I landed Professor Flynn took me, as the last visiting member of the British Association, with him and Mr. Rodway, the Colonial Botanist, for a Christmas camp-out on the Hartz Mountains. We were encamped in burnt forest, and most of the forest that I saw on the Huon had been burnt. It was everywhere the same picture of utter neglect and wholesale destruction of forest by fire: here and there a small part of the mature timber utilised in the mills, and the rest burnt. There was no forest demarcation. It was quite an accident which part of the forest was milled and which part burnt. If a milling company wanted timber they were given concessions with absolutely no provision for the preservation and continuance of the forest. The larger part of the population got a living by working in the forests, but no care whatever was taken for the continuance of the forest and of their livelihood. At a recent visit to Port Esperance I found a well-equipped sawmill, an expensive line of railway laid to carry a heavy locomotive. and a workmen's village where some two hundred families had lived; all this now

deserted and waste. A Government unworthy of the name of a Government had neglected their first duty to the forest which has now lapsed to the waste of burnt timber and fern shown in the accompanying photo. I walked two or three miles up the railway, which had been carefully remade and regraded on an expensive scale, representing by now pretty well the cost of nearly two railways.

At another part of Port Esperance I visited what had once been the best Blue-gum forest of the district. It was burnt out in 1898. The same fire destroyed the sawmill and plant, valued at some £2,000, and a 20 years' supply of good milling Blue-gum. The accompanying photo shows the fine regrowth of Blue-gum; but this, in its turn, was nearly all destroyed in a bad fire two years ago. Another timber company have put in some 25 miles of tramways and railways at an averge cost of some £1,500 per mile, there being heavy earthworks and the railway constructed like a Government passenger line. All this expenditure is incurred without any plan of securing it for the permanent development of the country; and the whole forest in the South-East of Tasmania is at the mercy of the fires which sweep through it unchecked every two or three years. The contrast between this waste and destruction and the well-ordered working of cultivated forests in other civilised countries can be imagined! It will be difficult to describe it! On my return to Hobart I climbed Mount Wellington and stayed at the "Springs" Hotel; I was told it was no use staying at Ferntree because the beautiful fern-gully had all been burnt out, but I soon found that the Mount Wellington forest was also a burnt-out shell, the forest which should have been religiously preserved for the sake of the water supply of Hobart and for the tourist traffic.

577.—*Hobart's water supply and forest.*

Springs shrunk.—Hobart, like most growing towns, has a not too abundant water supply, yet the forest supporting the springs that feed its reservoirs is nearly all destroyed; a sad contrast to the forest of former times. The following is from a description (in the *Mercury* of February, 1915), by an old resident of Hobart, of a visit to Dr. Smith's monument on Mount Wellington (Dr. Smith, the surgeon of the "Derwent Water," was lost on the mountain in January, 1858):—

> They (the forest paths) all lead up to the Springs, and when old Harry Woods lived there 50 years or so ago, parties would rest for breakfast a little further on, where the giant forest trees and shrubs were delightfully shady, with a grassy carpet to recline on while enjoying the scenery; and alongside a stream of pure water constantly flowing, which then fairly merited the name; but *now, people are curious to know where the Springs are.*

I found the "Springs" hotel packed with tourists, but said one of them to me: "This cannot go on for long." The tourist sees "better forest and scenery on the Victorian mountains"!

This seemed to be an extraordinary state of things, and on my asking reasons for it and inquiring what the Forest Department were doing, I was informed that there was no Forest Department!

578.—*The National Park exposed to fire risks.*

Since I have been in Tasmania a national park has been proclaimed, and the beautiful scenery well warrants it; but where is the machinery for fire protecting it? You cannot, in this climate, have a frequented forest without fires, and it is only waste of money to think you can keep down fires by merely appointing guards or watchers. You might as well expect a policeman to do the work of the fire brigade in Hobart. To fire-protect a forest requires knowledge of the subject and organisation; with that, it is as easy to protect a forest as a town from fire (p. 20).

579.—*A hopeless situation.*

To a Forester visiting Tasmania the present position of the country must strike him as one of the most curious in the history of the British Empire. Here is the one all-forest State of Australia, the one State which should be making its chief wealth from its forests, entirely without the usual skilled agency for conserving and working the forest. Tasmania has been compared to a lunatic camped on "visible gold" for 100 years! In sober truth here is a State with the best climate and scenery in Australia, with towns having the conveniences of up-to-date European towns, with (in my opinion) good railways, with certainly good roads (as far as they go), a magnificent port; but at the end of over a century of Anglo-Saxon colonisation, a population only equal to that of a largish English town, and the most important branch of the administration in a forest country entirely absent!

It is indeed a very remarkable position, and one which it is difficult to entirely account for, even after making full allowances for the fact that the country is closely modelled on British lines and that there is little Forestry in England, and less State Forestry.

The extraordinary result cannot be put down to any political party. The maladministration of the forests was every bit as bad under Downing Street and the various parties that succeeded it as under the present Labour Government.

580.—*Railway dangers to the National Park.*

The proclamation recently brought out for the formation of the National Park deals with some of the most beautiful Alpine scenery of this fair land. Up to 27,000 acres are to be preserved on the Mount Field Range, where there are mountains higher than Mt. Wellington, giant trees, lakes and streams, and where for more than half the year there are snow-effects like Switzerland. I doubt if anyone knows the mountain scenery of Tasmania much better than the Government Botanist, Mr. Rodway, and he is said to describe this as the finest mountain scenery in Tasmania. "But," adds the local newspaper, "this wonderland of beauty and enjoyment has now been brought within easy railway reach of Hobart." That will mean that in a few years it will be a blackened, burnt-out shell like Mt. Wellington, while the ordinary Government machinery for stopping this desecration is absent from Tasmania. The Forest Department, which should conserve, improve, and protect the forest from fire, is non-existent in Tasmania!

581.—*Government culpability for bush-fires.*

The mischief done by fire to the forests of Tasmania generally is indescribable. As in most Australian forests, the forest of to-day is little more than an indication of what the forest would be if protected, as in other countries, from fire.

There is evidence that in North-West Tasmania during the last 85 years, between the time that the blacks have gone and the beginning of "settlement," the forest has become more dense and the open flats smaller. This evidence consists of charts and travel notes left by Surveyors of the Van Dieman's Land Company (Macdonald).

In Tasmania the Government does its best to cause fires! There are no spark arresters on the Government railway locomotives, though certain private lines have them. The Government trains run along burning very smoky coal and emitting streams of sparks that would do credit to a firework display! I lived by the side of the main Government line for six months, so that I speak after seeing. One farmer I know well had his crops and trees burnt by the sparks from a Govern-

ment railway locomotive, and found he had no legal redress! That is a fair sample of Government methods in Tasmania. Not long ago I counted seven bush fires along one mile of railway on the Huon. Bush fires rage unchecked all over the island every summer. There are stories of the sun being obscured for days together during this dissipation of the wealth of the country in smoke. In February of this year the following notice was posted at the General Post Office, Hobart:—

Owing to serious bush fires between Burnie and Zeehan, communication with the West coast is totally interrupted.

The solitary instance of any attempt being made to control forest fires in Tasmania is the municipal park forest on Mt. Wellington. Here the municipality have endeavoured to make fire paths and it maintains an active and zealous forest ranger; but the means at his command are insufficient. The protection of the Mt. Wellington forest should form part of a general Government scheme directed by men who have a practical knowledge of forest fire work. At present the municipal park forest and the municipal water-catchment forest are assailed each summer by fire on every side, while the £200 or £300 said to have been spent on the municipal fire lines is so far money thrown away, as the lines made are of no practical use. The worst fires are said to come from the very forest which, under a more enlightened Government, would have been the suburban forest of Hobart (p. 156); and as soon as modern progress and modern forestry come to be understood in Tasmania, one of the first measures will be to redeem the alienated suburban forest and put in hand the systematic fire-protection of the whole forest on Mt. Wellington as far back as the forest has any interest or value.

582.—*Mount Wellington and Table Mountain compared.*

At Cape Town, Table Mountain has been replanted by the Forest Department; its fire-protection followed as a matter of course. The replanting was a costly business, more than is generally known, more than Hobart would like to pay. Why not then take the Mt. Wellington forest in hand before it is quite too late, while there is still dormant tree seed in its soil, while there is yet a thin layer of soil over the bare upper slopes?

In 1893 I was given the task of planting the slopes of Table Mountain overlooking Cape Town, as does Mt. Wellington, Hobart. Half-way up the mountain was an old Dutch block-house falling into ruins. I restored this and turned it into a convict station, the scheme being to replant the mountain-side with prison labour. A road had to be made from the block-house to Cape Town, and to show how the trees have grown I may mention that in one place where solid rock had to be blasted to get the road through, trees now meet overhead. The planting was the most difficult I have ever had to do, and only the circumstances of its being so near Cape Town could have justified the expenditure; 750 acres have been planted at a net cost of £20,000, say £27 per acre. That is more than double the usual cost of planting, but it was planting under extraordinary difficulties; the soil was nearly all gone. In places the men scarping out paths on the mountain side had to work secured by ropes round their waists. In many places it was useless attempting to plant because every vestige of soil was gone. Then seed was sown and sown again and again, each winter. A few seeds germinated, fewer still surviving each summer; in the end, the work was successful. Waving forests of Pine from the northern hemisphere, and Eucalypts and Acacias from Australia now cover the rocky slopes. From a scene of bareness and desolation the mountain slopes have been transformed to one of beauty and fertility. With the planting there naturally went fire-protection, and there has not been any fire of consequence since the planting commenced.

The moral to be drawn from this is, that the forest on Mt. Wellington can be restored and fire-protected at any time, but the longer the work is postponed the more costly it will become. If, along with other civilised places out of England, Tasmania had had a Forest Department in charge of the Mt. Wellington forest, it could not have been seriously burnt, and with a forest so favourably placed to a market there would have been an ever-increasing net revenue from this forest. Firewood would have been half the price it now is in Hobart, and the profitable tourist traffic would be attracted instead of as now repelled. There is no reason, except misgovernment, why the citizen of Hobart should not get firewood at one-third the price he now pays. This, I understand, is all the Cascade Brewery Co. pays for its firewood cut in adjoining forests.

583.—*Fatalistic attitude of Tasmanians with regard to bush-fires.*

Since I have been in Australia I have found it difficult to make people believe that protection of the forest from fire was easy or practicable. In South Africa and on the Mediterranean, as described elsewhere, fire-protection goes necessarily with all the forest work (p. 25). People are not going to spend millions on their forests and have them burnt!

In Australia it is only to a slight extent in South Australia and in Victoria, that forest fires have been checked by the more or less complete use of modern forestry methods. For practical purposes fire still rages unchecked through the forests of Australia, and it has done so since the white man came to the country; as indeed, from all accounts it did for ages previously when the blacks lit their fires to drive the game, and to provide open hunting grounds where the game would be attracted by the young grass and easily attacked.

During hot weather in Tasmania the newspapers are full of the devastation caused by bush fires. Crops, buildings, and occasionally lives are lost as in February, 1915. When the fires are particularly bad spasmodic attempts are made by the Government to suppress them. Then it is suggested in the Press that fires may have been lit in order to secure payment for trying to put them out, which is quite possible.

In speaking below of the Blackwood forests of North-West Tasmania, I have described the destruction wrought there by fire. In the absence of any areas of fire-protected forest, the fires of last summer swept over the whole countryside; even the bridges and culverts of the roads were destroyed. The fires of the past summer, 1915, are described as the fiercest that have been known there for 15 years or more. Several lives were lost, others suffered from inflammation of the lungs! The dense forest there will not burn; but where there had been felling, the whole forest was completely burnt through, and the fire penetrated some distance into the dense virgin forest. (See also pp. 32, 33).

Of course a large part of this firing is necessary. In South Africa most of the farmers burn their veldt every year; their stock would starve if the veldt were not burnt. It is the senseless indiscriminate burning that is the evil in Tasmania, the burning of valuable timber and the ruin of the forest.

584.—*Hobart an ideal city to have a suburban forest.*

I have referred to suburban forests at pages 156 and 338, their utility to towns for cheap supplies of wood, and their usefulness for purposes of instruction and fostering the love and reverence for forests which we see developed so strongly in many of the nations of Europe. Such a forest would have been a fair setting to the beautifully situated city of Hobart.

It would have been possible to have demarcated out for Hobart a beautiful suburban forest into which the streets on one side would have led, as do the streets of Brussels, into the Bois de la Cambre and the forest of Soignes. But for 100 years Tasmania has looked on the forest as a thing to be destroyed only. There has been no discrimination; no forest demarcation. A map of the suburban forests of Paris is attached to this report (p. 157).

A suburban forest of this nature would have meant cheap firewood for every citizen of Hobart; the pleasant wood fires that have nourished our ancestors far back into geological time, instead of the dirty, sulphur-smelling coal fire. Hobart coal seems of a particularly dirty kind, but as things now are Hobart must use coal except in the houses of the wealthy, for coal is rather cheaper than wood fuel in Hobart per ton, and coal, even poor coal, gives out somewhere about double the heat of air-dry firewood.

A suburban forest *on good soil* near Hobart, in order to give every householder as much firewood as he wanted for the trouble of cutting it, would have meant (as a rough approximation) about one acre per household. The average Tasmanian householder wants somewhere about 10 tons of firewood per year. This is the approximate yield of a Blue-gum (*Eucalyptus globulus*) forest, under fairly good conditions of soil and climate. On the Nilgiris, in Southern India, Blue-gum forest yields up to 21 tons of dry firewood per acre per year. There are exact measurements of this checked and recorded with every precaution, and the official report is that these measurements which I took in 1883 have been maintained since. The Blue-gum forest worked in this way is a cut-and-come-again business. There have been no expenses for replanting.

On the whole, Hobart has not done so well as the Negus of Abyssinia. He looked after the supply of firewood for his Capital, but he was not a forester, and so made a practice of shifting his capital as the firewood became cut out. Hobart cannot shift, and thus, with Forestry on a level with that of the Negus of Abyssinia, firewood is becoming dearer year by year.

585.—*Natural advantages discarded.*

A general forest demarcation (page 1) would have given Hobart a suburban forest. Owing to the absence of forest demarcation, the unfortunate State of Tasmania has lost, I fear for all time, the natural sites of some of its most valuable State forests—(1) Splendid river frontages and slopes abutting on to them, from whence Tasmania might have commanded the hardwood markets of the world; (2) and, in the drier midlands and on the eastern sides of Tasmania, the lower mountain slopes which alone have sufficient sub-soil moisture to carry the best-shaped timber.

However, the chance that Tasmania has lost, Victoria, Western Australia, and other States with better Forestry can seize. There is not the same water carriage in Western Australia, but there is a higher grade of hardwood. By water carriage I mean not floating, but loading on to ships with the minimum of handling. The rivers and natural harbours of S.E. Tasmania are like the fiords of Norway, especially in the south-west where there was the best Blue-gum (*Euc. globulus*).

The burnt timber of Tasmania represents millions of pounds in hard cash, but the want of forest demarcation represents more; since the burnt timber is a single loss, but the giving up of forests which economically should be preserved as forests, means a loss extending probably to all time, which is beyond estimation in £ s. d. Thus, to compete with other countries and to get hardwood on to the almost limitless European market for hardwood, Tasmania must have cheap working; and the first element for cheap working is accessible forest. But, the want of

demarcation during the last 100 years has deprived Tasmania of probably three-fourths of its best accessible forests. It would be the work of a Forest Department to save such accessible forests as remain and to restore, as far as possible, the economical situation by plantations in accessible sites of the timber now imported from America. For Tasmania, with its favourable climate, could easily grow exactly the same timber which is now being imported in rapidly increasing quantities taking gold out of the country exactly where gold should be coming in!

586.—*The best remaining Tasmanian forest.*

The best accessible forest left in Tasmania seems to be that along the Scotsdale railway, and possibly now that it has been cut over, it could be redeemed at moderate cost. The forest here, in spite of the treatment it has received, shows capabilities of the highest order. Near Karoola, especially, is regrowth forest that looks like a Eucalypt plantation. It is this forest in North-East Tasmania that produces the finest "Tasmanian Oak," together with some Blackwood. So dense is the regrowth and so good the rainfall that much of the forest is growing up resistant to ordinary dry weather. But with the Government railway locomotives pouring forth streams of sparks it must go sooner or later, in exceptionally dry weather.

The Blackwood and "Tasmanian Oak," which have been burnt wholesale in the North-West of Tasmania are so badly wanted in Launceston, Melbourne, and Adelaide that when the furniture-makers and others get them they are obliged to make them go as far as possible with veneering, and replacing them partially with cheaper imported softwood. When I first came to Australia I imagined that the three-ply board and the furniture with softwood in parts not seen was cheap, inferior, imported furniture. A good deal of such furniture is sent into South Africa. But I am told that they actually make three-ply boards in Melbourne to economise the well-figured Blackwood. A three-ply board, it should perhaps be explained, is a centre board with veneers of Blackwood, etc., above and below. After seeing this I understood how as much as £50 could be paid for the good Blackwood logs suitable for veneering, though indeed considerably higher prices are sometimes given for Walnut logs of a good figure, such as what one sees in piano veneers.

587.—*Settlement has occurred only on the best forest land.*

What has happened in North-West Tasmania with the wasted timber is this: There has been no forest demarcation and much of this fine forest land was sold for settlement without "demarcation" some years back, so that land which should properly have been put into the forest reserves was sold to settlers, and land which should properly have been alienated remains waste and undeveloped by either agriculture or scientific forestry. The settlers, of course, proceeded to destroy the forest on the land they got. You cannot blame them. They were there, the pick of the population in point of enterprise, the vanguard of civilisation; and they had been put on this land under circumstances which compelled them to destroy the forest in order to live.

A few years afterwards, as settlement progressed, the make-shift Government began to make roads and railways. A good road is now being made from Smithtown to Balfour, and the Myalla railway is being pushed forward in the same direction. Those who were compelled to destroy the good timber some years back tell me they would be only too glad now to have it back and turn it into money; but it is now too late!

Here is a unique forest, with its giant trees that people might come half-way round the world to see, with its Blackwood logs, worth up to £50 a piece, its heavenly beauty in Beech and fern tracery, sacrificed for what? Not *settlement*, for much of the wrecked forest is on steep stony soil, which when it carries timber carries its best crop!

It is sacrificed simply to the want of forest demarcation, to the absence from the public administration of a Forest Department. An attempt is now being made to save some of the present crop of timber by shutting up a lot of country till it has been milled. This is delaying the settlement and only doubtfully saving some timber. The necessity for preserving the best of this forest for the production of Blackwood permanently has not been grasped.

588.—*Tasmania's loss reacts on Australia.*

Facts like these show what the want of scientific forestry is costing Tasmania and, incidentally, the Australian Commonwealth and Australian industries that should be nourished with the products of Tasmanian forests. Contrast this waste and loss with what would have happened if the State Forests had been demarcated out before the country had been thrown open. Instead of the shocking waste of the country's resources one sees, there would have been progress along economical lines. The land best suited for forestry would have been reserved for forestry. The land best suited for grass and potatoes would have gone to the settlers. There would have been first, forest demarcation and opening up of the country with roads (and perhaps railways) and then settlement.

The accessible demarcated forest would not have remained idle. A local forester would have been installed, and such roads as were necessary for the protection of the forest from fire and the economical working of the first crop of timber would have been made. This would naturally mean expenditure (I shall refer to this later), but it would be money well expended, for which there would ever afterwards have been a good return. And it must be remembered that this circulation of Government money in a new district, and the opening up of roads, and the working of a large quantity of timber without waste, is a great help to a young district.

Behind the demarcated forest, in the less accessible parts, where for the present it would not be advisable to spend money there would be "timber reserves," where the crop of mature timber would be worked, as far as might be, at present, the supervision being done from the nearest demarcated forest where a resident Forester had been installed. In the more valuable accessible forest, forest fires would practically cease, as they have in South Africa and other countries. The timber would have been marketed as soon as a sale could be found for it, and the fellings so conducted according to a carefully studied and pre-arranged "Working-Plan" that the regrowth forest would have been of much better quality, and more profitable to work, than the virgin forest full of over-mature and fire-damaged timber.

Scientific Forestry, which should be the first consideration to every dweller in this "fortunate island" of the South, is pooh-poohed and disregarded. There is no Chair of Forestry in the University, no teaching of Forestry in the schools; there is not a work on Forestry in the Public Library. I once heard a saddened tourist, fresh from the burnt-out mountain, remark that the country was "run like a London suburb"! Latin and Greek, French and German, Euclid and Theology —the stock-in-trade of the British pedagogue—are freely taught. Forestry, which in Japan runs from the infant schools to the Universities, is unknown and untaught in Tasmania. Nature made Japan and Tasmania much alike. Man is doing his

best to degrade Tasmania to the level of the barren mountain lands of Southern Europe. And the educational system ignores the whole business.

589.—*Vallombrosa's climate that of Tasmania.*

This too is certain, that if Tasmanians could travel as we foresters do on the Continent of Europe, they would wake up to the ruin and desolation of their island. Tasmanian Forestry would be put on the footing it now has in South Australia and, across the Straits, in Victoria; and this beautiful island, this pearl of the White-man's Australia, would return to its pristine glory, added to and enlarged by the sylvan wealth of the northern hemisphere. Northern animals, flowers, and fruits have flourished as in no other part of Australia. Northern fish are multiplying in the lakes, but where are the northern Pine forests, more beautiful and valuable than the first, and more easy of introduction?

I have mentioned the splendid remnants of Silver-fir forest on the Apennines, in Italy. Vallombrosa and the Central highlands of Tasmania have the same climate. The Silver-fir (*Abies alba*) might grow equally well on the Tasmanian highlands. Some trees would require planting throughout; others, on introduction, would spread naturally in the sparse and half-stocked forest. These are matters for test and experiment. Herein lies the real wealth of Tasmania.

The continent of Australia will never now get its normal area of State Forest. It is for Tasmania to supply some of the deficiency. Where are the beautiful pine forests of Southern Europe and California that might grow like weeds on the waste lands of Tasmania? Where are the Italian Walnuts that should shade and beautify the streams? In Cyprus they plant them along the streams like Willows. A few Walnuts scattered through some of the older orchards show how the trees can grow. The growth of the Walnut as a river-side tree in Cyprus and in one or two such situations in Tasmania shows what an asset this tree might be to the country.

590.—*Utopian schemes for a bankrupt State.*

It is often said that the neglect of Forestry in Tasmania is due to the fact that the country is nearly bankrupt, that no more taxation is possible, and that the taxes now only suffice to about pay interest on the heavy debt. Forestry offers no chance of making money at once, either to the Government or to the individual, so no one troubles about it. We may put that aside. The debt is moderate, only £12,000,000—barely £61 per head. What is certain is that the debt would have a different complexion if the natural resources of the country had been husbanded; if behind the debt there were valuable State forests, properly conserved and scientifically worked. It is certain, too, that the rational way to meet the debt is to nurse the great rural industry of the island—its State forests—and by so doing attract population and capital to the island.

After a century's occupation, one-quarter of Tasmania is, to use the official phrase, "without permanent inhabitants," and hardly explored; and another quarter is scarcely utilised. And this is the only country in Australia which has the exact climate required for Oregon and those timbers that Australia is now importing at a cost of £3,500,000 a year! The Government has good intentions, but it has no technical adviser on forest matters, and this gives its forest policy the shape of that of an uncivilised country. The Tasmanian Government has lately been at the expense of getting an expert from America, at a cost of slightly over £1,000, to report on such a nebulous scheme as paper-pulp from Eucalypt wood, while it has never taken the first step to plant the Firs and softwoods in those climates of Tas-

mania where they grow naturally and where possibly they might, with fire-protection, spread like the Sweet Briar, Blackberry, and Gorse.

In the North-East of Tasmania are thousands of acres of those sandy soils which civilised countries for the last 100 years have been busy planting up with pine. Here, and on the sand-drifts, Cluster-pine (*Pinus pinaster*) would naturally grow as it does in Southern France and in South Africa. But not an acre of Cluster-pine or any other pine has ever been planted to prove the point. So that when the day of awakening comes there will not be even a practical guide for those turning the waste lands to account.

591.—*Tasmania's poverty is a needless crime.*

Instead of an almost bankrupt State, the heaviest taxed in Australasia, and a handful of inhabitants there should have been a rich, prosperous State working valuable accessible forests. If, with only a little knowledge of woodcraft, the forest, cut over from 60 to 100 years ago, had had the cuttings regulated, been fire-protected, and kept under skilled direction, Tasmania might to-day be sending certainly £500,000 worth of timber yearly, and probably a good deal more, to South Africa, India, the Argentine, and Europe. A regular, even-aged forest would have been produced, carrying a far heavier stand of timber. This is the Eucalypt forest, free from fires, that we see in South Africa, South Europe, and California, where it has been planted at, of course, considerable expense, but which it has paid them to plant. This is no mere matter of opinion. Anyone can go and see it for themselves. The Portuguese forest I described in a paper read before the British Association at Sydney a few months ago. This second-growth forest which Nature would have given Tasmania for nothing would have been so much more profitable to work that the timber mills would probably only want to work the wild forest as an adjunct to it.

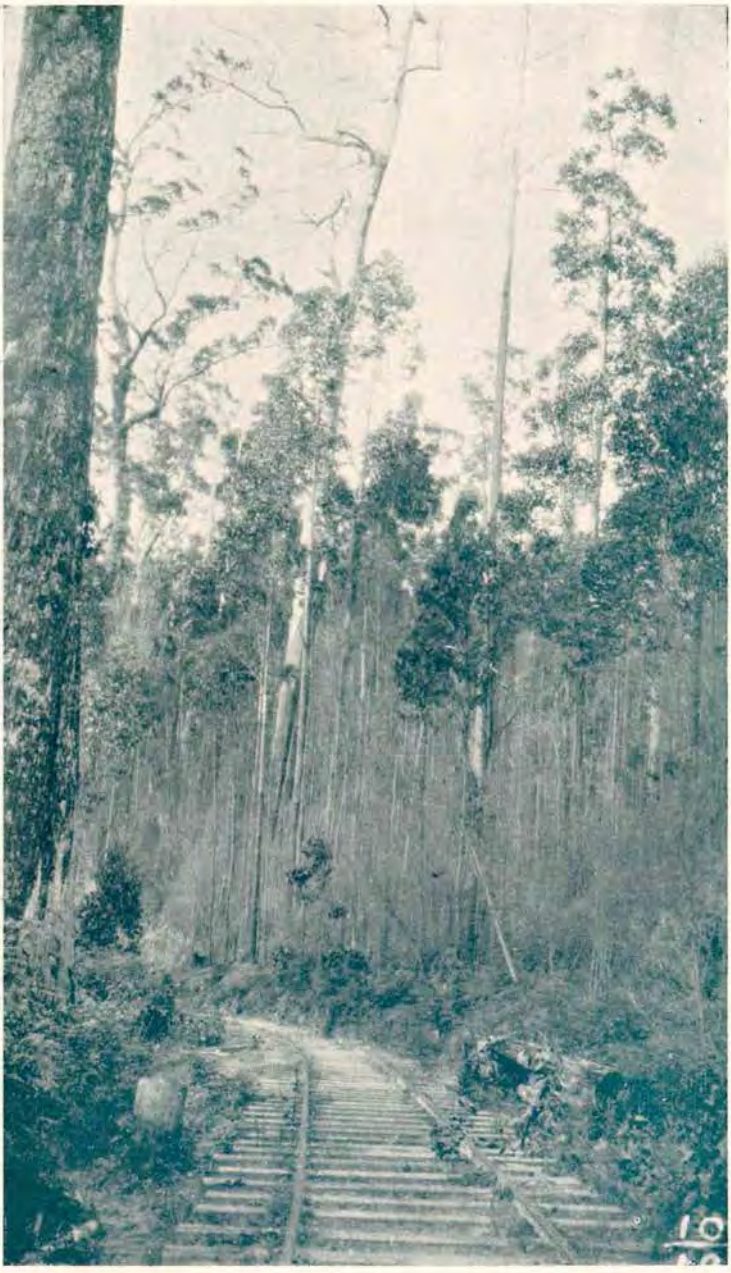
Nowhere have I seen better second-growth hardwood forest than in Tasmania here and there in patches and strips where it has escaped the forest fires. A sample of this is shown in the photos attached. With the usual fire-protection of other countries, it would be only exceptionally that fires would get into the second-growth forest. The cost of the little Forestry required to fire-protect and conserve this forest would have been a flea-bite compared to the value of it on the markets of the world.

592.—*A voice in the Tasmanian wilderness.*

"The soil of two-thirds of Tasmania is unfit for Agriculture, and will only yield a return by being devoted to forest purposes," says the Government Botanist in the official *Hand-book of the British Association*—an excellent hand-book, which was only a small part of the reception which the kindly people of Tasmania gave to the British Association. There are few abler public servants in all Australia (there are certainly none more useful to the State) than Mr. Rodway. That I heard many years ago—long before I ever thought of coming to Tasmania. His opinon would carry weight anywhere but in Tasmania. Should Tasmania allow any more of that two-thirds to go into worthless scrub, or very poor grazing? As grazing ground for sheep (p. 203) it may support, say, one-tenth the population that it would support under tree-culture. I have had it described to me by men who have lived in Tasmania all their lives, and who have travelled farther into the wilds than I have had time for.

593.—*Japan and Tasmania compared.*

I have compared Tasmania to the central island of Japan. Let Tasmania work its forests as the Japanese are working theirs, and attract a forest-working



Stringy-bark Regrowth after a forest fire: Port Esperance, Tasmania.

Photo: D. E. Hutchins.

population like Japan. Why does Tasmania not do as Japan did, and send out a commission of business men (not politicians) to see what Japan and other countries with climates like Tasmania are getting out of their forests.

The reason why Tasmanian Forestry (continues the Handbook) is in such a backward condition, is the want of foresight on the part of our public men, the excessively low price our timber has commanded in the markets of the world, and the fact that the demand has been only for the pick of our timber, whereby we have had no use for waste material."

I know little about the public men except that they seem to have an incomplete knowledge of what Forestry is doing in other parts of the world—the Forest Department of India with permanent control over one-quarter the area of British India, and the Forest Departments of North America, Russia, and Japan, with huge organisations employed mainly in organising and improving vast areas of wild forest. The State of Tasmania seems semi-bankrupt and overtaxed, its public men like sick rusties who will not go outside their village to consult a doctor. Ten minutes' talk with the Conservator of Forests in the next State (Victoria) might do much to help them!

594.—*The waste in the virgin forest.*

It is not necessary to talk of waste material in the virgin forest. That is common in virgin forest. The wild Teak forest of India barely averages one good marketable tree per acre! (It was there that I spent my earliest forest days.) What Tasmania has to do is to work the virgin forest for what it is worth, and at the same time replace that by better forest.

The second-growth forest, with skilled treatment, will come up denser, straighter, and with a heavier and more uniform stand of timber, more suited in size and soundness to economical sawing. At present the great unwieldy hollow logs cut up to about half-waste, and the number of marketable trees per acre is small. In the North-West of Tasmania I found good Blackwood forest to average only four good trees above the standard 2ft. diameter, with an average stand of 200 cubic feet per acre. The present forest of Tasmania is but an indication of what the forest might be. And the good forest is so sparse and broken up by bad forests that working is expensive and difficult. The first necessity of the country is forest demarcation, to settle what forests are to be worked and destroyed, and what forests conserved for the really valuable second-growth forest.

Even in the virgin forest the "picking over" is greatly diminished as timber becomes more valuable and as regular working is introduced. "Picking over" the timber is much less troublesome now than it was. In South Africa timber-marked sections of forest are sold at a reduction so as to get all the exploitable timber worked off.

595.—*A scheme to make paper pulp in Tasmania.*

The chance of making paper from waste hardwoods is discussed in the *Brit. Assn. Hand-book,* and the Government has taken some action in the matter. A fair paper and cardboard has actually been made from Tasmanian hardwood, and even from sawdust, but whether this could ever compete with softwood paper pulp is very doubtful. What is not doubtful, however, is that modern Forestry in 50 years could fill up the half-empty wild forest of Tasmania with the same softwoods that produce commercial paper pulp in Europe and America. Paper pulp from hardwood, with the world's great stores of softwood, is rather like grasping at a shadow while a very substantial substance is lost, when a forest country sets up a Government machine so ill-organised as not to include a Forest Department.

Then the *Hand-book* repeats one of the current misconceptions:—

It were, however, as well to remark that any proposal to denude the island of its timber or pulping purposes in a wholesale fashion, as has been done in the United States and Canada, would meet with serious opposition.

This is the general misconception of modern Forestry so prevalent in Australia—that to use the forest is to destroy it. As a matter of fact, the economical position is exactly the reverse (p. 165). Only give the forester a market for his timber and produce, and he can, by fire-protection and regulating the cuttings, improve the forest so as to produce any class of timber that is required. It is the inaccessible forest, without a market, that is the really impossible proposition. The bee-keeper of 60 years ago sulphured and destroyed his bees to get the honey. The forester of 150 years ago cut his timber and often destroyed the forest. The scientific forester of to-day cuts his timber and at the same time preserves and improves his forest.

596.—*Limited grazing area in the forest country.*

The *Tasmanian Brit. Assoc. Hand-book* (page 330) concludes pathetically, thus:

If, by drawing attention to the waste which is going on, and enlisting the aid of the visiting members of the British Association to solve the problems which now confront us, something can be done to stop the waste, the writer will be well repaid.

In a forest where the good timber is so scattered as in most Australian forests, this provision of grass for the drought animals is an important point. English dray horses, fed with corn and fodder, are expensive methods of getting timber to the mill, tramline, or hauling gear. It is advisable that Government in the first instance should import some more economical hauling animals (p. 115). The strong draught cattle of South Europe or South Africa are wanted, particularly the buffaloes which will pull out the heaviest timber, and thrive on rough grazing where even a South European or South African ox would starve.

The present timber crop will not allow of any extensive system of forest roads, but if the country were opened up and the forest organised, the timber worker would have some roads to help him.

It should be one of the functions of the Forest Department in the future to co-operate in and advise regarding the best methods of working the present forest which is generally sparse, under-stocked with good timber, and difficult to work; and when private enterprise, which must necessarily be backward after so many years of discouragement and neglect, declines to work the forest, the Government should undertake the working itself, as is being done on a large scale in Western Australia, and on a smaller scale in Victoria and South Australia. In Germany all the timber working is done by Government.

Generally in Australia the timber is felled out of season and put on the market green, though both South Australia and Victoria are remedying these evils.

597.—*Tasmanian wattle-bark.*

Tasmania is the Wattle State of Australia, and has provided the greater part of the bark for export from the Commonwealth. The Black Wattle grows in Australia as a weed. Nothing would be easier in systematic forestry than to produce, at small cost, as large an area of Black Wattle as was required. This is a truism in Tasmania; the man in the street will tell it you.

Generally all that is required to be done in Black Wattle country is to put in a fire and follow that up by protection against further fires and grazing. But though Black Wattle grows like a weed in many parts of Tasmania, even weeds in a garden

after burning in rubbish heaps for 100 years become nearly extirpated. That is the position of the Black Wattle now in much of the accessible Wattle areas of Tasmania.

But there is still enough good Black Wattle at Swansea and on the East Coast to ensure the permanency and increase of the industry if only the Government could be cajoled into doing its duty by the forests.

Some 40 years ago, large quantities of bark were exported from Tasmania. I have even come across an old entry of hogsheads of tan extract being shipped to England.

About 1891, and for some years before, Tasmania exported about £40,000 worth yearly of Wattle bark. It is stated that some £4,000,000 worth of tan bark is imported yearly by England (U.K.).

In 1899 the Wattle bark exported from Tasmania was valued at £31,000. It is less to-day, but the exact figures I have been unable to ascertain, as no Inter-State accounts are now available. The three bark mills of Tasmania succeed in maintaining their supplies and, in fact, show an increasing output.

There is a small export of about £7,000 yearly to countries outside the Commonwealth; for the year ending June, 1915, this figure was £6,289. (Customs Department.)

598.—*Tasmania still has a tan-bark trade.*

I have mentioned elsewhere (pp. 111-114) how, as the result of bad Forestry in Australia, the Wattle industry has greatly shrunk; but in this shrinkage Tasmania seems to have suffered perhaps less than South Australia and Victoria. *In the four years* 1908-12 *the net export of tan bark from Australia (excess of exports over imports) has shrunk to less than one-fourth,* viz., from £86,000 in 1908 to £21,000 in 1912. Taking export alone, the figures have shrunk from £102,410 to £72,128. Most of the world's Wattle bark industry has gone to Natal.

There was no Wattle there a few years ago; but seed was brought from Australia and sown in the fields where it gave a better return than Maize or other field crops. In 1913 Natal had 160,000 acres of planted Wattle, and a bark export worth £283,000. There is a large import of Natal Wattle bark to Australia in spite of a tariff of 30s. against it. Corresponding with the fall of Wattle export, the import from Natal has more than trebled in four years. In 1908 Australia imported £16,289 worth of Wattle bark; in 1912 as much as £50,920 (Knibbs).

In 1915 the Tanners' Association of Victoria in an interview with the Minister of Customs asked for the duty on Natal Wattle to be taken off as they could not get bark from Australia.

Black Wattle in Natal is grown, as has been mentioned, as a field crop. With the fall in the prices for Wattle bark during the last few years, the Natal farmer can now make as much out of Maize as out of Wattles, and make it more quickly. He has, in many cases already, grubbed up his Wattle and planted Maize in its stead. If the fall in Wattle bark continues there will be a progressive decline in the Natal production, and an easier field for the growth of Wattle in the forests of Tasmania; provided, of course, Tasmania has the requisite Forestry to do so. In some parts of Tasmania, Forestry may have to take measures against the growth of the Silver Wattle. The effect of forest fires and indiscriminate cutting have both had the same effect, to increase the proportion of Black Wattle.

If, through want of scientific Forestry, the timber industry is suffering in Tasmania, the Wattle bark industry is worse off. It must, without Forestry, gradually

get into the position of the vanished charcoal industry. It is hardly possible to avoid this conclusion. It is true that on the East coast Black Wattle grows so vigorously that with light sheep-grazing to keep down the fires, supplies may hold out for many years yet; but indiscriminate grazing and fires must tell in the end. Says the Conservator of Forests, Victoria: "Blackwood is unusually susceptible to destruction by fire." That is my own experience with Wattle plantations in Africa. Wattle plantations have been made in Victoria and South Australia, but with the present labour rate they scarcely pay. The only course now left is to protect the natural forest from fire. That will produce once more the vast store of Wattle that once existed in the forests of Tasmania.

Australia has a tariff of 30s. per ton against South African Wattle bark, and the Australian Tanners want that lowered because they cannot get enough bark in Australia! Could there be a clearer demonstration of what the want of Forestry leads to?

599.—*Tasmania's lack of a rural population.*

The handy little Statesman's Year-book of Tasmania (page 59) gives statistics of the value to Tasmania of the Forest industry, and this figure, it will be seen, amounts to over half a million (£557,000) yearly. There are 132 saw-mills. The Forest industry is the fourth most important industry in Tasmania. It comes after Agriculture, Pastoral, and Mining.

As showing the poor development of the rural industries of Tasmania we see under the heading of "Effective bread-winners" (in Statesman's Pocket Year-book, 1914) that out of the 75,458 effective bread-winners in the island, only 10 per cent., or 20,000 men are agricultural; 3 per cent., or 5,541 men, mineral, and 1.4 per cent., or 20,690 men, pastoral. Thus, in round numbers, only 15 per cent. of the bread-winning population are rural.

The bread-winners getting a living directly out of the forest are apparently so few that they are not separately classified. This may be compared with the cultivated forests of Germany, where about one million workers live directly on the forest, and three millions indirectly, viz., on industries resulting from the forest. These figures show clearly how little Tasmania, after 100 years of settlement, is making out of its best rural industries. It has taken a very unusual course in banishing Forestry from an all-forest island. These figures indicate that the result has not been satisfactory.

At page 59 of the Statesman's Year-book we see that the timber industry, even crippled as it is by its divorce from Forestry, is stated as worth £557,000 in the year 1913. It is the fourth most important rural industry in Tasmania, Agriculture being first with £1,839,000, Pastoral £1,378,000, Mining £1,416,000, and Forestry £557,000.

600.—*Tasmania's forests can pay off her State debt.*

According to the Tasmania Statesman's Year-book (1914) the forests of Tasmania to-day, even in their depreciated state, are more than enough to pay all the charges on the public debt. The cost of the public debt of Tasmania amounted in 1913-14, interest and sinking fund, per inhabitant to £2 9s. 4d. (page 34). The value of the forests, shown as one of the "Primary and Manufacturing Industries" of the country, figures at £2 15s. 3d. per inhabitant (page 59). A very little scientific forestry would, in the future, double or treble the value of the forest industry. So that we may safely say that Tasmanians have only to do their duty by their country, to treat their forests like every other civilised State (except England), and they can push ahead with the development of the country and have

no qualms about piling up the public debt too rapidly. If the forests are destroyed, the position will be less secure. The debt now amounts to £60 16s. 5d. per head, and in 1913-14 over £750,000 of borrowed money was spent, nearly twice as much as during the previous year, or in fact during any year.

And this, too, must be remembered. A country with rich and productive natural forests has a tangible security, useful to a borrowing country. The existence of the forests is a proof of prudent, good government; exactly as the reckless waste of the forest is the reverse.

Tasmanian taxation is by far the highest in Australia. In 1912-13 taxation furnished 28.62 per cent. of the total State revenue of Tasmania, nearly two and a-half times the average for the Commonwealth, which is 11.74 per cent. Says the Commonwealth Statistician commenting on these figures:—"One of the most noticeable features of the figures here given is the comparatively low percentage for 'public works and services' and the high percentage of 'taxation' in the case of Tasmania."

This is not to be wondered at when it is considered that through an antiquated system of Government the forest revenue is entirely lost to the State. If, from the forest revenues of other Australian States, we assume the lost forest revenue of Tasmania at £90,000 a year (Timber and Wattle bark), that figure is practically equal to the special Commonwealth subsidy of £95,000. And the question must arise, why should the Commonwealth continue to pay Tasmania £95,000 a year to bolster up a Government which is really causing a loss to Australia of three or four times that figure, in the loss of permanent forest wealth?

601.—*Tasmania's timber trade.*

Extraordinary though it may seem for the one all-forest State of Australia, with both softwoods and hardwoods in the forests and very little industrial development, there is a considerable import of timber to Tasmania. It is common to see the better class houses in Hobart built half of imported and half of home timber. Even the cheaper wooden houses are sometimes built entirely of imported timber. I know one such built by an architect for himself. The joists in the Government buildings now being erected in Hobart are of imported timber.

The exact amount of imports is not easy to arrive at, since the figures handled by the Government Statistician do not comprise separate figures for each State. I am indebted to the Customs Department for the figures for the year ended June, 1915, which are 2,447,691 super. feet (203,974 cubic feet), having a value of £8,671, or an average declared value of 7.1d. per 100 super. feet (equal to 10½d. per cubic foot). This year, however, on account of the war, the imports of timber are far below the usual figure, which is from £25,000 to £30,000. Most of the imported timber comes ordinarily from Scandinavia. It is now coming from America, while the mills on every side are closing down on account of the lessened demand for hardwoods.

In 1901 and previous years, timber exports of Tasmania averaged from £30,000 to £40,000 yearly. (Victn. Roy. Com. of 1901, 14th Report.)

In spite of some large timber which has been exported occasionally to England, as in the case of piles for Dover Harbour, the regular export of timber from Tasmania to non-Australian countries is little. For the year ended 30th June, 1915 the total figures are slightly under £33,000. These figures also are affected by the

war, but curiously they are some £3,000 or £4,000 above the average. Thus, total foreign exports for 1913 were £26,547, for 1914 £30,613.

Tasmanian Exports for Year ended 30th June, 1915, to Non-Australian Countries.

	Timber, Undressed.	Super. Feet.	£
England (United Kingdom)	.. ..	2,583,707	9,890*
Colombo	.. ..	246,075	1,230*
New Zealand	.. ..	3,427,114	13,518
South Africa	.. ..	1,195,051	5,975
	Total	7,451,947	
	Palings.	No.	
Germany	.. ..	500	3
New Zealand	.. ..	412,080	2,262
	Total	412,580	£32,878

* Mostly Sleepers.

Exports to Australian Continent.

The export figures to the Continent of Australia are more important. For these I am indebted to the courtesy of Mr. Pilgrim, of the Hobart Timber Company, and Mr. Ellerton Brown, of the Huon Timber Company. The average exports to the three Australian ports of Adelaide, Melbourne, and Sydney, are as follows —those to other ports may be neglected:—

		£
Adelaide	.. .. 5¼ million feet, super.—Value about	.. 25,000
Melbourne	.. .. 10 „ „ „	.. 50,000
New South Wales	.. 1 „ „ „	.. 5,000
	Total	.. £80,000

602.—*Trade in dressed timber.*

Most of the Tasmanian timber sent to South Australia is building timber, for which the f.o.b. price runs at about 8s. per 100 ft. super. Recently some 100,000 sleepers have been shipped from Tasmania to the Transcontinental Railway.

In 1909, according to the Blue-book of "Tasmanian Statistics," the total imports of undressed timber to Tasmania was £21,017. Of dressed timber and building material, £16,359; and of furniture, £23,526; total £60,902. The figures for the following years do not give the inter-State importations, and so are of little value, for no doubt there is a certain amount of re-export of foreign timber from mainland ports.

Thus the average figures of timber exports and imports are approximately these:—

Tasmania.

Exports, £110,000. Imports, £30,000.

The imports of dressed timber, building material, and furniture run into some £31,000 more. Though this £31,000 represents chiefly labour, its significance is that industries tend to follow cheap raw material, so that bad Forestry and dear timber in Tasmania mean not only increased timber imports and decreased timber exports, but injury to the entire home industries, of which the basis is wood and tan bark. The price of hardwood in Tasmania has nearly doubled during the last few years.

603.—*What Tasmania is losing under the present system.*

The present position of Tasmania is so peculiar in the complete absence of a Forest Department or any agency for the scientific working of the forests, that it may be useful, even at the cost of some repetition, to emphasise what the want of a Forest Department is costing Tasmania to-day, in hard cash, putting aside all patriotic considerations of what the country is being reduced to, by the wholesale destruction of its forests—the loss of water and soil from the mountains, and a condition such as that which the traveller sees now in Southern Europe. As a mere matter of present money loss, then, we have these considerations:—

It has been seen (p. 182) that while the forests of Tasmania and Victoria are similar, and the amount of timber worked, on the average of the last ten years, has been about the same, Victoria has a forest revenue now close on £70,000, while the forest revenue of Tasmania remains stationary at about £4,000. Victoria while actually cutting rather less timber than Tasmania has 15 times the forest revenue, and the revenue of Victoria has risen from £17,000 to not far off £70,000 during the ten years that it has had an efficient Forest Department. Tasmania with 122 sawmills valued at over £250,000 sterling has a forest revenue of only two-thirds that of South Australia with its diminutive forest revenue.

Queensland and New South Wales show a similar rise in their forest revenues since they have had efficient Forest Departments (p. 182).

South Africa with only a diminutive workable area of natural forest has a Forest Department organised on the same scale as those in Europe, and has a forest revenue of £57,000.

The fires in the forests of Tasmania are already depriving them of much of their beauty, and thus injuring their attractiveness and the tourist traffic. This money loss it is difficult to estimate, but it can easily be imagined.

The experience of other countries shows that measures against fire are of little use without a skilled agency to put them in force. It is certain that there will be no fire-protection for Tasmania until there is an organised Forest Department. As mentioned, the newly dedicated park near the Russell Falls will soon be reduced by fire to the state of the forest on Mt. Wellington.

604.—*Loss and waste in working by license.*

This is a patent abuse which is in everyone's mouth. The ordinary forest, instead of being demarcated, opened up, and worked for preservation (or the present timber crop on land for settlement utilised, as far as may be), is licensed for working in the most slipshod manner possible; or worse even than that, burnt before being opened up. An attempt has been made to curtail this loss by inspecting timber on land required for settlement, but this is a small limitation of the total loss that ensues. The very timber that is inspected at some cost to-day, by the special visits of the Timber Inspector, may be burnt to-morrow. This sounds rather like "throwing good money after bad."

There is loss in the wasteful method of working the forest that is licensed; there is loss in an idle capital giving no return in the forest that is not licensed for working. There is the more patent waste in the good timber on alienated public land, that is either given away for nothing or condemned to be burnt by alienating the land first, and making roads afterwards. That is loss all round. It benefits no one.

To give a concrete instance of the loss. When I visited the reputed best Blackwood area in the North-West of Tasmania, I found mile upon mile of first-rate Blackwood forest which had been selected and burnt, and then opened up

afterwards with a road and a railway. The selectors, too late in the day, would have been glad to have worked the timber, but it was now a piled up mass of charred timber and wood ashes. I have in my possession samples of beautiful figured wood that *I chopped out of fragments of old logs in this burnt forest.* Figured Blackwood was the cream of Australian timbers in the fine show of Australian woods prepared for the Panama Exhibition. A wonderful sight, indeed, this rare and beautiful wood presented. The eye looked into a depth of grain, while at the surface were opalescent hues, like croccidolite. There was a play of light and shade, varying like shot silk, with each point of view. Millions of people must have seen the Blackwood trophy at Melbourne before it left. How many of these were behind the scenes, and knew how scarce really good figured Blackwood is, and how Australia is being robbed of its slender inheritance of this rare and beautiful wood by the anarchical Government of Tasmania.

605.—*Organised forests would make Tasmania the Norway of the South.*

If the best and most accessible of the irregular virgin forest of Tasmania had been converted to a regular, heavily-stocked forest, with a good system of roads and fire-protection, the timber-working would have been as easy and economical as to-day it is costly and expensive; and then Tasmanian timber, with the fine ports and water carriage in the South-West, where was the best Blue-gum forest, would have captured the lion's share of the world's market for hardwoods. Tasmania, I have no doubt, might have been supplying South Africa, the Argentine and Europe, with, say, £500,000 worth of timber yearly for the last 20 years.

In 1912 as much as £270,282 worth of timber went to South Africa from Australia. South Africa requires an average of £250,000 worth of sleepers yearly for sleeper renewals alone. Tasmania is almost the nearest forest country to South Africa, and could have supplied it with timber much like Norway and Sweden supply England. There is very little doubt about this. I was 23 years in South Africa, most of that time the Chief Forest Officer at Cape Town, and so was in the way of knowing what South Africa has had to pay for imported timber while its own young timber in the forest plantations was growing up. The imported timber came from America, Australia, Java and Europe; most of these countries farther away than Tasmania.

Tasmania, with its *forests in order,* could have ruled out most of the timber these countries sent. To have had its forests in order would not have cost Tasmania the tenth part of the £10,000,000 worth of lost export, and every penny spent would have had its equivalent in well-stocked and improving forests. The contrast with the fire-swept, ruined, and degraded forest one now sees in Tasmania is almost incredible. There are, of course, other markets besides South Africa. The Argentine, Paraguay, India, and European markets I have referred to at page 174, "Cost to Australia of 100 years of bad Forestry."

606.—*Fruit cases will become more expensive.*

The Apples now exported are put into bushel cases, which are made of local wood, rough, and economical, but strong and good enough for the purpose. Said Mr. Sheridan, M.H.A., at a recent deputation of the Forest League:—

> In 1909 I moved the establishment of a Forestry Department in the House of Assembly. In two years' time Tasmania would require about 20 million feet super. of timber year, for apple cases alone.

Timber for fruit cases will have to be obtained, either from forests less accessible than now, and therefore more expensively, or else from plantations made of quick-growing Insignis or other Pines in accessible areas. The present cheap fruit

cases cannot continue with the loss of the accessible forest, and it will take a good many years after a Forest Department is established to restore a sufficient area of accessible forest to supply even the comparatively small quantity of timber required for fruit cases.

607.—*Fire paths will give more grazing area.*

The organisation of the forest against fire means the laying down of fire lines, of which the breadth and frequency would depend on the danger from fire. In any case, fire-paths must represent a considerable area, and a large proportion of these fire-paths it will be most economical to put under grass. Some of these fire-paths may have to be 300 or 400 yards wide. In any case the amount must mean a considerable area of good grazing whiche comes, as it were, as a by-product, the result of organising the forest against fire.

608.—*Handicaps to sawmilling.*

Owing to the want of a Forest Administration, and the help which it would give to a saw-miller, the latter is working in Tasmania at a disadvantage. This is commonly the case in Australia, as mentioned at page 100. The sawmiller is left to make costly tramways, sometimes practically branch railways, while co-operation between the Government and the saw-millers would help to make the roads so badly required to develop the country, as well as to develop and fire-protect the forest.

The general waste of timber has induced extravagant methods of working, but not so much by the saw-millers if we except the 10 or 15 feet of the best timber at the base of large logs. I may refer to my remarks under Forest Working (p. 101). I have seen branch railways in the Huon country which seemed hardly justified by the value of the timber to be got out. But the primary failure here was that of the Government to make roads.

Hauling gear for bringing timber on to a tramway is economical where there is a good stand of timber, but when the logs are very heavy and scattered, as in many Australian forests, steam hauling may become as expensive as steam-plowing. Forty years ago steam-plowing was considered likely to revolutionise Agricultural production, and the world's economics. Where is it to-day? In Western Australia, where the Government are working on the largest scale that I have yet seen in Australia, instead of hauling gears, teams of horses and oxen are employed to bring the logs to the "landing places" on the railways or tram-lines.

Says the Report of the Forestry Commission, Washington, 1913:—As a rule animal logging is more profitable in stands running 8,000 (equal to 666 cubic feet) board feet or less per acre, in rolling or rough country and in small timber.

The saw-milling interest should be sufficiently powerful to insist on the Government doing its duty to the *forest* and to *them*. The Government should meet the saw-millers more than half way with roads, tramways, and railways. At present the saw-millers have to pay for the right to make them, and are mulcted in other ways. But the saw-millers are stated to have been rendered apathetic by the long continuance of the forest anarchy, and to have been pacified by very low royalties on the timber cut. They are about one-quarter of those of Queensland. Such low royalties must necessarily invite waste.

Pit-sawing was practised in Tasmania up to 1830, and the pit-sawyers got the cream of the giant Stringy-bark, Blue-gums, and Blackwood that grew down to the water's edge in those days. A piece of timber 146ft. long was sent to the London Exhibition of 1851. One wonders why it was sent, for it must have served

to call attention, even in those days, to the scandalous forest administration. Pit-sawing will probably have to be revived as sawn timber increases in price, and the timber in the neglected forest becomes more scattered and difficult to reach with mill-work. In South Africa pit-sawing is preferred to splitting. It is much less wasteful.

609.—*Timber working with minimum of profit.*

Blue-gum and Blackwood are now scarce and difficult to obtain, for forest destruction goes ahead of road-making, so that the unfortunate forest worker has often a difficult task before him. To get the timber out he must either make long costly tramways, or public roads out of his own pocket, or wait till the thriftless Government makes the roads and too often burns down the forest at the same time. Thus, when millers do get into the forest, it is often so poor and inaccessible that it will not pay to work it (p. 335). *Destructive,* instead of *constructive* rights are given to the millers and very low rates (pp. 182, 173, 194) to enable them to work under the difficult conditions created by Government neglect.

Altogether 160,216 acres have been "leased for timber-getting" (*Statesman's Year-book,* 1914). This is not quite 1 per cent. of the area of the island, a small proportion for forest working if the forest were organised; and of this 160,216 acres but a small proportion is being effectively worked.

It is quite easy to stop felling out of season. Most saw-millers would prefer to fell (or ring-bark) their timber during late summer or early winter. But the drying or seasoning of timber is not such an easy matter, and probably timber in the log must continue to be exported green. But all boards and smaller timber should certainly be dried before exportation if only to stop the export of cracked, split, and unsound timber. With softwoods the drying can be left to take care of itself, but not so with hardwoods.

Thus the timber industry of Tasmania, worth at present over £500,000 a year to the country, more than enough in fact to pay the charges on the public debt, is being ruined by antiquated Forestry methods, and the absence of the usual Government Agency to conserve and improve the forests. As a result of these unscientific methods the timber is necessarily being worked expensively, and cannot reach the greatest hardwood markets of the world.

In international finance the public credit of a State is a delicate thing to play with! The story of the forests of Tasmania will get known as surely as the faults of other States are known, and discounted when they come into the money market. England (United Kingdom) is paying out £43,000,000 yearly for imported timber, but to appreciably remedy that state of things would require a huge expenditure on forest replanting. The English forests were destroyed many years before modern forestry, as an exact science, existed, and England is not now like Tasmania, casting in ashes to the winds splendid natural forests. England knows the faults in its own history, and is not likely, where money is concerned, to look very favourably on a State that is repeating to-day the faults of England in days when scientific Forestry was unknown.

Said a deputation not long ago to the Minister of Customs, "An English Timber Company in Tasmania has spent £250,000 in recent years and never paid a dividend." Nor has the reconstructed company since.

Tasmania is the heaviest-taxed State in Australia, and it has spent least on public works (*Commonwealth Year-book,* 1914). It tolerates the public gambling of Tattersalls; it receives a special Commonwealth grant of £95,000 yearly. The public debt per head is not now notably large, but soon must be so with the rapidly increasing loan expenditure and the slowly increasing population.

610.—*Capital needed to restore Tasmania's forests.*

Tasmania, for nearly 100 years has stood still, the pick of a fine population going to develop Continental Australia. Thus it has much leeway to make up. To do this, capital is the *sine-qua-non*. A Forest loan of £1,500,000 or £2,000,000 is an immediate necessity to put the forests in order. If the present picture of wanton waste and mis-government in its forests continues, it is not to be supposed that the capitalist will be encouraged freely to lend money to a country so misgoverned.

And what is more, a country notoriously wrong on one point suffers in public estimation more than it deserves. "Give a dog a bad name and hang him." Tasmania has, unfortunately, a bad name amongst Australian States, and, as Forestry progresses with them, and the forest scandal gets worse in Tasmania, this bad name will become accentuated!

Tasmania may be losing actually in cash, comparing it with Victoria, perhaps not above £90,000 a year for want of the usual Forest Department of a civilised country. But the absence of a Forest Department in a forest country *par excellence* must tend to exaggerate this loss in public estimation. A Government, ranking below that of the average South American Republic, in the waste of its forest resources, cannot expect to borrow on the same terms as a Government husbanding its assets and natural resources. Agriculture, Commerce, Minerals, Forests, and Fisheries are the heads in the guide-books to which the financier turns. Under Forests, Tasmania must now appear with the entry—*"Once possessed valuable forests, but the most valuable portions have been destroyed, and no steps are being taken to preserve the remainder."*

But there is some light in the darkest of pictures. Much of the best forest in Tasmania is capable of restoration. All that is required is to demarcate it and place it under a Forest Department for working and fire-protection. Accessible forests, with cheap working timber and tan bark, can be built up in two ways—(1) Forest demarcating must be ahead of settlement; and (2) there should be forest redemption, as Victoria and South Australia are to-day redeeming accessible forest that was lost in the bad old days of Australian Forestry.

611.—*The vigorous growth of Blackwood.*

If one considers the quantity and fine quality of Blackwood that has been sent from Tasmania to Victoria, and the continual demand for Tasmanian Blackwood right through the mainland of Australia, it seems probable that the restoration of the Blackwood forests of the North-West should be the first work to be taken in hand. Over large areas there it can be restored at no great cost. Blackwood reproduces itself freely from seed, and often from suckers. It is for this reason that it is being planted so largely in the forests of South Africa. And this restored forest can easily carry 10 times as much Blackwood as the wild forest of to-day.

On my visit to the North-West I saw Blackwood coming up like weeds in a garden (or like the mustard and cress of a garden bed) whenever the forest was opened out, either by burning or clearing. On this point there is not the slightest doubt; one has only to visit burnt forest or forest that has been cleared for a road or tramway to see young Blackwoods everywhere coming up profusely. This abundant natural reproduction is destroyed, either by further fires, by sheep grazing, or the up-growth of more quickly-growing trees. It would not be difficult to demarcate out Blackwood areas, and with a little attention and protection from fire to produce a stock of young Blackwood trees far in excess of anything that is now seen in the natural forest!

Probably it would be desirable, for sylvicultural reasons, to leave a portion of the Beech as is the practice in Europe. This will present little difficulty, the portion of Beech desired being left and the balance ring-barked.

A step in the right direction is being taken by surveying before selling. With the establishment of a Forest Department the rest would be easy, and the total expense moderate compared to the value of the timber produced.

612.—*Special features of some Tasmanian woods.*

It must be remembered that Tasmanian Blackwood has an established reputation on the mainland of Australia; and, amongst those who know timbers, beyond Australia. In the museums at South Kensington and Kew, London, I cannot recall any timber that, on the whole, figures so largely as Tasmanian Blackwood! The Tasmanian Court at Kew begins and ends with Blackwood! The market for Tasmanian Blackwood is an assured one. Throughout the length and breadth of Australia, from furniture on the goldfields of Western Australia to the billiard tables of Brisbane and the tropics, I have found Tasmanian Blackwood universally popular. It resembles Walnut, and is only inferior to this valuable timber in being somewhat more difficult to work and to season.

An interesting subject for inquiry is the growth of figured Blackwood. Is the peculiarity inherited, or is it caused by any accident of growth or wind pressure? As in the case of Walnut, it makes an enormous difference in the value of the logs. It is not the same as the figure in Walnut timber.

The Blue-gum of the South-East should be at least as easy to reproduce naturally and protect from fire as the Blackwood of the North-West. As is well-known, no Eucalypt has been so largely cultivated through the extra-tropics of the world as the Blue-gum: it is not to be supposed that *Eucalyptus globulus* cannot be cultivated profitably in its home in Tasmania. Its cultivation is necessary because the supply of the wild timber is estimated to last only 10 years more. There is a large area of regrowth Blue-gum forest in Tasmania which, though not growing so quickly, is as vigorous as in countries where the Blue-gum is cultivated. It is all a question of fire-protection. Blue-gum is more sensitive to fire than Stringy-bark, and that has curtailed the supplies of the Blue-gum. But fire-protection in the future will tend to make it as abundant as Stringy-bark.

And nearly the same remark applies to Cypress-pine and the other Eucalypts. They are difficult of extirpation, they reproduce easily. Little more is wanted than the skilful use of fire, followed by fire-protection; and as they grow up dense they become more or less self-protective against fire.

613.—*Tasmania has a forest climate and rainfall.*

And then, there is another bright feature! An inspection of the rainfall map of Tasmania shows that somewhere about one-third of the total area of the country has a rainfall below 30 inches, and is, therefore, not suited to the growth of the best timber. And, happily, the settled parts that have been alienated without forest demarcation are chiefly in this dry area. The figures shown on the map of average rainfall are these:—

Mainland—between 20in. and 30in. rainfall ..	6,035	square miles.
Flinders Island, etc.	1,524	„
Under 20in.	937	„
Total	8,496	„

The total area of Tasmania is 26,215 square miles, so that the comparatively light rainfall area (below 30in.) occupies rather under one-third of the whole.

I do not mean to say that very good timber, especially pines, cannot be grown in rainfalls lying between 20in. and 30in.; but in this latitude, and with the risk of recurrent droughts, the higher rainfall is better, and will certainly produce timber more easily.

No doubt, too, there is rough country with deep open soils within the dry area, which could be redeemed at moderate cost for local forestry, and also where it is specially accessible for general forestry. The beauty, the water-supplies, and cheapness of living, demand this for the drier country.

614.—*Forest education the only cure for Tasmanian apathy.*

Though the general feeling with regard to forest fires is one of apathy and hopelessness, there is little doubt that if the Government could only be persuaded to remodel its administration on the lines of other countries in these latitudes, it would, in a short time, have an overwhelming support at its back. The main things required in the reform are—a liberal expenditure (from a forest loan), organisation, and the education of public opinion. The evil of forest fires has gone on for so long that it has come to be regarded as inevitable—(like small-pox in the rural districts of France before Jenner's discovery). Perhaps the best plan would be to follow the example of the Japanese when they were starting Forestry, and send a number of influential Tasmanians as a commission to travel and study modern Forestry methods in South Africa and America, the Mediterranean and Japan; or, simpler still, to follow the lead of Victoria in Forestry.

615.—*Energy of the sawmillers.*

The good working of the forest is another encouraging feature. If the Government Forestry had shown one-quarter of the energy that has been expended by the enterprising men who have been working the timber without the least assistance or co-operation from Government, the State of Tasmania would have been in a very different position to-day!

In 1913 there were 132 saw-mills in Tasmania, of which the invested capital is returned at £238,000: 1,751 persons were employed in the saw-mills, and they earned £150,000, while the value of the produce turned out of the saw-mills figures at £325,000.

There were three bark-mills, with a capital value returned at £5,000; they employed 27 men earning £1,000 per year, and turned out produce to the value of £22,000. There were also four tanneries, with a capital value of £20,000, employing 80 men, who drew over £9,000 in salaries, and turned out produce to the value of £84,000 (*Tasmanian Year-book,* 1914); and at least one of these tanners produces leather not to be surpassed by any that can be imported.

The saw-mills, in or near the forests, were reported as turning out, a few years before the war, 45,000,000 feet super. yearly, or about 3,750,000 cubic feet of timber, which is nearly one-third of the total yearly export of timber from Australia.

616.—*The hope ahead.*

What Britons have done in other countries, the vigorous off-shoot of the race can accomplish in beautiful Tasmania. In more ways than one, the Australian is seen at his best in Tasmania! In each of the other Australian States, nearly half the population is in the capital towns, with that physical degeneration which

is seen in the population of all large towns. In Tasmania, not one-third of the population is in the two chief towns; and in Hobart, the capital, only one-fifth. With the development of its forests in the future, Tasmania can, with confidence, look forward to the development of the finest branch of Australian manhood. In Europe, the pick of the manhood for stature, physique, and powerful frames, are those working in the forest; and usually now, too (notably in Germany), they command comfortable wages; allowing them leisure for intellectual pursuits, especially during the long evenings of winter, the season when most of the forest work is done.

ARBORICULTURE.

617.—*The first beginnings made.*

The growth of individual trees for shade, shelter, beauty and profit, has been nearly as much neglected in Tasmania as forestry. In these latitudes, 41° to 43°, a road is only half a road until it has been planted with trees. Think of the beautiful roads of Southern France; and it is not difficult to plant the roads in a fertile climate when you have the right sort of trees on the spot in Government nurseries, where they can be turned out at 3s. per 100, or probably less in an easy climate such as Tasmania; 3s. is the common South African figure.

At the Government State Farm a few days ago, I saw a small forest tree nursery; most interesting as a beginning in Arboriculture. There are profits in Arboriculture as well as in Forestry, and one cannot help wondering why the Tasmania farmer should not be in an equally good position with the farmer in Southern Europe.

In our one South European possession, Cyprus, where I spent some months at one time, reporting on its Forestry, there is a yearly export from the little island of about £160,000 worth of agricultural produce. One half of this is Barley, the other half Carobs, from Carob trees that grow over the crops of Barley, and do the Barley no harm, perhaps improve it. This, broadly speaking, is what one sees all through the Mediterranean. The farmer there has, so to speak, crops in two storeys. He has his barley and wheat and oats on the ground, and, later in the year, he reaps the fruit harvest from the trees planted over the cereals: Olives, Stone-pines (for the kernels), Carobs, Mulberry, Almond, Walnut, Cork-oak, etc.

All these flourish in Tasmania; nowhere better in all Australia. These are not the highly cultivated trees of the orchardist; all but the Olive when once planted require no further attention, and the pruning of the Olive is a light matter, recurring only at intervals. All the farmer has to do is to gather the fruit, or let his animals have what he does not want. The great wealth-producing tree in South Europe is the Olive. It is growing like a weed in the Botanic Gardens, Hobart; but I have seen it nowhere else in Tasmania.

The Walnut grows freely in Tasmania on any average good soil with subsoil moisture. We do not know how it would grow generally by streams as it does in Cyprus, and nothing has ever been done by the shiftless Government to find out. I cannot imagine the state of things that has existed in Tasmania for 100 years to have continued in any other country for 10 years! The Walnut is such a valuable tree for either its nuts or its timber. The nut sells freely and at good prices in Melbourne and Hobart: 6s. a cubic foot is about the average price for Italian Walnut timber. A good figured log has been known to fetch £300 for piano veneers. They make good pianos on the mainland of Australia, but can they grow Walnut timber quite like Tasmania?

618.—*Tasmanians do not fully utilise their sunshine.*

The Tasmanian farmer, with the sun of Southern Europe, gets no more off his fields than he could get in the weak sun of England. Broadly speaking, the ground won at such expense from the wilds in Tasmania is only yielding half, or two-thirds of that which it might yield if suitable "trees of the field" were dotted over the fields.

If Tasmania had Forestry, Arboriculture would follow. At every man's door (or at no great distance), there would be a Government nursery, where he could get the trees he wanted; an Arboretum, where he could see how the trees grew in his district, and the forest official to tell him how to plant and care for the trees; or, if he preferred it, to raise them for himself. This is what South Africa is doing. There are 160 regular Government nurseries, besides smaller ones, scattered throughout the country, supplying useful trees at cost price to the farmers. The trees are not given away, or they might be wasted, and the private nurseryman have a grievance. The farmer has the choice of seed, tiny seedlings, strong transplants, or young trees six feet high.

619.—*What the cities would gain by Arboriculture.*

Then, think for a moment, what more attention to Arboriculture would mean for such towns as Hobart and Launceston, which have grown up too much like London suburbs, possibly because too many of the early settlers came thence, bringing their cockney ideals (and alas, also, their speech) with them. With attention to "a's" and "i's" should come to the school children instruction in the tree wealth which, in this bounteous climate, lies spread around. Arboriculture and tree-planting would bring Hobart and Launceston into line with the more beautiful cities of Southern Europe.

Launceston Gorge.—There is no reason why Launceston should not be as beautiful as Florence, apart from the Florentine monuments. Nothing gave me greater pleasure in Tasmania than the visit to the unique Gorge at Launceston. There is probably no other spot in the extra-tropics of Australia so well suited for an Arboretum to exhibit in a nut-shell the growth of extra-tropical trees (p. 242). I am aware of the sentiment with regard to keeping the Gorge as a Nature Reserve; but by far the most beautiful part of the Gorge is that where the choice trees of other countries have been already planted, and it must be remembered that every State Forest in Tasmania, before long, must become a Nature Reserve, and a Nature Reserve in the highest sense since it will be protected from fire.

There is a wide range of trees suited to the climate of Launceston which would grow well in a sheltered situation so favourable as that of the Gorge, and if these were planted, the beauty of the Gorge would naturally be greatly enhanced. What would it be now without its clinging ivy and graceful conifers?

And if these valuable trees were gradually planted, there would presently be formed an Arboretum to which tree-lovers from all parts of Australia would bend their steps for instruction, as well as the gratification of the beauty sense in this unique Gorge.

620.—*The atmosphere and streets of Hobart.*

And if Hobart could get rid of its six bad chimneys, and attend to Arboriculture and tree-planting in the streets, its unrivalled situation would make it comparable with Avigon, and some of the other beautiful cities of Southern Europe. The streets of Hobart are very wide, compared to Southern Europe, and happily, there is room everywhere for beautiful avenues of trees. Wide streets such as Macquarie and Davey Streets could have two rows of trees on each side, and be made as beau-

tiful as the boulevards of Paris, or the waterside avenues of Plane-trees at Paris. There would be very little expense in doing this, if there was a large local nursery to draw from. Ultimately there would be a saving in the reduced width of street metalling to maintain. There is no beauty and a good deal of unnecessary expense in a glary stretch of wide dusty macadam. Plane-trees seem to grow as well in Hobart as in Paris, and having no leaves in winter, there is no objection to them on the score of damp; and what is more, the Plane-tree will stand a great deal of town smoke, so that Hobart might get its Plane-trees while still making assaults on its bad factory chimneys.

621.—*The Hobart "Domain."*

The beautiful Domain at Hobart, with its views hard to be equalled in Australia, being so near Hobart, affords a unique opportunity for instructive aboricultural work; but the situation is unfortunate in its shallow soil and exposure to the violent hot winds of summer. The surroundings, however, are so beautiful that tree-culture on the Domain, Hobart, merits special attention which, it seems, could be best given in this way. For picturesqueness and shelter, the planted trees should be disposed in groups of close trees not more than 6ft. apart, like the "bosquets" of Versailles (pp. 28, 155), and to obviate the serious difficulty of the shallow soil the ground below these "bosquets" should be opened up by dynamite. This would not be a costly work as prison labour is available. There is at present some considerable expenditure and interesting work in tree-planting on the Domain; and it is well worth the cost of being rendered more effective.

At present the picturesque old trees are dying at the rate of 100 or so a year; the planting is not keeping up with the deaths, and is not entirely successful, while the soil is being washed off with the loss of the tree-growth. To stop the soil wash there might be some zigzag strips of dense planting, the trees being planted not farther than 2ft. apart and *not over-thinned or pollarded.*

Dormant Forest Departments are not unknown in Australia, but nowhere else in Australia is there a complete absence of Forestry, and only in Queensland so little Arboriculture. In Tasmania there is not even the semblance of a Forest Department. Its first duty, Mt. Wellington, the suburban forest of Hobart, and one of the chief attractions to the valuable tourist traffic, is a blackened, burnt-out shell. The whitened spectres of the gaunt dead trees dog the steps of the tourist at every turn. Figured Blackwood, worth £50 a log in Melbourne, now worm-eaten and rotten, can be seen within a stone's throw of a new Railway in the North-West of Tasmania. It was impossible to utilise this valuable timber with Tasmanian Government methods. I have seen or heard of millions of cubic feet of good Blackwood and "Tasmanian Oak" burnt in the forest fires of last summer, while the same timber costs the cabinetmakers of Launceston and Melbourne so much that they put in into veneers, and counterfeit it with inferior stained imported wood.

622.—*Tasmania must reform or be absorbed.*

As the result of no Forestry the Tasmanian Government is losing some £90,000 a year in forest revenue, and the people of Tasmania have lost, during the last 20 years, at least £10,000,000 worth of timber export, probably a good deal more.

Tasmania of to-day should write off its losses and think of Tennyson's well-known lines:—

> My father left a park to me, but it is wild and barren,
> A garden too, without a tree, and waster than a warren.
> Yet, say the neighbours when they call, this is not bad but good land.
> And has in it the germ of all that grows within the woodland.

That the future of Australia requires the restoration and cultivation of the forests of Tasmania is a point that few will contest. How that can best be done must engage early attention. The State debt of Tasmania is not so large that a forest loan of from £3,000,000 to £5,000,000 would be seriously felt. It would help to bring to the level of the other Australian States that expenditure on public works which the Commonwealth Statistician has shown (*Com. Year-book*, No. 7) is deficient, and it would save from loss that £500,000 yearly at which the Tasmanian Government Statistician values Forestry to the State as a Primary Industry. (*Statesman's Year-book of Tasmania*, p. 59, £557,000).

Failing a local loan of from £4,000,000 to £6,000,000, there are the alternatives, both perhaps more attractive from a purely Forestry point of view of: (1) a State union with Victoria; or (2) Commonwealth Forestry for the great Central and Western area of Tasmania (pp. 14, 330). There is not the least antagonism between mining and scientific Forestry; in fact, it is very much the reverse, since the mines bring a market, working and improvement to the forest. That was demonstrated on the Knysna goldfields of South Africa.

The Commonwealth is now called upon to administer the forest of the great Northern Teritory, and of the small Federal Capital Territory. This will demand a Commonwealth Forestry administration similar to the Federal Forestry Administration of the United Staes of America. It would seem quite a practical step to extend Commonwealth Forest Administration so as to embrace the demarcation forests of the centre and west of Tasmania. That area is required to help produce the timber for which Australia is now paying £3,500,000 yearly, and which, I estimate, during the next thirty years will average (p. 176) not less than £6,000,000 yearly.

623.—*The climate of Oregon on Tasmania's north-east coast.*

The great central and western area of Tasmania, some 5,000,000 acres in area, with its cold, wet climate, seems to offer ideal conditions for the production of Oregon, and the other timbers now imported to Australia at a cost of £3,500,000 yearly.

In the North-East of Tasmania is sandy country which should be planted with pine, probably Cluster-pine (*Pinus pinaster*). In the Oregon, Red-deal and Fir paper-pulp area of South-West Tasmania, never a tree of *Pseudotsuga Douglasii, Pinus taeda, P. strobus, Abies alba, Picea excelsa*, and all the wealth of Conifers in Western America has been planted to put the matter to practical test in Government plantations. Many of these valuable trees are growing well in small private collections of Conifers. The Government of Tasmania is itself impotent to deal with its forests. South-Western Tasmania remains practically unoccupied, while it is fitted to carry a large forest population, and support the flower of Australian manhood. The question is a Commonwealth, if not an Imperial one.

Says the President of the Forest League in a recent official report written for the Tasmania Government, and printed and distributed by the Tasmanian Government. (*Tasm. Cypress Pine*, 1911):—

This State stands almost alone among the business communities of the world in its neglect and non-conservation of its timber forests.

Division IX.

RECAPITULATORY DIGEST.

EARLY DESTRUCTION OF FORESTS.

The wooded coast belt.—Of the wooded coast belt of Australia, only a comparatively small area ever contained good timber forest. The area with a rainfall of 30 inches and over is but 259,000,000 acres, or a little over three times the area of the British Isles; and the area above 30 inches rainfall and south of the tropic is not greatly above that of the area of the British Isles; and as a rough approximation we may say that the area of the good timber Eucalypt forest of Australia was never much above the area of the British Isles. In an extra-tropical climate, with severe droughts at intervals, the only part of extra-tropical Australia that can permanently carry good high timber forest over large areas is that with a mean yearly rainfall of at least over 30 inches.

A smaller rainfall than 30 inches will, it is true, carry useful forest on certain soils—soils that are permeable and hold subsoil moisture. Such forest is very precious for local supplies, but has little bearing on the general timber supply of a country. The better class of Cypress-pine forest is an example of such precious local forest, and nowhere will the want of forest demarcation be more felt by succeeding generations than in the loss of this.

Why the forest was destroyed.—The whole of the coast belt was more or less wooded, but the bulk of the forest was only fit for sleepers; and having to be destroyed to make way for settlement, the Australian forest gradually got to be looked on as a thing to be destroyed. The prevalence of English ideals had, no doubt, much to do with this state of things. There is practically no State Forestry in England, and England is to-day paying £43,000,000 for imported timber, a large part of which would be produced in the country if the forests had not been destroyed. Forest destruction in America has also had its influence on Australian sentiment. Unlike Australia, North America has actually to get rid of between three-quarters and two-thirds of its huge forest area to develop the country; but the American "backwoods" view of Forestry has been a most unfortunate influence in Australia. It has allowed the most accessible and valuable forest to be destroyed—exactly the forest which economically ought to have been kept—rendering it difficult for Australia, with the finest hardwood forest in the extra-tropics, to put its hardwoods on the European market at a price to compete with the European Oak, on account of the costly working of inaccessible forest.

RESULTS FROM DESTRUCTION OF FOREST.

Loss, £2,000,000 or £3,000,000 of export.—This destruction of the accessible forest has cost Australia some one or two millions a year (perhaps three millions) in lost timber export, since it has prevented Australian hardwood ever really *cutting below the price of Oak* on the European market.

Each generation thought the forest would last *their* day, and if a little timber was getting to be imported, why, it was good for trade. It is only quite recently that the ruinous free-trade nostrums have been quite got rid of in Australia.

No discrimination or demarcation.—It was in vain that the few scientific Foresters who visited Australia (mostly Indian Forest Officers on health trips) pleaded for discrimination. They preached forest demarcation, but their words fell on deaf ears. So far, only Victoria, among the Australian States, has made notable progress in forest demarcation; and nothing in all I have seen of Australian Forestry has pleased me more than forest demarcation in Victoria.

In the attitude of Australia towards its forests it seems to have been overlooked that America had to destroy its surplus forests; that England, with more wealth and population than Australia, could afford to pay its huge bill for imported timber, and was better able than Australia to stand the loss of its best rural population. In Europe, apart from England, the flower of the country's manhood are those working in the forest, or in the forest in winter and on small farms in summer. There is no counterpart in Australia for the one million men who live directly on the forest in Germany and the three millions indirectly on forest industries.

Loss over imported timber.—And it seems to have been overlooked, too, that the mere carriage of the imported timber to Australia represents a serious wastage. England gets timber from Norway and from across the Atlantic; but if in the future Australia had to bring all the timber that it wanted from the northern hemisphere, it would be at ruinous cost. Even now, with the present small population (and consequently small importation of timber), and when the shrinkage of home forests has only begun to be felt, the mere carriage of the imported timber represents in bulk the daily arrival of a ship of 3,400 tons. The Australian import of timber, raw and slightly manufactured, amounted, when the war broke out, to some 50 million cubic feet; and the total value of timber and other forest produce was, in round numbers, £3,500,000 or very nearly £10,000 a day, going out of Australia for imported timber than could so easily be grown at home.

Loss of home production.—On a similar valuation, the Australian home production of timber and forest produce is worth at present some £5,500,000 yearly (Finances, p. 216). But the loss of all the accessible (and therefore the most valuable) forest is making itself felt all over Australia. Timber has nearly doubled in price during the last few years, while firewood is at prohibitive prices in all the older centres of population, and is coming to be replaced by imported kerosene, and coal which is often of an inferior quality and dirty. Charcoal-making is a perished industry, and the atmosphere of many of the larger towns of Australia is so poisoned with sulphurous fumes—Melbourne for instance—that some kinds of trees and many plants can hardly be grown. London is a somewhat dingy model for towns in the bright Australian climate.

Loss of people's playground.—But far worse than these discomforts and inconveniences is the loss of the people's forest playgrounds (suburban forests, p. 156) that have vanished so sadly in the absence of forest demarcation. In Europe, even as far north as Brussels, the forest of Soignes is the centre of the people's life during the long hot summer days. Paris is encircled by suburban forests, but

Brussels has its big forest of Soignes at the very gates of the city. In the unfortunate selction of Canberra, not only is the country too dry, even to grow good trees without artificial watering, but, according to the plans shown to the British Association, a suburban forest for Canberra has been clean forgotten.

It is two hours from Melbourne, and three hours from Sydney to the nearest *not quite spoiled forest.* From the Avenue Louise, one of the chief streets of Brussels, one steps into the Bois de la Cambre, which is the northern end of the "Forèt de Soignes," a forest which, for giant trees of Beech and Oak, for depth of shade and verdure, is unsurpassed by any forest in Europe. And Soignes is no expensive park, but an ordinary State forest, with an average net revenue of about £1 per acre. In it, everyone is free to wander as they list, and practically do as they like.

Loss least in Western Australia.—An impartial critic, I am inclined to think, would say that Western Australia has the best chances of all the Australian States for successful Forestry, because it has gone the shortest distance on the wrong road in Forestry. Its energetic working of the forest is a model to other Australian States, for after demarcating the forests and staying the destructive agencies of civilisation—fire and ill-regulated grazing—the problem is to turn to money the vast stores of decaying and over-mature timber always seen in a virgin forest; and, as a result, the change of the comparatively poor virgin forest to the valuable cultivated forest that we see all over the Continent of Europe to-day.

Future loss £588,000,000 *in next* 30 *years.*—Most things are done well in Australia, but Forestry has gone wrong. I hope my reading of the published official figures can be modified. I estimate that it will take about 30 years for Australia to get its national Forestry on a sound footing, and that the cost of doing so will, with interest, at the end of thirty years amount to £588,000,000. This figure discounted at 4 per cent. would have a present value of 243⅛ millions. In any case, there is no doubt that the present position of the forest question is one of extreme gravity—£10,000 a day going out of the country for imported timber, a shrinking home production, rapidly increasing in cost, a poor and dwindling hardwood export, and all the accessible and more valuable forests clean gone.

FOREST FIRES.

The everyday evidence.—The ravages of fire is the first thing that strikes the Forester on seeing the Australian forest, and indeed the mischief caused by forest fires is patent to everyone. The better forest is destroyed outright, the poorer forest in the drier country is deteriorated—there being less herbage, the fires there are slight.

Every Australian is familiar with the spectacle of the burnt forest, every traveller tells the tale of the monotonous scene of ruin. Most of the burnt forest the traveller sees had to go to make way for settlement. How much has been wrongfully burnt will never be known, because there has been no forest demarcation. The serious aspect of the matter to-day is that the effect of the fires is to deteriorate the existing forest, to make the timber more costly to work, and thus render it difficult for Australian hardwood to compete with the ordinary hardwoods of the European market, besides rendering the home cost of the wood dearer to the consumer.

A fire-swept forest gives costly timber to work.—It may be said that this is a matter of opinion. But it is an opinion easy to prove the correctness of. One has only to take the appearance of the timber in the strips of forest that have

escaped fire in Australia (either because the timber itself was too dense, or that there was a dense underwood), and compare that with the same forest that has been grown fire-protected in other countries, to see the difference in both the quality of the timber and the stand of timber available.

It is these two points—(1) the unsoundness of the Australian timber (the hollow logs and the defect in the logs caused by fire) and (2) the low stand of timber per acre coupled with inaccessibility—that make the cost of working the present Australian timber so high to the miller. The inaccessibility results from the neglect of forest demarcation; but for the unsoundness and the poor stand of timber, fire is the chief cause. The present out-turn from the mills is often not more than 40 per cent. of the measured cubic content of the logs. The official ratio in Western Australia is 50 per cent., and that may be taken as about the average. There is a 50 per cent. loss in Australia, against some 15 per cent. loss in a normal well-grown forest.

Grassed strips instead of the "fire habit."—It has been thought that because fires have always existed in Australian forests that they are inevitable. But this, the experience of other countries shows, is not the case. The forests of Eucalypts and Acacias (Wattles) which have been planted in South Africa, Southern Europe, and Califoria are protected from fire without much difficulty. The question of protecting the same forests in Australia is entirely one of organisation—organising the forest into blocks and compartments, and isolating these by broad strips of fire-paths, the fire-paths just as broad as the conditions require. In an Australian hot wind the burning strips of Stringy-bark will travel far, therefore the fire-paths must be made correspondingly broad.

It seems that with the dearness of labour in Australia, the most economical fire-paths in the end will probably be broad grassed strips. While these grass strips will be somewhat costly to make at first, they will give a good return in grazing, whether that be grazing leased to the dairymen, leased for ordinary grazing, or utilised for the grazing of the animals that are working the forest, or perhaps merely left for the game which, in forest so open and organised, will prosper as they have never prospered before. These fire lines, or rides as they are termed in England, are seen in every cultivated forest: they are as necessary to the organised forest as streets to a town.

Fires of the Blacks less harmful than those since made by the White Settler.—From an unknown period the Australian forest has been subject to the fires of the Blacks, fires lit for the purpose of providing food and hunting-grounds for the game. With the advent of the Whites, the fires have become more severe, and in the absence of any demarcation and control of the forests, have entirely destroyed the most valuable accessible forests near towns and settlements. There is evidence that in a part of the North-West of Tasmania, since the disappearance of the Blacks, and before the country has been opened up to White "settlement," the forest has extended itself and the timber improved (p. 35).

FIRE-PROTECTION.

Wattles easily destroyed.—In Wattle areas the destruction caused by fire has been swifter and more complete. Wattles succumb to fire easier than Eucalypts. Wattles are also much more easily destroyed by grazing than Gums. Thus, it has come about that the destruction of the Wattle forest in Australia has been on a more pronounced scale than Eucalypt forest. This destruction of the Wattle forest, as indicated in Forest Statistics (p. 185) and Wattles (p. 111), is now

costing Australia in round numbers £250,000 yearly. This figure is arrived at by taking the loss of export, plus the import from South Africa.

Maize growing lands converted to Wattle-farms.—When the wild Wattle began to get burnt and grazed out in Australian forests so seriously that supplies were restricted, the Natal farmer found that he could grow Wattle-bark on his *fields* at a handsome profit. He could perhaps get more out of cereals, but the Wattle gave least trouble, and for some years when the price of barks was high small fortunes were made by Wattle-bark growing in Natal. Now that the price of Wattle-bark is lower the farmers are beginning to put the fields back to Maize. Obviously the wild product in accessible Australian forests costs less to produce than Maize, so that Australia really has the whole matter of Wattle-bark production in the hollow of its hand. Organise the forests; stop Wattle destruction by fire and grazing, and the Natal farmers will certainly find it more profitable to go back to their Maize, and the people of England will get a little addition to their food supplies, for there is a growing export of Maize from South Africa to England.

Cost of Fire-protection.—General figures applicable to one country, even although they may be good averages there, are of little use in another country. In India, where the work is most difficult on account of the alternation of tropical luxuriance during the rains, with intense drought and heat afterwards, the average cost is stated at a fraction of a farthing per acre, but there the cost of labour is about one-fortieth the cost of labour in Australia.

In the large and as yet only partially organised National forests of North America, the cost of the fire-patrolling is stated to range from about 1d. to 2d. per acre. The fire-protection at Creswick, Victoria, where the fire-lines are excellent, works out to a cost of 3d. per acre (p. 29).

In the extra-tropical countries of the Mediterranean and South Africa, where the conditions approximate closely to those of Australia, the cost of fire-protection *when once the forests are organised* is almost nominal, and that is the most practical way of looking at the cost of fire-protection in Australia. For the broad grassed strips will pay on the cost of making them the same good rate of interest that is received on other grass lands; there has to be a Forester in charge of each forest; and once the forest is put into working order it costs no more to keep the Forester at the Forest Station in his hill-top look-out than to keep him in an adjoining village, possibly less. Thus, after organising the forest, the actual expense of fire-protection is no more than the cost of a few extra fire-guards at certain times, and the pay of men actually called out when a fire occurs.

It is thus correct to say that after the cost of organising the forest has been met, the current cost of fire-protection is insignificant. And the forest has to be organised for management and the economical working of the timber, in any case.

What has to be remembered is that fire in the Gum and Wattle forests of Australia is no more necessary than is scab in sheep. Scab, says the South African Boer, is the "Act of God." The Australian farmer has got rid of scab in sheep, but he has come to think that forest fires are inevitable, simply because he has grown up with them. The same forest in the same climate in South Africa, Southern Europe, and California is quite successfully protected from fire. The chief expense of fire-protection is in the organisation of the forest, with fire-paths, roads, buildings, and resident Foresters; once that is accomplished, the cost becomes nominal. The burning of *débris*, the so-called "cleaning-up" that has been practised in Australian forests, and the fire-patrols are partial expedients which are usually ineffective, and, in the end, cost more than a complete system of "organisation."

The fierce fire in one place resulting from the burning of the *débris* of old workings strikes the imagination, but the real mischief is done by the general fires raging over hill and dale, that destroy the forest seedling, deteriorate the forest soil, and start fires in the inside of the timber, and all sorts of defects on the outside of the timber. Indeed in an organised forest a fierce fire in one place may be an advantage, in providing a well-cleaned richly fertilised planting place for the introduction of choice trees. That has been my experience in South Africa.

Naturally all the Australian forests cannot be completely organised at once, but the more accessible and valuable forests can, and these are exactly those which are most exposed to fire and where fire will do most mischief, in that it will reduce the quality and quantity of the accessible timber which is by far the most valuable.

White-ants and hollow trees.—White-ants are bad in most Australian forests; they are absent from all South African forests in the same latitude, the species being different. They are credited with being the cause of much hollowness in Australian timber, but it is possible that they do more good than harm in plugging the old trees, and thus helping to keep out fire.

In Tasmania White-ants are not seen in the timber, but the hollowness continues, though not so badly as in the warmer parts of Australia.

Fire-protection and Grazing.—The effect of general fire-protection, besides preserving the forest in its timber, regrowth, soil, and water, will be to reduce the quality of the grazing but to increase the quantity, and there will be a stored up amount of grazing which will prove a precious stand-by in times of drought. This feature of grazing reserves for times of drought proved to be of so much value in India that it has been remarked that the whole cost of scientific Forestry there was not more than the value of the drought insurance afforded by the accumulation of fodder in the fire-protected forest reserves. Such grazing in the fire-protected forests of Australia will be of two kinds: (1) Good grazing in the open fire-lines; (2) Grazing of an inferior character, but valuable in times of drought in every part of the forest except those areas where the young trees are not yet out of reach of injury from grazing animals. At present, with drought, there comes very hot and dry weather, tending to bad fires in the unprotected forests, and further, there is no accumulated fodder and little grass growth during droughts. The accumulated drought fodder of the Indian forest reserves is absent.

DOUBTFUL EXPENDITURE ON THINNING AND "CLEANING-UP."

What's in a name?—As mentioned (p. 20), it has been attempted to cope with forest fires by a partial measure, variously called "cleaning-up," "improvement thinning," and in New South Wales "re-afforestation." Many of the old Forest Reports give long descriptions of the work, and from first to last it must represent a considerable expenditure. The Victorian Minister told a recent deputation that he was spending £1,000 a week on "thinning and cleaning up."

Indeed, if to the cost of this "cleaning up" in New South Wales and Victoria is added the cost of fire-patrolling in Victoria, it seems that a large part of the expenditure required to organise the forests would be met. No doubt there are considerable areas where improvement thinnings will be remunerative; that is a matter for the Working-plan to specify. It is in adopting this as a general measure lies the danger of incurring unnecessary expenditure. The pruning sounds more like orchard work than Forestry. The forest in its natural state, protected from fire, will do its own pruning with the denser growth following fire-protection.

How harm may result.—The practice was invented in the Eastern States at a time when nothing was known there of modern Forestry methods, and, I am glad to see, has not been followed in Western Australia. Too often the so-called "cleaning up" means thinning an already too thin forest. This is seen by the study of Eucalypts grown closer in South Africa. Thinning is costly, and should only be done by trained Foresters. In inaccessible forests it is best left to Nature. There may be some loss in individual timber growth, but most probably not in the acre-increment, which is the real test; while the timber will be more slowly grown, straighter, and more self-protective against fire. No doubt much of the expenditure on "cleaning up" has been done with the low-grade labour of relief work. But this labour could be equally well employed on the roads, fire-paths, and rough buildings required for forest organisation. Bye and bye, with close plantations of Conifers from broad-cast sowing, there will be plenty of light-work thinning *which must* be done.

A common mistake.—The "cleaned-up," bare forest soil obtained by burning is a mistaken ideal. It robs the soil of its fertility, the timber of its growth, and the forest of its natural reproduction.

DEMARCATION.

The object of Demarcation.—Sometimes the reservation of a block of country on a permanent basis can be effected, and this saves much trouble. But, more usually, it is necessary to work out a detailed forest demarcation, the best ploughable ground being set aside for agriculture and steep, rough, and poor ground going for Forestry, but with the provisos: (1) that ground to carry good forest in all countries subject to drought must be deep and penetrable by tree-root growth; (2) a good boundary must be secured for the forest without small enclosures of alienated ground.

Where a detailed demarcation has to be done the ground indicated as specially suited to Forestry is that which satisfies these three points: (1) Accessibility. Grazing may be away on distant mountains, while timber in such a position may be useless, though such forest may be reservable for water and climatic reasons; timber being the heaviest crop per acre per year (p. 2), forests should be in the most accessible situations and, on account of the advantages of forests as public recreation grounds, they should be situated as close as possible to towns and villages. (2) The better the soil of course the better the crop in forestry as in agriculture; but forest improves its soil while agriculture exhausts it, and so if the soil is deep forest will flourish on comparatively poor soils. (3) A good crop of timber now on the ground is the best indication as to the suitability of the area to be retained as forests.

It may require much detailed work, careful discrimination, and finally the decision of an authoritative Commission to decide whether certain ground is more suited for Agriculture or Forestry.

Forestry and Grazing.—As regards forestry and grazing, there is no difficulty or doubt. Unless the forest is very poor or slow-growing and without any climatic value, the forest crop will always be many times the most valuable. There is no comparison between grazing and forestry, either as regards the employment afforded or the value of the crop (pp. 57, 200); and, as a rule, forestry and grazing should not come on the same ground in Australia, grazing having its place economically on shallow or dry ground and forestry in the wetter areas with rainfalls above 20in., except in the east of local forests for local supplies, such as the Gum forests on the Goldfields of Western Australia and the Cypress-pine of the inland

drier districts of the Eastern side of Australia. Nevertheless, with the clear economic loss of letting good forest go for grazing, we have the Conservator of Forests, Victoria, only three years ago stating in his Presidential address at the Inter-State Forestry Conference:—

> During the present year, Victoria has disforested and alienated about 100,000 acres of useful and valuable timber land, unfit for cultivation, but suitable for grazing.

And this in Victoria, the Australian State where Forestry is comparatively advanced. It is reckless alienation of forest ground without previous demarcation which has brought Tasmania and New South Wales to their present position in Forestry. Forest demarcation is the most urgent question now pressing in Australian Forestry. It is the want of it in the past that is at the bottom of the present crisis in Australian Forestry.

AREA OF FOREST RESERVES NECESSARY.

An authoritative suggestion.—At the Inter-State Conference on Forestry held at Melbourne in 1912 the President proposed that each State should devote 10 per cent. of its total area as inalienable State Forest. That would give a total of some 192,000,000 acres. It was not stated on what basis this high estimate was founded.

No decision yet made by the State Governments.—I can find no mention of a definite decision having been arrived at as to the proper area required for the Forest reserves of Australia, and naturally this is a most important point, because the first step in Forestry is to demarcate the forest, and the first question in demarcation is how much forest is wanted. It has been the fashion to put the question off with untrustworthy statistics, showing a larger area of Australian forest than actually existed.

Progress in demarcating.—All the Governments of Australia are occupied at present with demarcations except Tasmania and South Australia. Tasmania because it has not yet begun Forestry, and South Australia because it has finished the demarcations as far as any area of accessible forest is concerned.

In Victoria the bulk of the forest demarcations are finished; it is the only State in which this important matter is settled, for South Australia has little accessible forest within its demarcated areas.

The problem what should be the demarcated area of Australia resolves itself into one of population. I have endeavoured to solve it for the extra-tropical portion of Australia, by taking the area of fertile and partially fertile country and allowing for this an area for the Forest reserves according to usual standards.

European standard of area to be kept under forest.—In the schools of forest economy in Europe, where this question has naturally been much studied, it has been usually held that the proportion of area to be kept under forest in a fertile temperate country should be about a quarter or 25 per cent. This is the European standard. In Europe at this day the proportion of forest per inhabitant works out to one and three-quarter acres per inhabitant (Forbes *"Forestry,"* 1914). On this basis and a future population of 40,000,000, Australia would require about 70,000,000 acres of reserved forest. But Europe is far from having all the forest it requires. England is importing some £43,000,000 worth of timber yearly, Germany half this, France £5,000,000, and the smaller States in proportion. Europe, to be self-contained, should have between two and three acres per inhabitant. Germany and Central Europe generally, have 25 per cent. of their area under forest, while Russia and Hungary have rather more; but in Southern Europe, where the climate is extra-tropical like southern Australia, the effect of forest fires and goat-

grazing has been to reduce the forest area to quite a small percentage. This, and the very small area of forests in England, has reduced the general European percentage to 31 per cent. In France the present percentage of forest is 17 per cent. This is admitted on all hands to be too low, but France lost its best forests when the disasters of 1870 robbed it of Alsace and Lorraine.

The 15 per cent. standard will require 74 million acres.—In the extra-tropics timber grows faster than in Europe, so that so high a standard as 25 per cent. is not necessary. Allowing for a smaller population in the drier areas of Australia and a complete population for the fertile extra-tropical area with a rainfall of over 20in. (of which Australia has 300,000,000 acres) and taking a 20 per cent. standard for the forest reserves, I arrive at a normal area for the Australian forest reserves of 98,000,000 acres. Since, however, the total area of well-timbered forests in Australia, according to official statistics (*Commonwealth Year Book,* 1914) is stated at 102,000,000 acres, and is probably less, it is doubtful whether Australia will ever be able to secure the 98,000,000 acres required for the 20 per cent. standard.

I have therefore, in discussing Australian forest economics, assumed a lower standard, viz., 15 per cent., which would mean an area of 74,000,000 acres of Forest reserves; and, on the whole, it is probable that this area will be sufficient, for these reasons: Well-executed planting work usually gives the highest yield in cultivated forest, and Australia must have a large area of softwood planting whatever supply of pine timber may be obtained by the cheaper process of natural spreading in fire-protected forests. (2.) It is natural to suppose that with fire-protection and under heavy rainfalls there will be produced yields of timber in the forest, improved by cultivation, which will approximate to the yields of timber obtained in the cultivated Eucalypt forests of other countries, which are two or three times the average of yields in European forests. If, therefore, Australia can secure 74,000,000 or 75,000,000 acres for its forest reserve, I should consider that this side of the forest question was satisfactorily settled.

Forest plantations versus native forests.—It will be said, and very truly too, that a much smaller area of forest plantations on good soil and under a heavy rainfall would produce all the timber likely to be required, even for the time when Australia had arrived at its full population (see page 375); but, against this, as pointed out at (p. 13) "Percentage of reserved area required for extra-tropical Australia" are the following considerations:—(1) The best soil in the most fertile climate is required for settlement; (2) to destroy the present forests and re-create others by planting would be enormously expensive; (3) even with the best knowledge of Arboriculture and Forestry, even with the skill of highly-trained forest experts, there is risk in making large plantations of exotics, especially Conifers; (4) Forests have other uses besides the production of timber. Climatically, they probably increase the rainfall to a small extent; they certainly increase the supply of useful water to a large extent, and instead of floods rushing uselessly to sea and carrying the best of the land with them, forests will check erosion and increase the supply of perennial springs nearly everywhere; (5) on the Continent of Europe the forest is the great recreation ground of the people. When the Englishman goes to the seaside the Continental goes to the forest, for health and recreation. In the out-door life of the extra-tropics this is the most important and popular aspect of national forests. As has been indicated, the future most valuable forests of Australia will be accessible, some of them on the outskirts of towns and villages such as one sees so conspicuously in the suburban forest of Soignes at Brussels (p. 156, Suburban Forests); at Paris, Berlin, and many other European continental towns.

ORGANISATION OF THE FOREST.

Safety of the Forest.—Fire-protection is mainly a matter of organisation. Once the forest is organised against fire, the subsequent cost of fire-protection is but little.

The central point of the organisation of each forest is the Forest Station, usually placed on a hill-top where there is a good look-out for the Forester in charge against fire, with radiating paths so that the Forester, who is ever on the watch during the fire season, can drop on to a fire in a few minutes to extinguish it. Living near him are the forest labourers, who can be summoned as they are wanted for fire-work. There is also at most forest stations a nursery, with a supply of water, preferably at pressure.

Forest playgrounds.—Fire-protection is not the only good result following forest organisation: the grass fire-paths, roads, and inspection-paths, open up the forest to the enjoyment of the public. One has only to see the people of Continental Europe enjoying their forest during the hot summer to understand what forest organisation will mean for Australian town dwellers.

Game follows on organisation.—And the organisation of the forest does more. It is certain that a great variety of the most attractive game would flourish in an organised forest, where they would fail in a wild forest; partly on account of the more varied grazing in the organised forest, and partly on account of the protection afforded by the Foresters living at their stations in the forest. Of course, all game in the forest must be directly under the care of the Forest Department, as in other countries. This measure, while costing the State nothing, will greatly add to the attractiveness of the forest and to the forest revenues. There are many forests in Europe where revenue from game brings in more than the revenue from the timber.

Tourists.—There are Tourist Offices in most of the Australian Capitals—the best in Sydney—and the attraction of the valuable tourist traffic is the declared policy of all the States.

It is safe to say that double or treble the men of the well-to-do classes would come from England if the forests afforded the shooting they might afford, with facilities for getting about and stalking and shooting, which the organised forest would offer. The practical failure of game introduction to the forests of Australia may be set down to forest fires and the absence of men on the spot to look after it and study it; and, to a less extent, the attempted introduction of climatically unsuitable species and the unrestricted range of vermin. All this should be remedied with a proper staff of resident Foresters.

Efficiency disproportionate to cost.—Every State except Tasmania has a Forest Department, but no one of the Forest Departments is completely organised; and thus they are unnecessarily costly. Practically the whole of the forest staff employed by the various Australian States at present live in adjoining towns and villages. In Europe nearly the whole Forest Department lives in the forest, the bulk of the strength of the Department represented by the Forester in charge of the Forest Station. At present the forest officials lose necessarily much of their time in journeying from their residences to the forest; but the chief economy in a well-organised department is that the bulk of the staff consists of the rank and file, paid as such, while the forest officers are highly trained University men with the knowledge and experience required to manage a scientifically worked forest.

Wider experience required.—In South Africa the forest officers are men who have qualified for their position by going through a regular course of Forestry

study. Most of them have a practical acquaintance with the scientifically managed forests of Europe. The greater number have been trained in Europe or America. It has been stated that at present only two forest officers in Australia have seen a modern European forest, and not half a dozen of the present subordinate staff are living in the forest.

Divided official control.—Office work bulks far too largely in Australian Forestry at present. There is divided control and friction and waste in the administration of the forests. In New South Wales no one knows quite who is in charge of the forests—the Forest Department or the Lands Department. Victoria presents a double-barrelled Annual Report for the information of Parliament and the public; half the Report by the Forest Officer, half by some other person—by whom is not stated.

FEDERAL FORESTRY.

Federal administration essential.—As in the United States of America, a Federal Forest Administration has become essential for Australia; not to compete with the State Forest Administrations, but to supplement them at points where Forestry assumes a national rather than a local colour, such as the great softwood and paper-pulp region of South-West Tasmania (pp. 15, 360, 330, 216), and the big Cluster-pine sand area on the coastal borders of Victoria and South Australia, and similar sandy areas on other parts of the coast, such as the North-East of Tasmania (pp. 185, 289, 79, 361). These lands have been lying unutilised and unused for over 100 years. It is a curious fact that one year's timber bill put into good softwood plantations on suitable ground would provide all the timber now being imported. Thus: present import timber bill is £3,500,000: £3,500,000 spent on planting at £10 per acre would plant 350,000 acres. On a 150 "Acrim" this would produce yearly 3,500,000 $\times$ 150 = 52,500,000 cubic feet, or more than the present importation of 50 million cubic feet (p. 187).

There are some 5,000,000 acres in the central and western region of Tasmania, apparently a first-rate paper-pulp region, and Australia is spending £3,000,000 yearly on paper-pulp (p. 185). This is a national matter which a State with the worst forest history in Australia cannot be expected to take up.

The Commonwealth has already assumed responsibility for the Forestry of the Northern Territory, and such Forestry as may be possible in the Federal Capital area, for it is unfortunately too dry there for Forestry on any comprehensive scale.

Victoria and Tasmania contrasted.—Victoria and Tasmania represent the opposite poles of Australian Forestry.

Victoria has satisfactorily accomplished the first crucial step in Forestry for a new country—its "Forest Demarcation." Its State Premier has promised a loan of one-third of a million sterling to fire-protect the hardwood forests and plant softwoods. The Forest Department, with an able Conservator at its head, shows enterprise and a well-balanced though, at present, small expenditure. A healthy public opinion on National Forestry is apparent to the visitor.

Victoria and Tasmania cut about the same amount of timber yearly, Tasmania rather the more; but while the Victorian forest revenue has increased in recent years (to put it tersely) from £17,000 to £70,000, the forest revenue of Tasmania remains stationary at £3,000 or £4,000 a year.

Tasmania is the most pronounced example in Australia of the neglect of Forestry. It is behind every Australian State in Forestry, and one and a half

centuries behind the Continent of Europe. It is essentially a forest country, and after over a century's occupation of the country it has not taken the first step in scientific Forestry. It might now be drawing well over £1,000,000 a year by exporting hardwood to South Africa, and supplying itself and Victoria with softwood. Instead of which its forests, after a century of shameful neglect are, in their most valuable parts, a burnt-out wreck. I went over one costly timber railway and mill at Port Esperance, abandoned after a few years' work, the forest burnt and 200 employees thrown out of work; the company bankrupt after spending, it has been publicly stated, £250,000. Even timber at nominal rates is not much good to a timber company unless the Government looks after the forest and prevents its being burnt. The accessible softwood is done, the Blackwood just finishing; the timber companies are finding it difficult to get even hardwoods at a paying price. One of the most experienced and respected sawmillers at Geeveston, Mr. Crennett, estimates 10 years as the period for the practical exhaustion of the Blue-gum. The forest revenue is a very small fraction of what it should be, the Forest Department non-existent. On its timber cut I have reckoned that the Tasmanian State gets revenue at the rate of 0.18d. per cubic foot, which is somewhere one forty-seventh the mill value of the timber; this figure being about one-fourth for South Africa, and some one-fifth in America (U.S.A.). So far has the ruin of the Tasmanian forests proceeded that houses of the better class, in this once all-forest State, are now built mainly of timber imported from the northern hemisphere.

Tasmanian finances, as the natural result of this misgovernment, are in a straitened condition. There are no funds for the development of its fine natural resources: one quarter of the island is scarcely explored, and another quarter practically unproductive. The still valuable forests of Tasmania might be yielding a revenue equal to the special Federal grant of £90,000, but, owing to the anarchy in the forest administration, this is lost, along with the best of the export trade; and, worst of all, the best of the forest. Tasmania has lost perhaps £1,000,000 worth of hardwood export a year for the last 20 years for want of scientific Forestry methods 80 years ago (p. 352). It is said, in its distress, to be making £80,000 a year out of the State countenance of gambling, which most of the civilised world but Monte Carlo and some of the Mediterranean countries taboo.

A few more years of the present ignorance and apathy will see remaining forests of Tasmania reduced to worthless scrub and bracken, and the island, bereft of its chief natural resource, in the condition of the poorer parts of Italy and the depopulated region of South-Eastern France in the same latitude.

It may be hoped that, on national grounds, Australia will not allow this to happen. Tasmania has not got the resources now required to restore its ruined forest estates. About one-third of the island is peculiarly adapted to Federal Forestry. It is the only part of the Commonwealth exactly fitted to produce climatically the same species of softwood timbers that are now being imported at a cost of £3,500,000 yearly, and the softwood paper-pulp required in Australia for making that paper which is now imported at a yearly cost of another £3,000,000 (p. 185).

POLITICS AND FORESTRY.

Political control in New South Wales.—There is not very much difference in Forestry between Tasmania and New South Wales. Tasmania has done nothing and spent nothing, whereas New South Wales has a good Forest Department and has spent money on Forestry, but the expenditure has been without skilled direction and the whole work has been at the mercy of the politics of the hour, one Minister

doing his best for Forestry, and the next Minister throwing over the whole thing, boasting of the country that he had "opened to settlement," and giving vent to such clap-trap as "never devoting to Forestry land that could grow bread for the people," as if the people did not want cheap timber for houses, recreation grounds, springs of pure water, and grazing reserves for times of drought. And then there is the curious result that the more Australia burns and grazes off its Wattle supplies, the more the South African farmer will plant Wattles instead of Maize on his fields and so reduce the food supply.

Ministers should not attempt forest "management."—Ministers in Australia receive handsome salaries. They are above the temptations which assail the poor man so sorely in politics, and, I am told, are no better or no worse than the average Englishman with the Englishman's ideals of duty before him. But when a Minister is put into the position of a Forest Officer, or indeed allowed any direct forest management, it is evident that he is a square man in a round hole. It would be hard to find two more unsuitable persons to whom to entrust a Conservator's duties than a Minister and an office clerk, yet this frequently has been the lot of forest administration in Australia. The Minister is too often the creature of the hour; it is perhaps a fault of the present political system that this should be so, but one must take facts. Forestry, on the other hand, is a thing of centuries. There are trees, alive and well now, that were good trees in the time of Julius Cæsar. Forest management is useless unless it is conducted on a continuous forest policy; and the direct management must be by experts. It is no exaggeration to say that you might as well put a minister of religion in charge of a dreadnought as one of the Ministers of the Government in direct charge of Forestry. I have recommended that Forestry in Australia be treated like Railways, and freed entirely from politics. The head of the Forest Administration should be responsible only to Parliament for the carrying out of such forest policy as Parliament may determine, and all technical Forestry details left to him.

City versus Country.—I have heard something about a Country Party in Australian politics. If the countryside should ever acquire a preponderate influence in Australian politics (as it has in fact in South Africa) there would be less need to take Australian Forestry away from politics. But with the forest "out of sight and out of mind," as it is at present, there is no chance for it. In practical politics Forestry hardly bulks larger in Sydney than a thoroughfare in one of the City's treeless slums.

Even in South Africa, where the country influence is predominant, Forestry was held back for many years and much money wasted owing to a too direct Ministerial control. Forestry in Cape Town suffered, and Forestry in Natal had ceased to exist when the Act of Union did away with the serious influence of local politics and brought in better government.

Usually with Australian town politics the forest does not come much into view until *someone wants to make money* out of it. If anyone wants to work in the forest, he has a voice and a vote (the forest has not), let him work as he lists, and do not hamper him with the restrictions required to ensure the conservation of the forest for the country. If any enthusiasts want to preserve the forest, tell them to organise a deputation and *promise* it a great deal. If farmers, living on bare, wind-swept farms, ask for help in tree-planting, give a job to a "practical man" in starting a little tree nursery. That has been the common history of Forestry in Australia.

Federal control ensures more continuity of policy.—If one considers the fitful Forestry efforts in Australia; the grandiose forest scheme that lived for a day in New South Wales; the millions that Australia stands to lose owing to its want of

modern Forestry, more millions, in fact, than the value of all the gold that has ever been won in Australia, one is forced to the conclusion that the only remedy for this state of affairs is to get national Forestry away from direct political control. Federal Forestry would be an improvement, and might be a complete remedy as public opinion on the subject improves and hardens with education, and the up-growth of that love for the country which strengthens the longer that people live in it.

ROYALTIES.

Low Royalties induce waste.—Royalties in Australia are exceptionally low (pp. 93, 173, 182). This result has come about as the result of political control and the popular idea that the forests of Australia are inexhaustible, and an exaggerated idea of the waste in working Australian timber. Low royalties are bad, not only on account of the low revenues from the forests, encouraging the idea that the forests are of little value, but as leading to waste in the working of the timber itself in the forest. Timber is not always worked as carefully as it might be in view of the approaching scarcity, and this want of care in the working is encouraged by the low rates at which it is sold. I have computed roughly that the average rate of royalty prevailing throughout the Commonwealth is about ¾d. per cubic foot, whereas a low and useful working is £0.01 (the "metric tickey," or 2.4d.), though indeed actual rates are mostly higher; thus the average rate in South Africa is 4d. or 4½d. per cubic foot, and in Leiria, the model State Forest of Portugal, the rate for Cluster-pine is 4d. per cubic foot.

Sleeper-hewers' waste.—As a rule, sawmillers waste little timber (it has cost them too much to get it), sleeper-hewers waste a great deal; and the latter, in some of the Australian States, owing to local politics, get their timber for next to nothing and pay, not on what they cut, but on what they find it most *convenient* to use. Said Lord Rosebery, in his Chatham speech in the dark days of the Boer War: "We are a people of enormous waste." Nowhere is that national characteristic seen much more than in the timber of an Australian forest to-day.

THE RURAL INDUSTRY OF FORESTRY.

Solving a labour problem.—Said Mr. Cook on April 15, 1915, speaking in the Federal Parliament:—

> The one overmastering problem Australia has to solve is to make the interior of the country more attractive and to remove the great discrepancy between city and country population.

If Mr. Cook could go with one of the two English Arboriculture Societies on their Continental tours, he would see that no means is more conducive to rural employment than the scientific treatment and development of the national forests. The Belgian Government, which is now busily employed in increasing the area of its State Forests and doing a good deal of planting, has now 750 men in its Forest Department, and provides winter employment for 32,000 labourers.

Money saved is money earned.—It will be asked, if a corresponding amount is to be put into the national forests of Australia, how is it to be paid for? The reply is, "Out of the £3,500,000 yearly now paid for imported timber and out of the larger sum representing the vanishing value of home forest produce. At p. 205 I have estimated the amount of rural employment which scientific forest conservancy would mean in Australia, for labour in the forest, apart from officials, and apart from men employed in timber working.

For this class of labour, the men employed in the cultivated forests of Europe, there is now no counterpart in the wild forests of Australia. Economically their

pay is represented by the difference in the yield of the wild forests and of the cultivated forests, a big figure, running into many millions yearly (p. 110).

Permanent employment.—The average employment in the cultivated forests of Germany is at the rate of 942 acres per man per year. This is the figure for men employed on roads, planting, sowing, thinning, and all labour in the forest apart from timber working. I take this figure as an average between Bavaria, where the forests are good, and Prussia, where they are poor.

Allowing for the shorter working day in Australia, and the increased work per acre, owing to fire-protection and the quicker growth of timber, I arrive at an average figure of employment in Australian forests of 800 acres per man (p. 205). This means that when the wild forests of Australia are organised, and fire-protected on European lines, there will be average employment for one man per 800 acres of forest as a permanency. Probably I have taken this too high, and that 600 or 700 acres per man may be more correct. It is difficult to estimate the efficiency of labour working under new conditions.

Temporary employment.—On temporary work, required to put the wild forests in order as cultivated forests, the employment will naturally be much greater. It will be the labour required for making roads, fire-paths, buildings, and nurseries, as against the labour required *afterwards*, to keep these in repair and to perform the routine work of the forest. A general idea of the quantity of this can be imagined, but figures will be misleading, since the amount of employment will vary according to circumstances in each forest.

But a general idea of the employment required can be formed from my estimate that from now onwards for several years there should be an expenditure of from £1,000,000 to £2,000,000 per year, taking as a basis what other countries similarly placed to Australia are now spending on their national Forestry; Japan, the equivalent of £1,000,000 a year; South Africa, one-seventh of a million; South Africa in white population and industrial development being about equal to one of the larger Australian States. Russia, with a huge area of forests being converted from their wild state to cultivated forests, is spending on its Forestry so much that the figure can hardly be taken as a guide to Australia. On routine forest work, we have France spending £500,000 yearly, and Germany about £2,000,000, excluding timber work.

If, therefore, Australia were to start away with an expenditure of £1,000,000 per year in stopping fires and putting the wild forests into order, this, on a basis of £150 per annum, would represent the employment of some 7,000 men yearly, which would be a considerable contingent to Australian rural employment, and it would represent employment of absolutely the healthiest kind that could be imagined.

The Forest labour must be well organised and cared for.—An important point to remember is, that this forest labour is not the casual employment of a sheep station, but labour that would be permanent throughout the year, and come to stop. The men would be located in the forests, as in Europe, in model hamlets, with most of the conveniences of civilised life. Each man would have a cottage and ground enough for a garden, and the domestic animals required on a small home farm. Living under these conditions life is cheap, and a Government rural forest labourer, with these and £150 a year as average earnings, would be better off than the average town labourer.

Proposals of this nature have been denounced in England as "State Socialism." In France, Germany, Switzerland, and other Continental nations the Government forest labourer is cared for by the State in this way; the system is really antag-

onistic to the bad features of socialism. In any case, permanent, contented, and well-cared for labour in the cultivated forests is an essential, because these are the men who have to be depended upon, the men whom the Forester has to ring up when a fire breaks out, and fire work in the forest is no easy or light work. Very commonly it is night work, for that is when the hot winds drop.

Forest Officials.—The number of resident Foresters required for the organised forest will naturally depend on circumstances. Probably 30,000 acres per Forester may be taken as a general average; so that if there were 2,000,000 acres of Forest Reserves organised at once, that would mean employment for about 66 Foresters, living in the forests, and in each charge of a Forest Station.

Foresters in South Africa are armed and mounted men, the Government supplying them with a horse, allowance, rifle, uniform, and a comfortable well-built house at the Forest Station. In the same house are one or two spare rooms for the inspecting forest officials. On the Continent of Europe the Foresters are all men trained for military service, and form a crack corps of guides and pioneers.

The inspecting part of the Forest Department would not differ greatly from that which at present exists in Victoria, and New South Wales, but it would be better organised and instructed.

Timber Workers.—These at first would not greatly exceed the number of men now employed (or that have been employed) in timber-working; but the opening up of the forest would entirely alter the conditions of living for the majority of them, and their numbers would naturally increase with the improvement in the timber supplies. If it be asked how is all the extra labour to be paid for, the answer is again "home-production," the reduction of the present timber import of £3,500,000, and the increase of the present timber export of £1,000,000 worth.

IMPORTS OF TIMBER AND FOREST PRODUCE.

Timber Imports, £3,500,000.—The import of timber, in the log and slightly manufactured, together with tan-bark, amounts, as has been seen, taking a normal year before the outbreak of war, to £3,500,000.

£250,000 *on Imported Tan-bark.*—As mentioned previously under Forest Fires, Australia is now losing some £250,000 yearly over Wattle bark imports and exports; and the tanners are complaining bitterly of the difficulty of getting tan-bark supplies. The duty against South African Wattle-bark has been consequently taken off to help the tanner, and a bonus on Australian Wattle-bark substituted. No bonus will be required when the forests are organised and fire-protected. There will be a large surplus for export. When the wild Wattle is no longer burnt and destroyed in Australian forests, the South African farmer will go back to maize and other crops on their fields. The present £250,000 yearly loss over Wattle-bark in Australia is the natural result of bad Forestry in Australia.

Furniture Imports, £354,257.—One has but to visit the furniture factories in Melbourne, Adelaide, and North Tasmania to see how entirely unnecessary it is for any furniture to be imported to Australia (p. 334). The so-called "Tasmanian Oak," the timber derived from various species of Eucalypts growing in the colder, temperate country, furnishes a somewhat better furniture wood than Oak. It has not got the same figure in the "silver grain," but takes "fuming" more successfully than English Oak. On the whole it may be said that Tasmanian Oak is but slightly heavier and decidedly stronger than European Oak, and also more ornamental. It is a strong argument in favour of Federal Forestry, that a portion at least of

the forests of Tasmania should come under Federal management, when one considers that the best supplies of Blackwood are derived from Tasmania, and that there is at present no State Forestry in Tasmania. I have seen Blackwood logs worth £50 to £75 which, owing to mismanagement, had been burnt on land opened up for settlement in Tasmania. There was no means of getting them out when the country was "settled." There are not more than a few hundred of such logs in all Australia.

While logs of figured Blackwood are being burnt in Tasmania, as much as £42,329 was paid in 1913 for imported veneers; and the Australian furniture-makers have to veneer ordinary Blackwood and make it up with imported softwood as even ordinary Blackwood from Tasmania is costly, they only getting the remains of what is left unburnt by the shiftless Government.

Tasmanian Government methods do indeed furnish one of the strongest arguments for Federal Forestry in Australia, since the furniture industry throughout Australia has to depend on Tasmania for its chief furniture wood, and Australia is paying £3,500,000 yearly for imported timber, and another one-third million for imported furniture. Figured Blackwood is like the figured Walnut of piano veneers and is by far the most ornamental of all furniture woods in Australia. One has only to recall the exhibit sent by Australia to the Panama Exhibition in proof of this (p. 352).

Paper imports, £3,000,000.—The importation of paper and stationery in 1913 amounted to £3,004,054. A considerable amount of this value represents raw material in paper-pulp, which in the cooler and temperate parts of Australia could be produced with ease and certainty. The common Insignis-pine would probably make a good paper-pulp. But the areas specially indicated for growing paper-pulp are the mountains of Victoria, and the cold, wet, south-west region of Tasmania, which on other grounds it is advisable should be taken over for Federal Forestry. There is a very slender prospect of the waste hardwood in Australian forests being used for paper-pulp, as has been more than once proposed. It must be remembered that waste softwood and sawdust have not yet been utilised for paper-pulp in countries where it costs a good deal to get rid of them. The total Forestry effort of the Tasmanian Government has been to import an expert from America at a cost of £1,000 to report on "paper-pulp from hardwood."

Turpentine and oil imports.—Kerosene and turpentine represent considerable items of import, but they are not shown separately in the *Commonwealth Year-book.* They appear to represent a value of between £1,000,000 and £2,000,000. Their importance is less now than will be the case with better Forestry when Cluster-pine, which should naturally clothe the sandy wastes of the southern coast and support the same valuable turpentine industry that one sees in the south-west of France, and to a lesser extent in Portugal. In South-West France a man takes the turpentine from his Cluster-pine trees as a matter of course, like picking apples from an apple tree; in Gascony it is the chief rural industry for a population of considerably over one million people. There is no reason whatever why Australia should not have a share in this rural industry.

Again, much of the kerosene imported from America is in use for cooking and heating purposes. One of the results of reckless Australian Forestry in the past is the destruction of the accessible forest, so that now it is more economical to import kerosene from America than to cut firewood and make charcoal in home forests. Firewood is so costly in Hobart and Launceston that householders are taking more and more to the use of kerosene for cooking and the very dirty coal of the country for heating. Reckless Forestry in other countries has had the same

results. It costs less to bring the imported product by sea from a distant country than to obtain it from inaccessible forest at home.

THE £588,000,000 LOSS IN THE NEXT THIRTY YEARS.

An unpleasant forecast.—For many years Australia got on well enough without scientific Forestry. It is true that the forest was shrinking visibly, and far-seeing men sounded notes of warning; but the area of forest *compared to population* in those days (though not to the future wants of the country) was large, and for many years supplies of timber were cheap and sufficient.

Gradually, however, the accessible forests began to come to an end, and with the increased cost of working the inaccessible forest came the deterioration of the forest that was left, and the rise in the price of labour. Thus, during the last eight or ten years the cost of home-grown hardwoods has nearly doubled. This and the rapid industrial development of Australia during recent years has favoured the rapid growth of imported timber. Hence the present position, which can be described in no other terms than a catastrophe: home-grown woods dear, the export of hardwood shrinking, and an import of timber and forest produce costing about £3,500,000 yearly, or some £10,000 per day. There is a yearly loss on tan-Wattle bark of about £250,000 yearly. The bulk of the imported timber represents one ship carrying 3,400 tons to arrive daily. The economic loss in the position is difficult to realise.

The present position of the forest question in Australia occurred in South Africa about forty years ago, and after considerable discussion it was decided to organise South African Forestry on modern lines. If Australia were to now start Forestry on the same lines as South Africa it would be about thirty years before there could be any appreciable relief to the present position. In 15 or 20 years there would be supplies of coarse softwood, and in some 50 years would come good supplies of regrowth hardwood and first-rate softwood, equivalent to that now being imported.

Assuming 30 years as the mean period required to obtain relief from the present position, I have attempted at p. 176 to calculate the inevitable loss which must ensue during the next 30 years while the forests are being put in order so as to produce at home the timber now imported and bring in a better supply of home-grown hardwood. That loss, it is seen (p. 176) amounts to £588,500,000; and, unfortunately, it is a low estimate. The imported timber has been assumed to increase to not more than £6,000,000 on an average during the next 30 years, and the loss of export trade, owing to bad Forestry, to average no more than £2,500,000 yearly; while the total shrinkage of home-production, together with some indirect loss to the forest industries in consequence, has been taken at only £2,000,000 a year.

The total bill, with interest, it will be seen, comes to £588,500,000, a sum which is somewhere near the whole British national debt when the war broke out, and about double the total public debt of Australia (State and Federal) at the same time. This sum exceeds by a good deal, as I have pointed out (p. 177), the total value of all the gold won from Australian soil. The present value of this figure, £588,500,000, discounted at 4 per cent., is 243⅓ millions sterling. Thus, the present forest catastrophe must cost Australia more than the war or any calamity that it has seen in short history.

The causes of the crisis.—The crisis which has now overtaken Australia on the Forest question has naturally not arisen from any one cause. There have been a

variety of influences at work, but since Australia has had home rule, the following seem to be the most important:—

(1.) Taking over the unfortunate British ideals in Forestry and the continuance of British Government methods of administration. Officially, "Forests and Fisheries" are still lumped together in the Government returns, though they have actually no more in common than chalk and cheese.

(2.) The predominant town and pastoral influences.

(3.) Free-trade. The more timber that is imported the better for trade, but the worse for Australian Forestry and all that the home forests mean to Australia; one of the greatest rural industries, water conservation, the soil, the fertility and the beauty of the fairest parts of the land! The noxious free-trade influence in the past, and its influence on Forestry, is well seen in the comparative positions to-day of Forestry in Victoria and New South Wales.

(4.) The shifting character of Australian politics unsteadied by the public opinion in favour of national forests that exist in other democratic countries such as France, Switzerland, Belgium, and latterly in the United States of America.

Expenditure advisable, £40,000,000.—If Australia now, or when the war ends, were to start away with scientific Forestry on the lines of South Africa, Japan, and other countries which, during recent years, have been in the same position with their Forestry as Australia now is, it would be advisable that Australia should spend £1,000,000 or £2,000,000 yearly at present and until a sufficient amount of forest had become organised to provide for a fair measure of fire-protection and for present timber requirements; while the sooner a good area of softwood planting were done the sooner will be the present softwood importation brought to an end. And when these ends were assured an expenditure in gradually decreasing quantity making up a total expenditure of some £40,000,000 or £45,000,000 during the next 30 years. This expenditure, I have shown under Forest Finance (p.), would give a far better return than railways or any public work that Australia has so far undertaken in all its history.

Government neglect of the Forest makes timber working costly.—The neglect of the forest by Government makes timber working more costly and this helps to keep Australian hardwood out of the European market. The present small and dwindling export of under £1,000,000 a year should reach £3,000,000 or perhaps £4,000,000 a year if the Government gave that attention to the forest, its organisation and working, which we find other Governments bestow on their forests.

TIMBER "WORKING."

Obstacles to profit making.—The present virgin forests of Australia are little more than an indication of what these wild forests could be converted to after some years working, under modern forestry methods. This is in the future; but to the man who thinks but of to-day, there is the fact that the existing poor forest is not being worked as economically as it might be, and thus Australian timber is not making its way in the great hardwood markets of the world as it should. The points that strike the visitor regarding the ineffective and costly present timber working are these:—

(1.) No roads. Not only do Australian Governments usually not make roads to develop the forest and open up the country, but they fail to help the timber worker to do so, in fact they commonly tax him for putting in timber tramways.

(2.) No grass for the draught animals. In demarcating forests in other countries, one of the considerations is the providing of grassed areas which will act as permanent firebreaks and grazing for the cattle in working the timber.

(3.) There is much timber which can only be worked economically by pit-sawing; I have referred to this lost industry elsewhere. It is probable that with well-organised and tactful Forest administration both the pit-sawing and charcoal-burning industries could be revived.

In any case, as in America (see Rep. Forestry Com., 5th Nat. Cong., Washington, 1913) the day of the big sawmill in Australia is nearly done for the present. The small portable sawmill working up such timber as is left will carry on for some time longer. If good Forestry be not introduced the day of the big sawmill and economically worked timber is gone for ever.

With good Forestry, in from 40 to 60 years, there is the prospect of heavier stands of better shaped timber than has yet been seen in Australian forests, with the economical working of large well-equipped sawmills that should enable Australian hardwoods to easily capture the European hardwood market.

FOREST DEPARTMENTS AND THEIR REVENUES.

The marked effects of full organisation.—It is instructive to note the rise in the revenues from Forestry in the Australian States as soon as their Forest Departments became efficient, also the cash loss in Tasmnia where there is no Forest Department, apart from the loss of the best forests and water supplies, together with the beauty and tourist attractiveness of the land.

On the average of the last 10 years, the amount of timber worked in Tasmania and Victoria has been about equal, but the forest revenue since Victoria has had a working Forest Department has risen to 15 times the forest revenue of Tasmania without a Forestry Department. And the forest revenue of Victoria which, 10 years ago when there was a poor, ill-organised Forest Department, was £17,000, has now risen to close on £70,000. The forest revenue of New South Wales, which was £10,000 in 1901, rose to £95,000 in 11 years after New South Wales got a working Forest Department.

New South Wales and Victoria spend between £40,000 and £50,000 a year on their Forest Departments, and New South Wales has a net forest revenue of £60,000. Queensland has a very small Forest Department, but it has the advantage of being under the only professionally trained Conservator in Australia, and Queensland has now got a net forest revenue of £56,000 (really more if the accounts were better kept).

We may go a step further and, leaving the partially organised Forest Departments of Australia, see what happens in South Africa where there is a completely organised Forest Department—men with a University training at the head and a rank and file with a sound practical knowledge of wood-craft. With only half a million acres as the total area of natural forest, and only a fraction of this good workable forest, South Africa has a forest revenue (1912-13) of £57,000.

But, of course, the best proof of what Tasmania is losing yearly by bad Forestry is afforded by the parallel of Victoria. The forests are similar, the timber worked rather more in Tasmania, but while the nominal forest revenue of Tasmania remains at about £4,000, that for Victoria has risen in 10 years, as mentioned above, from £17,000 to not far off £70,000. Actually, Victoria cutting rather less timber than Tasmania has 15 times the forest revenue. And Tasmania, with 1 per cent. of the area of the country leased for cutting and 122 sawmills,

valued at over £250,000,000, has a forest revenue of only two-thirds that of South Australia with its diminutive forest area. Thus a well-organised Forest Department like that of Victoria pays for itself many times over and saves the forests of the country.

THINNING AND PLANTING.

"Thinning" the Forest.—Contrary to the popular view, the general position of Australian forestry is that the forest is understocked not overstocked, and such thinning as is required is exceptional and to be dealt with in the "Working-plans." Even after a fire, and the very dense reproduction of young Eucalypts that often follows in the strips that escape further fires, the Eucalypt regrowth may be seen thinning itself naturally as it grows up. This natural thinning was strikingly seen in the plentiful regrowth of *Eucalyptus globulus* following the great fire of 1898 at Port Esperance, Tasmania.

Eucalypts are all strongly "light-demanding," and as such in the ordinary irregular forest thin themselves naturally. The regrowth in Nature is not so regular as in a plantation, so that the leading stems easily dominate the smaller stems, and with the "light-demanding" constitution of the Eucalypts the dominated stems soon die.

Thinning is not a subject of any general importance in Australian forestry. Special cases such as the dense growth of Cyprus-pine and of true pines in broadcast sowings are dealt with in the "Working-plans" of each forest.

In regular plantations with the trees even-aged thinning is necessary, but with the high price of labour is a serious difficulty in the way of growing first-class timber in plantations.

Forest Plantations versus the Native Forest.—The crude idea of cutting down the forest and replacing it by artificial plantations has been referred to under popular misconceptions (p. 311). At page 102 it is shown that to replant the area of the forest reserves of Victoria and New South Wales (only 9,000,000 acres at present) would cost, with interest to 50 years, no less than £958,000,000. New South Wales and Victoria have quite enough to do in organising, improving, and fire-protecting their existing forests without expending a sum of some £958,000,000 on the risky experiment of replacing the natural forest by a huge plantation of exotic trees.

Planting will have to be strictly limited to just as much as is necessary to (1) provide a sufficient area of accesssible softwood forest to meet the importation of softwoods; (2) improving the stocking of the native forest by planting up blanks and by the introduction of self-spreading species, especially shade-bearing species.

THE ROUTINE OF FUTURE FOREST WORK.

The three "P's" of Forestry.—The forest work first calling for attention is to get the demarcations finished as rapidly as possible, excluding all good agricultural land not required to give the forest the boundaries of workable economic estates. Grazing areas must be kept well outside forest boundaries; ploughing and cultivated areas can come in, but with defined and restricted veldt or bush-burning rights. Developing roads to these inside forest holdings, and main timber-working roads, to be laid out at once. Small areas of deep rich soil should stop in the forests for the growth of Blackwood, Walnut, Ash, etc., in the cooler areas, and Hickory and Camphor in the warmer forest. Then forest work should go forward on the usual lines of forest work elsewhere within the extra-tropics—as it has been aptly termed, the "three P's" of Forestry—Police, Protection, and Planting.

Police.—Supervision and police work at present, only with the forest organised and resident hill-top Foresters, most of the work now done expensively by visiting inspectors would be done automatically by the Foresters and their men living on the spot.

Protection.—For the forest, against the "vices of civilisation," fire, and unregulated grazing, protection is necessary. When properly regulated, fire and grazing work to gether for the good of the forest—fire to start regeneration, and grazing to keep out fires from the grown-up forest. The accessible forests are those which are most exposed to damage from fire, and happily these are they which will best repay the cost of complete organization and fire-protection. There is not a shadow of doubt that they can be as completely protected against fire as the average house in a city. These completely protected, accessible forests will help to keep out fire from the more remote forests when the situation will not allow of much expenditure on them.

Planting.—In the inaccessible forests, the mere introduction of self-spreading valuable exotic species; in the accessible forests, both regular plantations of softwoods and the introduction of self-spreading species.

Working Plans.—The area of fertile Australia is too small to allow of any forest being left undeveloped and not producing its best under the circumstances. Every cultivated forest has a "Working Plan" (p. 69) of some sort. Not a day should be lost in drawing up "Working Plans" for every forest in Australia that is to be preserved as forest. Important "Working Plans" should be considered and authorised by the Minister.

ARBORICULTURE.

Distinction from Forestry.—By Arboriculture I understand the growth of individual trees for shade, ornament, and fruit, as contrasted with Forestry—the growth of trees in masses for timber and forest produce.

The two are distinct; usually Arboriculture as lending itself more readily to private enterprise is that which is first undertaken. Australia, with all the reckless Forestry of New South Wales and the helpless Forestry of Tasmania, might still have been well advanced in Arboriculture; but this is not so. Throughout the length and breadth of extra-tropical Australia, the absence of Arboriculture is, if anything, more conspicuous than the absence of Forestry.

London streets in southern latitudes.—In all the large towns of Australia one sees dreary vistas of houses and cottages built on the lines of Kensington and Lambeth, when there might be all the beauty and comfort, in this sunny latitude, *of the newer parts of the* towns of Southern Europe. The streets are broad enough nearly everywhere—in Sydney, Melbourne, Adelaide, and the other Capitals—to have boulevards or a double row of trees—one on the footpath side of the kerbing and the other on the road side of the kerbing—trees planted close so as to afford under their shade, the complete comfort and enjoyment of outdoor life which one obtains in Southern Europe and cannot obtain in dreary, dirty London.

In a new country the houses are necessarily built on economical lines at first; but in the fine Australian climate a small house matters little if it is only used partially for sleeping and during bad weather—hot winds, dust, or rain. But at at present we have an outdoor climate, without the outdoor life which is so enjoyable a feature in other extra-tropical countries.

No doubt it is English ideals and customs that have brought about this loss of the daily outdoor life in Australia. It is almost impossible in Australia to get a dinner out of doors in summer. In Paris the restaurant keeper is full of apologies

if he has to put you inside. A change to more comfortable and healthful ways of living will only take place gradually; but the rise and study of Arboriculture will certainly do much to promote that change.

No Text-book of Extra-tropical Arboriculture.—It is remarkable that at present there is no general text-book of Extra-tropical Arboriculture in the English language. There is naturally an extensive literature of the trees that flourish in England and North America; but this literature tends rather to obscure extra-tropical Arboriculture, since the trees which flourish in Australia, California, and the Mediterranean grow only as more or less tender exotics in the mild climate of South-Western England and the sharp winter of North America.

In Australia itself, the only literature approaching a text-book of Extra-tropical Arboriculture is Mueller's "Select Extra-tropical Plants," but this, though a popular and useful work generally, speaks only to a slight extent of extra-tropical trees, and unfortunately, as regards trees and Forestry, Mueller's book is far from reliable. There are certain accounts of trees or groups of trees scattered through Australian periodical literature, notably those by Mr. Maiden in the New South Wales *Journal of Agriculture*. It would be useful if these could be collected and republished in book form. The arboriculture of the native trees of Australia is well represented in the publication of Messrs. J. H. Maiden and R. T. Baker, of Sydney, of Bailey in Brisbane, and Rodway in Hobart. It is the arboriculture of the usually more valuable trees of the northern extra-tropics that is deficient.

Nurseries.—To place Arboriculture in Australia on the same footing as that in South Africa, there will have to be a propaganda spreading information regarding trees, and a greatly increased number of Government nurseries for the distribution of young trees. The distribution that takes place from the few Government nurseries in Australia has very naturally taken the form of free distribution, and this has not given the best results. People are liable to be careless with what costs them nothing, and there is the complaint from the private nurseryman of unfair Government competition. In South Africa young trees are not issued free from the Government nurseries, but at cost price. This has been the practice for many years. Some 5,000,000 or 6,000,000 are thus sold yearly. They are issued at all ages, from seedlings the size of one's thumb-nail to saplings 10ft. high (p. 271). In South Africa there are as many as 163 Government nurseries from which trees are distributed, and at each of these there is a Government official able to afford information about the trees suited for the district, and the exact value to the farmer of the different trees; for there is wealth for the farmer and planter in Arboriculture comparable to the national wealth in Forestry.

Wealth in Extra-tropical Trees.—In the dry countries of South-Eastern Europe, the Carob tree supplies a large part of the fodder for domestic animals. No beast of burden can do the work of the mule, compared to the cost of its keep; there are no better mules in the world than in Cyprus, and the Cyprian mules have the most nutritious part of their food in Carob beans. Carob bean meal is about the most nutritious feed that can be given to any animal, and these trees afford a precious stand-bye to the farmer in times of drought; for, as commonly happens, it is during years of exceptional drought that fruit trees often bear the heaviest. In the better watered parts of Australia there is all the wide range of trees so profitably grown on the Mediterranean, especially Ilex and Cork trees for acorns and corks. Portugal fattens one-quarter million pigs yearly and exports one million worth of cork. Then there is the Olive (the poor man's cow, the rich man's relish), the Mulberry, Walnut, and Almond trees. These are grown, *not* as orchard trees, but planted about the fields and farms, and when *once planted and grown up, require no more attention.* Olive trees, contrary to what one would expect, can be taken out and transplanted as saplings 8ft. to 10ft. high, and with

only a bare stump of a root, will grow well. This has been done for centuries in dry Cyprus.

In South Africa farmers do well on pig-rearing from acorns. The poor people make "coffee" from roasted acorns, and considerable supplies of acorns go to the Chicory Factories.

There is money in all these trees. These are trees of the field and road-side, not trees of the forest, nor trees of the orchard. Once planted and grown up out of reach of cattle, they are no more trouble and expense. It is at the start where there is trouble with the trees, and difficulty for the Englishman to get away from the ideals of northern lands. I know an Australian farmer who cut down a grove of Oaks round his farm, because he said his pigs would not eat the acorns. In the same climate, and with the same Oaks, an old Cape friend, who has broad acres under vineyards and crops, has often told me that if his father had planted the place with Oaks he could have made as much out of bacon as he has out of his crops. The Southern farmer gets a double productiveness from his fields with the stronger sun and growing power of southern latitudes.

Seeds and a Government seed store.—For both Arboriculture and Forestry there should be a Government seed store, and in Australia this should be a Federal institution. Experience in South Africa has shown that the supplies of seeds required for its own use by Government, and to assist Arboriculture, cannot be obtained through ordinary trade channels. In South Africa in 1912 £2,806 worth of tree seeds were sold to the public at cost price, and 5,250,000 young trees for £14,000, also at cost price.

Seed is collected from the Government plantations, and issued with a guarantee of genuineness and quality. Seed obtained from other sources is tested and issued with a like guarantee.

The seed and young trees being issued at cost price, the whole distribution and issue are done at no charge to the Government. It may be easily imagined how this distribution of plants and seeds assists tree-planting.

Cut and Mulch System of Weeding.—In dry country or where there is a heavy growth of weeds, the "cut and mulch" system of weeding (p. 131) is almost a *sine qua non* in the successful tending and rearing of trees till they become established where they have been planted. It is more important in arboriculture than in Forestry. Practically speaking it is not known or practised in Australia, and the result is much disappointment in tree-planting.

Agriculture and Forestry in South Africa.—In the South African Parliament, farmers and the rural interests have always commanded a majority. What has done more than anything else to help National Forestry in South Africa is the fact that it has gone, hand in hand, with Arboriculture. If a town member, with timber importing profits in his head, gets up and begins to talk about the cost of the Forest Department, he is answered by a farmer with the thought of cheap trees for his farm in his head, who talks about Forestry bringing rain to a dry country, and the usefulness of trees to a farmer.

APPENDIX I.

Forestry in New Zealand.

1.—Constitution and Report of a Royal Commission 389
2.—The native forests not to be perpetuated 389
3.—"Planted" Timbers to replace the native forests 389
4.—Trained forestry officers not considered necessary 390
5.—A distinct and independent Department of Forestry thought undesirable .. 391
6.—The Commission's report a burlesque 391
7.—The Commission's fatal misapprehensions 391
8.—A verdict contrary to the evidence 392
9.—Chance selection of seeds for planting 392
10.—The agricultural misconception of the Commission 393
11.—The reputed slow growths of native timbers 393
12.—The financial aspect of New Zealand plantations 394
13.—The report founded on wrong premises 394
14.—The reckless waste of Nature's bounty 395
15.—The future policy of New Zealand as a timber grower 395

APPENDIX I.

FORESTRY IN NEW ZEALAND.

1.—*Constitution and Report of a Royal Commission.*

I have not yet visited New Zealand, but if Forestry there is to be judged by the recently issued report of the Royal Commission on Forestry,* scientific forestry in New Zealand has still to begin! The Commission is shown to have been composed of one Government survey official, two timber users, a botanist, and two farmers; one of these, Mr. Adams, an experienced tree-grower.† It was thus most unfortunately without technical advice on forestry, and it is perhaps not surprising that the results it arrived at are of a negative character. At the same time the report furnishes a valuable study. The Commission travelled some 7,000 miles, and the charts show that it went over the whole of both islands from North to South. A voluminous mass of useful evidence is recorded. The cost of the report is not stated on the cover, as with some Blue-books, but probably the evidence taken is worth the cost of publication.

2.—*The native forests not to be perpetuated.*

In New Zealand the indigenous forest is of a different class to that of Australia. The character of the forest and the general economic position of Forestry in New Zealand are more similar to that of South Africa. The indigenous forest contains valuable timber trees, but they are members of a restricted, perhaps retrograde, forest flora, with trees stated to be of so slow a growth, and of so poor a natural reproduction, that they are of little or of no use for plantation purposes. But this, of course, is not to say that the forest, as an organic whole, should not be preserved, as it is in South Africa. That it can never economically be replanted only emphasises the economic waste of destroying it by unskilful cuttings, instead of preserving it by "Conservative lumbering"—to use the American phrase. The New Zealand forest area has been reduced from 21 million acres in 1886 to some 15 million acres to-day, or rather, over a quarter of the total area of the country. So that New Zealand has to-day arrived at the critical point in its Forestry history, that any further reduction of the forest area will reduce it below the 25 per cent. standard.

Far worse than the mistakes made in forest planting in New Zealand seems to be the conclusion arrived at by the Commission, that the indigenous forest, economically, is not worth preserving! Apart from certain areas reserved as climatic, scenic reserves, or national parks, the destruction of the remaining indigenous forest is recommended. "It may be stated as a broad principle," say the Commissioners, "that no forest land, except it be required for the special purpose of a climatic or scenic reserve, and which is suitable for farm land, should be permitted to remain under forest if it can be occupied and resided upon in reasonably limited areas."

This thoughtless definition would exclude the greater part of the cultivated forests of Europe where, in the most highly developed and industrial parts of Europe, a population six times or eight times the population of New Zealand get a living out of the forest. The Governor General of Australia in a recent speech stated that the forests of Germany alone afford a livelihood to a population of about equal to the whole population of Australia. It is certain that if the same care and technical skill were bestowed on New Zealand forests they would become at least as productive as European forests; since almost the whole of New Zealand is representative of the best tree-growing parts of Europe.

3.—*"Planted" timbers to replace the native forests.*

In forest plantations New Zealand is easily the first State in Australasia, but it has long been seen that forest planting of so extensive a character, without skilled direction, was a perilous adventure! Some knowledge of the extra-tropical arboriculture of the world is required to begin with. New Zealand is not quite England (though indeed English forestry does not count for much), and over a large part of its area the

* (C. 12, Wellington, 1913). † There are some mistakes of botanical nomenclature in the report—*es excelsa* for Norway Spruce, page 25, and some of the Eucalypts.

climate of New Zealand is frankly extra-tropical. The report of the Commission shows that unsuitable trees have been planted. Thus, Larch (*Larix europea*) is of little use for planting purposes over large parts of Europe where the climate resembles that of New Zealand. The Commission points out that the success of Larch in New Zealand is doubtful. Yet more than 12,000,000 trees of Larch have been planted!

Says the report, page 35:—"Besides Larch, other doubtful and even useless trees have been planted in the past, not in small quantities for experiment, but in large numbers to form permanent plantations. The following examples of certain trees, useless for New Zealand afforestation, may be cited with the number planted: *Catalpa speciosa*, 2,196,544; Totara, 546,500; English Oak, 2,041,621; Norway Spruce, 1,242,723; English Birch, 252,710; Sycamore, 225,247; and Alder, 77,918. Of the above, the worst case is that of the Catalpa, a tree interesting for a botanical collection, but useless for afforestation. The planting of an acre or two might be justified, but it is hard to conceive why more than two million trees were planted. Planting the wrong trees, or faulty planting has led, in some cases, to its being necessary to replant the area . . . . In some cases the trees, though suitable enough in all other respects, have been planted in the wrong position . . . . Errors of this nature are just as costly to the State as destructive fires."

Most of these trees, criticised by the Commission, should not, on the face of them, have ever been planted! *Catalpa speciosa* was much over-praised some years ago by irresponsible persons in America, but a very few experiments in South Africa showed that it was of no use as a forest tree there, and not more than a few hundred were ever planted. Sycamore and Birch are curious trees to plant for timber! There had been, up to the end of 1912, altogether some 28,000 acres of forest plantations in New Zealand—18,000 in the North Island and 10,000 in the South Island, thus the major portion is in a purely extra-tropical climate.

But, perhaps the greatest mistake is one of omission. It is stated that the Californian Redwood (*Sequoia sempervirens*) grows well in New Zealand. There are good grounds for considering this tree the most valuable one for planting in the Extra-tropics, if not on the Globe. But less than 200,000 Redwoods have been planted!

The average cost of all the planting has been £13 4s. The estimated cost of future planting is under £8. The difference may be held to represent the cost of working without skilled direction: "experimenting" as the report euphemistically puts it (£8 per acre has been the actual cost of the Railway Sleeper Plantations in South Africa). The New Zealand planting, I gather, is similar to planting in South Africa; not the poor, wide, cheap planting followed in the Australian Government plantations.

New Zealand had spent £239,000 up to 1913-14, on forest plantations without that skilled direction which is customary in other countries. I have no means of knowing how far the strictures on the planting contained in this report are such as would commend themselves to a Forester.

4.—*Trained forestry officers not considered necessary.*

With regard to the crucial question of the appointment of a qualified Chief Forest Officer, the report thinks that the evil day can still be deferred!

It is true that a "young man from England"; or even from India, where there *is* State forestry, would probably be out of place in New Zealand. The climatic and other conditions resemble neither of these countries. But why should the New Zealand Government not direct itself to the South African Government, and try to obtain from it the services of a qualified man with administrative experience, and a practical knowledge of the trees and climatic conditions prevailing in New Zealand? Nearly all the natural forest of South Africa is in the same latitude as Auckland, New Zealand; and this forest stretches up into the damp wet mountains where, at 3,000 feet, the climate and vegetation (so travellers say) are the same as the middle latitudes of New Zealand, and naturally would be. Here grow the giant yellow wood trees as thick, though not so tall, as the New Zealand Kauris.

Fifty years ago the Indian Government were as badly in want of forest officers as is New Zealand to-day. What did it do? Not kill time with Royal Commissions and leave the forests to be destroyed and lost for ever by the unhealthy inter-play of local politics; but they set to work to form a strong forest administration; and in order to secure Englishmen, trained in Forestry, they made a bargain with Napoleon III. A certain number of French students were allowed to study in the English dock-yards, and the Indian Government was allowed to send its forest students to the French National Forest School, where all French forest officers are trained, at Nancy, in Lorraine. Thus, the New Zealand Government might get a trained forest administrator

from the South African Government; and send a certain number of young men to be trained abroad for future requirements at the Oxford Forest School in England, at Nancy in France, or at Yale in America. Most of its future planting trees will come from North America; but, on the other hand, there are the New Zealand Rhodes scholars at Oxford to draw on.

South Africa began training its forest officers at these three schools a quarter of a century ago!

5.—A distinct and independent Department of Forestry thought undesirable.

The report recommends that there should still be no independent working Forest Department.

New Zealand thinks it is still in the age of miracles, and that it can have State forests without a Forest Department to look after them. In fact, it tells the world in all seriousness, that there is no such thing as modern forestry. In this fortunate island the millenium has been reached, the lion and the lamb lie down together. The forest does not require protection against fires, cattle, ruinous felling, and the other little evils of civilisation! There is no such thing as woodcraft and improving the wild forest. If the European countries can double the yield of their forests in a generation; and if South Africa can apply the same system to its forests, so like, in many respects, to those of New Zealand, that does not matter. Even the planted forests, on which over £250,000 has been spent, is left pretty well to take its chance, like a farmer's wood-lot!

6.—The Commission's report a burlesque.

"We don't know much about fire-protection, and we sometimes lose a lot from fire"; says the Royal Commission report in a few more words. That is bad luck. "We will plant Poplars and stop the fires. We understand our own business; we know it better than the rest of the civilised world. We will send an English forestry book to our 'practical men.' It does not matter if English forestry (or the want of it) is costing England £34,000,000 a year, and the loss of the pick of its rural population.

"Our people don't want to go to school and learn forestry, like the stupid Frenchmen, Germans, Italians, Spaniards, Japanese and Americans, living in climates like ours. We can learn something more useful at school—Greek, Latin, and modern languages spoken at the other end of the world! These are of practical use to the people; but forestry! The time has not yet arrived to treat the matter seriously."

That is the substance of the report of the Royal Commission on Forestry in New Zealand, A.D. 1913. The report might very well have been written 100 years ago. It should, unquestionably, ante-date the "*Code Forestier*" framed in the time of the first Napoleon.

If the New Zealand forest amateurs would go to their latitude in the South of France, and live there for a few years, they would learn something of value to the practical forestry of their island. They would learn to value the national resources of their beautiful country, its unique forests, its alpine scenery.

7.—The Commission's fatal misapprehensions.

The best evidence was naturally in favour of a scientific training in forestry for the forest officials, yet the Commission in all gravity writes:—"*Forestry is not a science in itself, but is a compound of many sciences, together with a practical knowledge of nursery work and tree-planting.*" The italics are mine. This is rather like saying "navigation is a compound of stars and salt water!" Would the Commission be surprised to hear that nursery work and tree-planting may be only a small adjunct to the best forestry, and that many foresters have nothing to do with nurseries or tree-planting from the beginning to the end of their careers. I lately visited the splendid pine forest of Leiria—the pride of the Portuguese foresters—a forest of Maritime pine, growing in a climate the same as Auckland. In all the old forest I do not remember seeing a nursery or planted tree. Why should I? The natural regeneration is ample, even after the rare accident of a fire. Every forest should be regulated as an organic whole. It will reproduce itself and improve itself from generation to generation, as long as the forester conducts his fellings with a due knowledge of woodcraft.

It takes an average intelligent youth two or three years at a forest school to learn his forestry, after he has had his grounding in the subordinate sciences—chemistry, physics, meteorology, botany, geology, surveying, etc.

The Commission may not have heard that modern forestry has been brought to such a pitch of perfection that even in the slow-growing climates of mid-Europe, the cultivated forest has been got to double its yield by the simple process of a carefully studied regulation of the cuttings. But for that you want men who make the forest their life's work. You may as well expect a tailor to navigate a "dreadnought" as a man to manage a forest who is not brought up to it.

In South Africa, forestry is mostly constructive, viz., "plantations," though there is also the management of the indigenous forest. In New Zealand, planting will be required—(1) To introduce exotics to the native forest on the chance of their spreading like weeds; (2) To form regular plantations where the want of forest demarcation has allowed the accessible forest to be destroyed; (3) and in treeless localities generally. Whether, considering the valuable softwood forest still left, it will be in the future most economical to get the future timber supplies of the country from this or from plantations of exotics, is a point that only expert opinion can decide. One thing is certain: to talk about cutting the indigenous forest down and replanting it as a general measure (which is the idea running through all this report) is like expressing to-day a belief in witchcraft!

8.—*A verdict contrary to the evidence.*

Most of the evidence, and perhaps all the best evidence, collected by the Commission, points the opposite way to the conclusions of the report. At least that is the impression gathered by the reader on perusing the questions asked by Mr. Murdoch and Dr. Cockayne.

A member of Parliament, Mr. H. G. Ell, gave excellent evidence on the need of a scientific training for New Zealand foresters. In reply to a question from Dr. Cockayne he recommended the training of young men in those branches of science cognate to forestry.

Said Dr. Cockayne:—

"I am not making any reflection on the officers here now in suggesting the appointment of highly-trained scientific men . . . . but, if forestry is to be put on the right lines, a great number of men may be required and they are not here."

Mr. Ell.—I think trained scientific men are very necessary. A mere planter of trees is not sufficient.

Mr. Adams.—Has not Mr. Robinson taken considerable pains to train some men?—Yes, in the art of planting only. But I do think it is essential that for a man to be a successful forester, he must undergo a certain amount of scientific training.

Dr. Cockayne.—One timber we could find out all particulars about is *Pinus radiata* (Pinus insignis), we have it here old enough; but would not work of that kind require a very distinct scientific training?—Yes; a man must have scientific training and instruction.

Mr. Lethbridge.—Are you aware that one-half the royalty on timber in certain parts of New Zealand goes to the local body?—Yes.

Seeing that we are short of funds for forestry, do you not think that a moiety of that one-half royalty should go to the Forestry Department instead of all to the local body?—I do.

9.—*Chance selection of seeds for planting.*

The method of selecting species for planting and securing seed, as detailed in the report, would be laughable if not so sad! It is thus described:—"The present method of procuring seed is for the superintending nurseryman to draw up a list of what is required, and the Head Office of the Lands Department to send the order to a local seedsman. It happens not infrequently that seed of certain of the species desired is not available at the time, and as it appears to be a fixed rule that a definite number of acres must be planted yearly, seed of some other species available at the moment is procured. This, in our opinion, is a remarkable course to take. It has happened more than once that trees not at all suitable for afforestation purposes have been raised for this reason."

The Lands Department would have to know a good deal more about seed of forest trees than most Land Departments, if they could procure it economically and of the right sort; and as soon as New Zealand comes to its senses in forestry, it will have a Government seed-store from whence it can distribute authentic seed of good quality to its own plantations, and the long-suffering New Zealand public. A seed-store would facilitate the carrying out the first stage of that production of pedigree seed which is

no doubt a feature in the forestry of the future, and which Dr. Cockayne has urged in this report and elsewhere. And, be it noted, that New Zealand, with its rapid-growing Insignis Pine and Eucalypts, could come to some result in a fraction of the time required in Europe. South Africa has had its Government seed-store for forest tree seed some 20 years.

10.—*The agricultural misconceptions of the Commission.*

Even from a purely agricultural point of view the report is futile. The richest soils with cultivation and rain-leaching will lose their fertility; the forest enriches the soil (this is indeed a truism, but after reading this report one begins to wonder what is a truism).

There is probably indirectly as much human food grown in the world with forest-fertilising as with any other fertiliser. (1) The forest roots have the power of breaking up insoluble mineral plant food, and, with the decay of the leaves, spreading this plant food on the surface soil in an assimilable form. (2) The humus and leaves of the forest contain nitrifying bacteria which have the power of fixing free nitrogen. Professor Henry, of the Nancy Forest School, has written a volume containing his researches on this point. This soil-improving action of the forest is taken advantage of by agriculture over wide areas of the earth's surface. It is the world's common soil-fertiliser, as firewood is the world's common fuel. Sometimes there is intermittent forestry and agriculture. Sometimes the forest litter is carted on to the fields. In Europe, the litter from the forest is removed as far as the forest will stand the process and put under the farm stock to form manure. This practice extends all through Europe. Lately, when I was in Gascony, the system of agriculture was to plant Maritime Pine (*Pinus-pinaster*) on a portion of the farm, keep a portion of the farm for stock, and manure the rest of the farm with litter from the forest after it had been through the stables.

New Zealand agriculture must look to the future when it will not always have rich, virgin soils to work on. The destruction of the forest was one of the chief causes of the decay in the agriculture of old Mexico. And the climatic effect of forest is not to be obtained by the nominal reservation of climatic reserves. They must have skilled treatment to preserve and improve them. And if the climatic effect of the forest is to be much good—increase of perennial springs and decrease of floods, there must be a general conservation of the forests of the country.

11.—*The reputed slow growths of native timbers.*

The Commission, perhaps misled by the rapid growth of Insignis Pine, Douglas Fir, and some of the other exotic trees, has come, seemingly, to a false conclusion regarding what it terms the impossibly slow-growth of the indigenous trees. The report says:—"During our investigations we have been frequently urged to recommend the planting of one or other of the indigenous trees. There, is, in fact, a general belief throughout New Zealand, that the planting of certain kinds, especially the Totara and Puriri, would be commercially profitable. This idea is altogether erroneous. Without exception, the timber trees are of much slower growth than those used in forestry operations the world over."

This statement is not true; the indigenous trees of New Zealand, according to the figure quoted, are not more slow-growing than the *average* of trees in most countries. Compare Veise's tables of Scotch-pine in Europe, or any of the standard tables of the growth of European trees. Compare the figures for Cluster-pine in the show forest of Leiria, Portugal. (My Brit. Association paper, Dr. Ewart, Melbourne.) The New Zealand indigenous trees are probably not generally so slow-growing as the Spessart Oaks (on mountains near the Rhine), which I visited with a party of foresters about a year ago. There, Government has not the smallest intention of giving up the cultivation and propagation of these oaks, though they grow at the rate of about a foot in diameter per 100 years, and the yearly rings of growth are like sheets of paper, they are so thin! In South Africa, where the indigenous forests are worked and reproduced as in Europe, the average growth of the indigenous trees seems slower than that of those in New Zealand.

Two of the most valuable trees in the indigenous forests of South Africa are Stinkwood (*Ocotea bullata*) and White Pear (*Apodytes dimidiata*). In the last report of the Chief Conservator of Forests, South Africa, it is stated that the average growth of these species is one inch radius in 15 years, "a by no means slow-growth for these valuable species." This equals one foot diameter growth in 90 years.

In the report of the Royal Commission on Forestry, New Zealand, commenting on the slow-growth of the indigenous trees, a sample Totara is quoted, which grew at the rate of about two feet in diameter per hundred years. This was apparently selected for slow-growth; yet the growth is nearly double that which the Chief Conservator of Forests, South Africa, considers "by no means a slow-growth"(Annual Report, 1912-13). Really, the big full-page illustration in the New Zealand Royal Commission report proves nothing. The evidence wanted to establish the slow-growth of Totara is (1) a mean figure obtained from a number of trees growing under normal conditions, measured in the forest by a skilled forester. Every forester knows that he can pick a sample tree out of the forest to show any growth that may be wanted; (2) Evidence that the rings are yearly. This is especially called for in the case of an evergreen. Except from a plantation of known age, it would be difficult to get this evidence.

Mr. O. Bradley reported to the Commission, planting a Totara on a specially good bit of ground, but not apparently under forest conditions, that it grew over 19 feet in 18 years. A foot a year is what the European forester terms "even time." This tree, away from its natural conditions in the forest, thus exceeded "even time." If the indigenous trees were even more slow-growing than they are, as long as they were on poor soil they would economically be worth maintaining, since most of them are Conifers, and it is coniferous timber that forms over 90 per cent. of all the timber used in the world.

12.—*The financial aspect of New Zealand plantations.*

On the two outstanding points of interest in New Zealand:—(1) Yield figures for the Insignis Pine; (2) The financial position of the plantations on which over £250,000 has been spent to date (without the usual skilled supervision), the report is silent. What is the exact financial position of the plantations is nowhere stated. No hint is given of valuation surveys, which, in systematic forestry, it is customary to take at intervals of from 5 to 10 years as a check on the operations. Indeed, we are not presented in the report with even an approximate balance sheet, showing *on one side* what has been spent on each plantation, brought up to date at four per cent. compound interest, plus the rental value of the land; and on *the other side*, an estimate of the average cubic content of the timber growth. An approximate balance sheet of this nature could have been prepared at little expenditure of time or money. Without it we are left absolutely in the dark as to the result of what appears on the face of it to be a risky undertaking, and with regard to which the criticism of the Commission must naturally arouse grave apprehension. The letter printed from D. A. Marchant (No. 7 on the list of printed letters) puts forward figures to prove that some of the inaccessible plantations cannot possibly pay.

Strangely, not much Insignis Pine seems to have been planted in the Government plantations. In the future much will depend on the yield of the Insignis Pine. Normal increment figures for Insignis Pine in different types of soil and climate must now be available in New Zealand. What are they? On this most important point the Commission is silent. Apparently this is the pivot on which constructive forestry in New Zealand will turn for the next few years. What is that figure? Quantities of undigested figures are produced, but no conclusion. I have endeavoured to frame a conclusion from the mean figures quoted in Mr. R. Opie's letter (No. 18 of the printed letters). He states that from 400 acres of local Insignis Pine plantation there was an average yield of 200,000 feet super. per acre. This would give a mean yearly yield per acre (if cropped at 40 years) of 416 cubic feet. With regard to the position taken up that the indigenous forest grows too slowly to be economically preserved, no proof is given. Indeed, the evidence adduced tends to show that the indigenous trees are less slow-growing, on an average, than those in South Africa and in Europe, where the forests have long been scientifically treated and conserved.

13.—*The report founded on wrong premises.*

Starting on false premises, the enquiry follows a wrong track throughout. No estimate is given of the millions that have been lost through not starting forest demarcation when the White-man landed in the country; nor of how far the position can be retrieved by starting forest demarcation now.

The Commission should have read the Victorian Royal Commission report, published 12 years before. After that, forestry in Victoria started on the right track. New Zealand has not done this yet.

Happily for New Zealand there is still time to do it. There is still a forest area of 25 per cent., the total area of the country, page 2. If New Zealand were to Instal

scientific forestry to-day, the economic position would be sound, the only loss being the misplacing of the forest reserves, owing to the absence of forest demarcation when settlement began. On a basis of the present destructive working, the timber in the native forest is estimated to last some 30 years longer.

14.—*The reckless waste of Nature's bounty.*

The usefulness of this report is not what it recommends, but what it does *not* recommend. Its usefulness lies in its exposure of the present criminal waste of the natural resources of a richly endowed island; the exposure of the progressive degradation of the country to the poverty and ugliness of the Mediterranean countries in the same latitude and climate. If the thoughtless people of fair New Zealand could only travel through Italy and Spain as I have done, and witness their barren mountains and wind-swept plains, they would awake to a sense of their peril. Italy is to-day paying about £3,000,000 yearly to England for coal to run the railways, and this figure is rapidly rising! If the forest on the mountains had been conserved, that fuel, under the Italian sun, could probably have been produced *in the country* (and at a less cost), in charcoal briquettes. From a beauty point of view, no words I have ever read or heard could describe the contrast between the barren Italian mountains and the vestiges of the original forest one sees at Vallombrosa and Camaldolli. The Spaniards, Italians, and Portuguese at great expense are now replanting their desolate mountains. But the military menace has not allowed them sufficient funds to do much. Little Portugal is said to be spending £222,000 yearly on forestry.

It used to be the fashion to criticise the Forest Departments of Australasia, as presenting disjointed parts; but (with the exception of South Australia) no complete working organisation. Thus, there was said to be a head in Queensland, a tail in New Zealand, hands (to give away forest concessions) in Western Australia and Tasmania; and two hibernating Forest Departments in Victoria and New South Wales. This state of things is passing. But I may, in conclusion, perhaps quote a rhyme that was put together by Forestry students in South Africa, descriptive of forestry in New Zealand. It ran something like this:—

> One thousand acres yearly, and three million doubtful trees,
> Cost some eight thousand yearly to the wild New Zeas.
> And they don't care a tinker's d—— for the grand Kauri trees.

This doggerel will be taken for what it is worth; but it has interest in showing the opinion of New Zealand forestry formed by forest students in a distant part of the world.

It is possible that the Kauri forests in an economical sense have to go. I have doubts on the point. But, in any case, to destroy them as is now being done, without first obtaining expert advice, is rather like abandoning a sick child with a doubtful illness, without first calling a doctor!

The story of the destruction of the Kauri forest is one of the saddest features in the history of this fair earth. There is nothing in this report to show that it is necessary or sound economically, or that it will not go down to history as a dark blot in the story of Anglo-Saxon colonisation. One cannot help comparing it with the havoc depicted by Prescot as wrought by the Spaniards in ancient Mexico; only that was in the dark days of religious superstition and ignorance of modern science. My friends the Spanish foresters of to-day are very different men! But are the New Zealanders?

15.—*The future policy of New Zealand as a timber grower.*

The fundamental mistake made by the Forest Commission is the assumption that it is sound policy for New Zealand to destroy its valuable natural forests and replace them by plantations of exotics. That is a complete reversal of the dictates of modern scientific forestry.

No doubt exotic timbers have a most important part to play in the future forestry of New Zealand. Exactly what is the part which each should play—the natural forest and the exotic planting, is a matter which can only be decided by foresters who make scientific forestry the business of their lives. Little light can be thrown on the matter by a hurried visit of six amateur foresters to the most important forest centres of New Zealand.

But the Commission has undoubtedly rendered an important public service in exposing the haphazard methods of administration in the present Government plantations. Will it ever be ascertained how much of the £250,000 spent on these plantations has been wasted owing to the absence of skilled direction? If one-half has been wasted, that would represent some £125,000; and to this has to be added the considerable expenditure, both public and private, on the Canterbury Plain plantations, which has been also without skilled direction, and where by now the expenditure may possibly amount to a still larger sum. Up to 1914 the total area of forest plantation in New Zealand is estimated roughly at some 47,000 acres, of which 22,000 is State planting, under the care of the half-organised Forest Department.

D. E. HUTCHINS.

Hobart, 28th April, 1915.

APPENDIX I

Forestry in South Africa.

(Some facts and figures from Forest plantations.)

1.—Artificial forests a necessity for South Africa 399
2.—Area of plantations and timber production 399
3.—Gross cost and revenue from plantations 399
4.—The Worcester plantation 400
5.—The Table Mountain plantation 400
6.—The Kluijtes Kraal plantation 400
7.—Results of Eucalyptus plantings 400
8.—Annual increments of timber growth 401
9.—Filling up the indigenous forests 401
10.—Planting drift sands 401
11.—The choice of wattles for planting 402

APPENDIX II.

FORESTRY IN SOUTH AFRICA.

1.—*Artificial forests a necessity for South Africa.*

It is the artificial plantation of selected trees of larger forest floras which have allowed South Africa to attain its present position in Forestry. Without exception, the indigenous trees grow too slowly to bear the cost of planting; and they are continued by natural regeneration only.

2.—*Area of plantations and timber production.*

The total area planted, up to the end of 1912-13, is returned at 57,514 acres; 9,511 acres being planted during that year. The total area planted up to date is somewhere about 80,000 acres. In size the plantations range from about 6,000 acres downwards. About one-third are Railway Sleeper Plantations. These are a special group of plantations made by the Forest Department for the Railway Department, with the object of supplying the railway timber and sleepers which are now imported at a heavy yearly cost. South Africa has a yearly importation of timber totalling about one and a-quarter million pounds. The plantations are composed of softwoods and hardwoods, in somewhere about equal proportions, the hardwoods being wanted for railway sleepers. There are 163 regular plantations besides small patches of planting in the indigenous forests. When a timber-working section in the forest is cut over the blanks are planted up as soon as may be, and self-spreading, strong-growing exotics put in along the edge of the forest where fire has touched it. It is worth noting that in one of these little forest plantations the last yearly Forest report from South Africa mentions that Red Cedar (*Cedrela toona*) grew 10 feet in two years.

The trees in the larger regular plantations are commonly Pines, Cypresses, or other Conifers, Eucalypts, and Wattles. The Pines and Wattles are usually planted on sandy ground near the coast, the Eucalypts on better ground. No leaf-shedding tree has yet been found hardy enough for general forest planting, though as on the Mediterranean, Ash and other trees do well by streams.

The highest yields of timber come from the Eucalypts, so that, economically, they are able to occupy better ground than the Pines. It is only exceptionally that the Wattles are planted for bark, it being considered that this is a matter rather for private enterprise; but large areas have been planted with the two hardy Australian Wattles (*Acacia saligna* and *Acacia cyclopis*) in sand-drift fixing. The former gives both timber for firewood and a fair bark, the latter firewood only. In situations exposed to the sea winds, and also in poor soil near the coast, there is a successful growth of the "Bushy Yate" (*Euc. cornuta var. symphiocarpa*).

The Pine used for the coast plantations has been almost exclusively Maritime-pine (*Pinus pinaster*). Latterly, this has been mixed with the more valuable Canary-pine.

The 163 forest plantations in South Africa are all what would be considered close-planted in Australia, viz., 3 feet x 3 feet in the case of Pines and 5 feet x 5 feet in the case of Eucalypts and other quick-growing trees. They have cost at the rate of £10 net and £15 gross, per acre (without reckoning interest at 4 per cent. and ground rents) up to the last returns, 1913.

3.—*Gross cost and revenue from plantations.*

The first cost of making the regular plantations (apart from areas merely ploughed and broadcasted) has worked out to an average of £8 per acre for some of the best plantations, where the cost can be easily reckoned. While £8 per acre may be taken as the cost of large regular plantations, this figure soon mounts up in the case of small plantations, or where there are unusual difficulties. On the precipitous slopes of Table Mountain, overhanging Capetown, where in some cases the first paths have had to be cut by men held up by ropes, the average cost has mounted up to £30 per acre.

The gross cost of the Cape plantations to the close of the financial year 1912-13 has been £881,115, and the net cost £613,471. The total revenue from the plantations amounts to £267,644, mostly thinnings.

These figures include nursery work, and in most cases the revenue from the distribution and sale of plants. In one item, Irene Nursery, the general distributing nursery for the Transvaal, there is a total cost of £18,481 and a total revenue of £18,370.

It is remarkable that the revenue from these plantations which are still mostly in the thinning stage, already practically equals that from the indigenous forest. Thus in 1912-13 the indigenous forest yielded a revenue of £28,000 and the plantations £27,000.

The revenue from the plantations is derived from: (1) Sales of young plants from the nurseries; (2) Sales of firewood and bark, together with poles and fencing droppers from thinnings.

4.—*The Worcester plantation.*

Timber has only been sold in any large quantity from one plantation, the irrigated Blue-gum of the Worcester plantation. This plantation was begun in 1878, and with a total area of only 76 acres, has had a total expenditure of £16,005 and a total revenue of £20,134. It has supplied mine-props for the Kimberley Diamond Mines. It was clean cut, the coppice reproduction being rather denser than the original planting. It is a good sample of intensive forest working. It is accessible and it has had nearly record timber yields. It adjoins the railway. Railway sidings were run into the plantation, so that the timber was cut and loaded directly on to the railway trucks, the total cost for this averaging about 1d. a cubic foot. The "Acrim" (mean yearly yield in cubic feet per acre) was from 500 to 600 cubic feet.

5.—*The Table Mountain plantation.*

Of quite another type was the Devil's Peak plantation on the slopes of Table Mountain at Capetown. It was most difficult planting, on very steep ground, often only bare rock; but happily loose rock, penetrable by tree roots. There was a good rainfall and the barren rocky slopes have become gradually covered with a growth of trees. Fire-protection was difficult on account of the very strong winds, which exceptionally range up to 80 miles an hour in the worst parts. But this also has been successfully met. Most of the planting is now through the critical fire stage; there has never been any serious fire. The area is 750 acres, and the net cost, up to 1912-13—£20,293, or at the rate of £27 per acre.

6.—*The Kluijtes Kraal plantation.*

"Kluijtes Kraal" is one of the oldest and largest plantation near Capetown, with an area of 5,209 acres, 1912-13. Begun in 1884, it has had a gross cost of £66,000, and a total revenue of £42,000. From the older portion it is making a revenue of about £1,000 a year from the sale of the straight spars, yielded by thinnings. These are chiefly used for the droppers in sheep fences.

7.—*Results of Eucalyptus plantings.*

Eucalypts have attained a maximum acrim* of 600 cubic feet in various parts of the Western Plantations; but the best general growth has been in heavy summer rainfall areas of the Eastern districts in the Transkeian Conservancy. Here the development has resembled that of regrowth Karri in the South-West of Western Australia, and of the best Eucalypt regrowth I have seen (or heard of) on the Northern rivers of New South Wales or the mountains of Victoria. *Eucalyptus saligna* in the Transkei has outstripped all other Eucalypts. In the last yearly report is an illustration of a plantation in the mast stage, averaging 80 feet high at 15 years of age. This is not the best growth, it seems to have suffered from want of thinning. These plantations also, on account of cheap Kaffir labour, have been the least costly in South Africa. The Tsolo plantation begun in 1888 has an area (1912-13) of 774 acres and has cost altogether £8,048 gross and £4,460 net, say £5 15s. per acre. The poles from these close plantations of Eucalypts and Wattles are sold to the Kaffirs for hut building or given to them in exchange for their ruinous right to cut poles in the adjoining indigenous forests—rights which are gradually being extinguished.

* NOTE —Acrim is a term used by South African foresters to mean the annual increment in cubic feet of a stand of one acre of growing timbers. [C.E.L-P.]

8.—*Annual increments of timber growth.*

A series of valuation surveys I had made in 1905, before leaving for Equatorial Africa, gave a good indication of the growth in the Western Cape plantations. The general result was a somewhat declining increment owing to want of thinning, but against this was a perfectly straight dense growth, so dense that the plantations were practically fire-proof. The figures were published in the Annual Report for that year, and are summarised in my general Extra-tropical "Acrim" table given in my report on the "Forestry of Cyprus." Some more recent "Acrims" are these:—

	Years.	Cub. ft.
Sydney Blue-gum (*Euc. saligna*) Natal coast, semi-tropical ..	at 5	683
Blue-gum (*Euc. globulus*), Fort Donald, Transkei	at 11	636
Pinus insignis, Wolf Ridge	at 10	571
Maritime-pine (*Pinus pinaster*), Hogsback	at 12	498
Busaco Cedar (*Cupressus lusitanica*), Hogsback	at 8	222
Blackwood (*Acacia melanoxylon*), "Wood Bush," Transvaal	at 7	187

The Insignis-pine Acrim is the highest recorded. It is not stated what area yielded this figure, nor if there were any accidental circumstances tending to magnify it. It is an extraordinary figure, even for this quick-growing pine. Mr. Gill has recorded 230 as a good figure for South Australia (Sydney Conservators' Conference), but his figure is sawable cubic content while the above are gross.

9.—*Filling up the indigenous forests.*

During 1912-13 half a million trees were planted, mostly *Acacia melanoxylon* in the indigenous forest at Knysna. The total of exotics planted in the indigenous forests of South Africa at that time being just over one million trees on an estimated area of 4,300 acres. This work was unfortunately suspended for many years.

10.—*Planting drift sands.*

A feature of the drift-sand plantations near Cape Town and Port Elizabeth is the utilisation of the town refuse which is carried out by rail and spread on the sand. The first result of the application of this refuse to the barren sand is a wonderful increase of fertility; the ground, in fact, becomes at once sufficiently rich temporarily, in plant food, to yield a good growth of Wattles, Pines, and even Gums; though, as a rule, Gums want better soil. Once the growth of Wattles is well started the fertility of the soil is maintained by leaf-shedding from the branches, and by the nitrogen-fixing nodules on the roots of the Acacias. Near Capetown an area of 2,401 acres has had the drifting sand fixed at a cost of £45,000 gross and £19,000 net, 1912-13; or, for the net cost, just under £8 per acre. Near Port Elizabeth an area of 5,112 acres has been planted with Wattles (and some Eucalypts and Pines) at a cost of £67,000 gross and £55,000 net, say for the net cost £10 15s. per acre.

Near Port Elizabeth the Wattle mostly used is *Acacia cyclopis*. It is a native of South Australia and Western Australia and so is quite at home at Port Elizabeth. Near Capetown *Acacia cyclopis* has also been largely planted; but it is *Acacia saligna* that has achieved a record, only surpassed by the Maritime-pine on the sands of Gascony. Both Maritime-pine in France and Saligna Wattle on the Cape Flats will have their chapters when the tree history of our globe comes to be written.

Both the Pines and the Wattles have turned dreary wastes of shifting sands into fertile areas. The story of Bremontier's pine-planting in Gascony has been often told. It is a marvellous work and one must go there and see it to fully appreciate it.

The sand drifts near Cape Town and Port Elizabeth, in South Africa, are smaller in area, but are none the less completely fertilised and rendered fit for human habitation. The Maritime-pine of Gascony was indigenous to that country; but the Wattles in South Africa were introduced from Australia, and are now as firmly naturalised in South Africa as any of the native vegetation.

The South African Government, sand-planting with Wattles, Maritime-pine, and some Eucalypts as mentioned above, had extended, up to 1912-13, over an area of 7,513 acres. It had cost, net, £74,000, including Railway sidings and all charges, or at the rate of £9 17s. an acre. There is a similar area of private planting: for the Saligna Wattle-bark is valued for tanning, and it is there more economical to put in a few acres and grow your own firewood than to buy coal. Two or three acres of Saligna Wattle will supply an average middle-class household with firewood—cooking all the year round, and heating for four or five months.

11.—*The choice of Wattles for planting.*

The Acacias used for Wattle-planting in South Africa have been *Acacia saligna* and *A. cyclopis* (as above) on drift sand, and for tan bark *Acacia pycnantha* and *Acacia decurrens var. mollis.* Other varieties of Black Wattle would, no doubt, be equally good. I see them commonly growing and being stripped for bark in Australia. Three useful works of reference are:—Maiden's well-known pamphlet "Wattle and Wattle-growing," and an account just published of Wattle-growing in Natal, by Angus, in "South African Agriculture" (Central News Agency, Cape Town), for May, June, and July, 1914. A useful list to consult is "A census of the genus Acacia in Australia" by Pescot, School of Horticulture, Burnley, Melbourne, prepared in connection with the "Wattle-day" celebrations.

D. E. HUTCHINS.

APPENDIX III.

Control of the Rabbit Pest.

1.—Some phases of the rabbit problem 405
2.—Forest countries in which rabbits do not thrive 405
3.—Natural repression of rabbits by vermin 405
4.—South African vermin 405
5.—Suppression of rabbits in South Africa by vermin 406
6.—Vermin experiments on an Australian island suggested 406
7.—The choice of vermin to be experimented with 407
8.—The cost of utilising the rabbit 407
9.—Cost of protecting Australian pastures from rabbits 407
10.—Australian experiments with South African vermin recommended 408

APPENDIX III.

CONTROL OF THE RABBIT PEST.

1.—*Some phases of the rabbit problem.*

As a forester in India, Africa, Cyprus, England, and now in Australia, the rabbit question has been brought home strongly to me. In South Australia and in England, one cannot lay down an acre of forest plantation without rabbit fencing at £30 to £50 a mile. In England, France, and Northern Europe the rabbit is a constanly recurring trouble to foresters; its natural enemies in these colder countries not being able to cope with the rabbits. The yearly cost of rabbit protection to the fine forest of Compiègne, near Paris, is stated at £1,000. This is a serious handicap to forest work; especially in these days, when both labour and money interest rates have gone up.

2.—*Forest countries in which rabbits do not thrive.*

There are no rabbits in Southern India, in South Africa, or East Africa, or Cyprus where I have had to do with forest plantations. It is the same in South America, in California, and in other countries where the climates are like extra-tropical Australia. When I was in Southern India I saw the Mysore planters turn rabbits loose repeatedly for sporting purposes. The rabbits never had a chance. When turned loose in these countries they shortly disappear. In Cyprus this is possibly due to the want of natural fodder, but in the other countries it is undoubtedly the rabbit-destroying vermin that keep them down. Thus in the desolate Kerguelen Islands rabbits swarm, simply because there are no vermin. I understand that rabbits are not a pest in Southern Europe; and it is there that the climate and, to a large extent, the vegetation, are the same as Australia. I have seen no evidence of rabbits in Italy, Spain, or Portugal, either in the well-cultivated or the wilder mountain parts. It is said that rabbits originally came from Africa to England and North-West Europe; that they are indigenous to Morocco and other parts of Africa, but are nowhere a "pest," the balance of nature keeping them down. We may suppose that under natural conditions in North Africa it is only their wonderful powers of multiplication which has enabled them to hold out against their natural enemies.

3.—*Natural repression of rabbits by vermin.*

Australia and New Zealand seem to be the only extra-tropical countries in the world where rabbits are a serious pest. These conditions are artificial, and have been brought about by man's interference with the balance of nature. Every forester must hope that the artificial conditions will soon be brought to an end.

For me the rabbit pest is no new question; I have spent the best part of my life in South Africa planting Australian trees. During all these years I have been in touch with Australia, getting supplies of seeds and studying the growth of trees in Australia, and always there has been this position: South Africa is a replica of Australia as regards the vegetation and climate, but there is no rabbit pest in South Africa. Whenever rabbits are turned loose in South Africa, and it has been many times attempted, the natural vermin of the country prey on the rabbits, which, in a short time, are exterminated. The question naturally arises, why not import the South African vermin to get rid of the rabbits?

To this, of course, nearly everyone in Australia and New Zealand will answer "No more vermin," and that no doubt would be the right answer, provided Australia and New Zealand had no vermin; but I cannot help thinking that the present position is this: The balance of nature has been disturbed in importing rabbits, and the remedy is to import comparatively harmless vermin to prey on the rabbits. There is the balance of nature everywhere. Once disturb that balance, as Australia has done with the rabbit, and half measures are fatal.

4.—*South African vermin.*

Now, what would be the effect of importing South African vermin? It is pretty easy to foretell, because in South Africa we have the same climate and the same conditions as in Australia, though farming is generally somewhat more diverse than in Aus-

tralia. There are more animals that might be injured by vermin in South Africa—ostriches and their chicks, for instance. These were bringing in four million pounds yearly before the present collapse. All along the Southern Coast towards Mossel Bay they keep a good many ostriches and geese (the ostriches eating the geese droppings), but the geese are not taken by the pole-cats and weasels, nor even poultry, except right in the forest country. One thing is certain, the vermin that prey on the rabbits there do not do the least harm to lambs. It is pole-cats, weasels, stoats, etc., that are credited with destroying the rabbits in South Africa. These may occasionally take poultry. One hears rarely of their doing so, and then it is in a place where poultry run loose in the bush parts of the country. I should say, as an old resident, that a £10 note would cover the yearly poultry losses in South Africa from the wild-cats and weasels. That seems to be the debit and credit side of the business—about £10 worth of poultry, against the mischief done by rabbits and the huge bill which Australia is paying for rabbit destruction, after allowing the set-off from rabbit carcasses and skins. Other agents besides pole-cats, weasels, and that class of vermin have been credited with destroying rabbits in South Africa. It has been said that the pole-cats, weasels, etc., of South Africa are not more destructive than the same animals in Australia, but that is almost certainly untrue. Even so large and strong a bird as the swan, which easily exists in the wild state in England, is taken by otters in South Africa. I know that as an absolute fact. Other persons have thought it is ants that keep down rabbits in South Africa. Young rabbits have been found apparently killed by ants. By that I fear is only an exceptional case. For if it were true it would be easy to introduce the ants. The ants referred to are not white-ants, and do no harm to anything in South Africa.

It is possible that moles may have something to do with rabbit destruction in South Africa. Moles are particularly abundant on the sandy ground near Cape Town. The so-called "Bles" mole is as large as a cat. I understand there are no moles in Australia.

5.—*Suppression of rabbits in South Africa by vermin.*

In South Africa, as mentioned, wild-rabbits cannot exist. Various attempts were made to turn them loose for sporting purposes, until it was realised what a pest they had become in Australia; and then, in order to make assurance doubly sure a "Rabbit Act" was passed prohibiting the turning loose of rabbits in South Africa. But for practical purposes this Rabbit Act is a dead letter. There are chances every day for tame rabbits to escape and run wild. Tame rabbits are children's favourite pets; small farmers will sometimes keep them for table purposes. They do escape, but never long survive their freedom. One must remember that it is over 350 years since the White-man, with all his domestic animals came to South Africa. The accounts of the early Dutch settlers show with what zeal every domestic animal and plant was brought to this land of "Good Hope" in the Southern Hemisphere; but, in all these 350 years, the rabbit in South Africa has never been able to exist wild there.

Per contra, there is the interesting case of Robben Island and its rabbits, which shows that rabbits will multiply in South Africa as in Australia, if only they can get away from their enemies on the mainland. Robben Island is a small island not far from Cape Town, well-known as the island where the Government have an establishment for the segregation of lepers. Some years ago rabbits were turned loose there, and they increased so rapidly that rabbit shooting on Robben Island became a Cape Town institution. On some of the other small islands off the South-West coast there has been a similar experience. Rabbits live and thrive as long as there is anything for them to eat on the islands. On the mainland they disappear.

I can remember some years back a Dutch farmer coming into my office in Cape Town to talk about trees, and telling me of the failure of a scheme he had tried in order to make money out of a barren sandy part of his farm. He lived, he said, on the coast of the mainland opposite Robben Island, and he went to the expense of getting over a number of rabbits from Robben Island and turned them loose on to his farm, hoping to make money from people who would come out to his farm to shoot them. But, he said, there was something wrong. As long as he kept the rabbits in confinement they increased, but as soon as they were turned loose they disappeared. I told him something of what was happening in Australia and that he might thank "le bon dieu" that they had not spread.

6.—*Vermin experiments on an Australian island suggested.*

Some seventeen years ago, in the course of correspondence on forestry matters with my friend, Mr. Walter Gill, the Conservator of Forestry in South Australia, I told him what, in my view, would be the true solution of the rabbit question in Australia, and he

replied that if I would engage to send him over a consignment of wild-cats, stoats, weasels, etc., he would approach the South Australian Government with a view to having them turned loose on one of the Australian Islands, where their effect on the rabbits could be noted without any fear of they themselves becoming a pest. But the cost of a consignment of wild-cats and weasels seemed to me a charge rather for the Australian public; I had other things to attend to, and the matter dropped.

7.—*The choice of vermin to be experimented with.*

I am now on my first visit to Australia, and while going through it with the British Association, and on my forest tour, I have had the advantages of discussing the rabbit question with various well-informed men in Australia. I feel that I owe it to the country, where I have received so much kindness, that the rabbit question should be ventilated in the light of South African experience, from the point of view of restoring the balance of nature. I know that this was proposed when the English fox was introduced, and that the experiment has not been successful. But surely in the nature of things this was a hazardous experiment! The climate conditions in England are so entirely different from the climatic conditions in South Africa and Australia, that it seemed just a toss up what would be the effect of introducing the English fox to Australia. And then there was the fact that the English fox, though generally so carefully preserved for hunting purposes, cannot keep rabbits down in England. Whenever, there, woods and cultivation are interspersed, rabbits, if anything, are more abundant than in Australia. A similar argument applies to the ferrets and weasels introduced from England to New Zealand. They do not keep down rabbits in England. Why should they do better elsewhere?

8.—*The cost of utilising the rabbit.*

As everyone knows, there is a debit and credit side of the rabbit question in Australia. In 1912 over half a million pounds worth of rabbit skins and a little under one-third million pounds worth of rabbit carcases were exported. The export of carcases has declined from nearly half a million pounds in 1910; the value of the skin export has been steadily rising.

But this is as nothing to the debit side where we have (1) the fact that every three (or according to some authorities four) rabbits eat as much as one sheep, and (2) the *enormous expenditure* going on all over the country, to *only partially* keep down the pest. Said a Tasmanian farmer a few days ago (Hobart *Mercury*): "Nearly all discussions about rabbits seem to take too little note of the enormous waste of time and money the ceaseless fight against them entails."

9.—*Cost of protecting Australian pastures from rabbits.*

It is useful to glance at what rabbits have cost Australia in the past to get an idea of what they may cost in the future, unless the South African remedy prove effectual.

According to Turner's "History of Victoria," from 1880 to 1900 the Victorian Government spent £350,000 and the Governments of New South Wales and South Australia £1,400,000 on rabbits, while the pastoral tenants are said to have spent at least as much. One may well believe they spent a good deal more. Though the rabbits are only partially kept in check, the cost of the Government rabbit "extirpation," as it is humourously described in the official returns, is ever rising. In Victoria in 1904 the "Rabbit Extirpation Department" cost £16,626. Ten years later the cost of the Rabbit Department has risen to nearly double, viz., £28,788 yearly!

The total cost of rabbit fences in New South Wales up to June, 1913, was:—State £70,000, farmers five and a-half million pounds, Pasture Boards £24,000. Doubtless by now rabbits have cost New South Wales a total of over six million pounds in fighting the pest. I have seen no reliable estimate of what the pest has cost New South Wales in loss of pasture.

The rabbit fences of Western Australia are a marvellous work. The great north to south fence scales 920 miles in length, from ocean to ocean; it is double throughout the greater part of its length, and the fertile South-West is defended by two double-wire fences besides.

Rabbits form a useful though not generally popular article of food in Australia. It is probable that there are more Australian rabbits eaten out of Australia than in it. The argument that many men get a living by rabbit-trapping is answered by the fact that more men would get a living if one sheep took the place of every three or four rabbits in the country.

Western Australia has most at stake, since its fertile area is still free from rabbits, but this cannot, in the nature of things, be expected to last. Australia has to face a forest question that in a few years must rank with the national debt in importance (page 259). So that it is no longer the farmer only who has to be thought of in connection with rabbits.

10.—*Australian experiments with South African vermin recommended.*

South African rabbit-eating vermin seem to be a certain and safe remedy against the rabbit pest in Australia; but it must be remembered that we do not quite know how this vermin will act in Australia. Nor are we even quite sure what the rabbit-destroying vermin in South Africa is till it has been specially studied with this object in view.

I suggest, therefore, that Australia should send a man to South Africa to confer with the South African museum at Cape Town, and to study the whole question. He could then bring a consignment of the South African rabbit-destroying vermin to be placed on some island where conditions are more like those on the mainland. There are several such islands between Tasmania and the mainland. Failing Federal action, and if the matter were taken up by the West Australian Government, possibly Rottnest or Garden Island might answer the purpose. Every Australian State is now suffering, more or less, from the rabbit pest; and it seems worth while spending a few pounds to prove or disprove that Australia, as regards rabbits, cannot get into the same position as South Africa. There are already two or three native wild cats in Australia besides a good many house cats run wild. The two native wild cats of Tasmania, *Dosyurus viverrinus* and *D. maculatus* do, it is stated, a good deal of damage to poultry yards and fowl runs, but "are protected because they cause extensive havoc among young rabbits." (Professor Flynn in Brit. Assn. Handbook.) The common wild-cat of Victoria is said to have died out about the time that rabbits became abundant; the too rich rabbit diet disagreed with it. The whole question may be one of rabbit vitality and breeding, versus cat vitality and breeding. And it does not seem a very hazardous proceeding to strengthen the Australian wild cats with some of their African cousins.

There would be no risk in such an island experiment; and the cost would be an infinitesimal fraction of what rabbits have cost Australia in the past and will cost in the future. Possibly New Zealand would participate in the cost of the experiment or provide a suitable island.

D. E. HUTCHINS.

Wellington, N.Z.

APPENDIX IV.

COMPOUND INTEREST TABLE.

The following interest table, extracted from Schlich's Forestry, Volume III., is appended for ready reference.

No. of Years.	Amount to which a capital of 1 accumulates, with compound interest in a number of years at 4 per cent.	Present value of a capital of 1 to be realised after a number of years at 4 per cent.	Present value of a perpetual rental of 1, due every number of years at 4 per cent.	Present value of a rental of 1 due at the end of every year, taken for a number of years at 4 per cent.
	£	£	£	£
1	1·0400	0·9615	25·0000	0·9615
2	1·0816	·9246	12·2549	1·8861
3	1·1249	·8890	8·0087	2·7751
4	1·1699	·8548	5·8873	3·6299
5	1·2167	·8219	4·6157	4·4518
6	1·2653	·7903	3·7690	5·2421
7	1·3159	·7599	3·1652	6·0020
8	1·3686	·7307	2·7132	6·7327
9	1·4233	·7026	2·3623	7·4353
10	1·4802	·6756	2·0823	8·1109
15	1·8009	·5553	1·2485	11·1184
20	2·1911	·4564	0·8395	13·5903
25	2·6658	·3751	·6003	15·6221
30	3·2434	·3083	·4458	17·2920
35	3·9461	·2534	·3394	18·6646
40	4·8010	·2083	·2631	19·7928
45	5·8412	·1712	·2066	20·7200
50	7·1067	·1407	·1638	21·4822
55	8·6464	·1157	·1308	22·1086
60	10·5196	·0951	·1050	22·6235
65	12·7987	·0781	·0848	23·0467
70	15·5716	·0642	·0686	23·3945
75	18·9452	·0528	·0557	23·6804
80	23·0498	·0434	·0453	23·9154
85	28·0436	·0357	·0370	24·1085
90	34·1193	·0293	·0302	24·2673
95	41·5114	·0241	·0247	24·3978
100	50·5049	·0198	·0202	24·5050
110	74·7597	·01338	·01356	24·6656
120	110·6626	·00904	·00912	24·7741
130	163·8076	·00611	·006142	24·8474
140	242·4753	·00412	·004141	24·8969
150	358·9227	·00279	·002794	24·9303
200	2550·7498	·000392	·0003926	24·9902

For ordinary plantation calculations it is easy to remember that in twenty years an expenditure rather more than doubles (2.2); in thirty years it becomes nearly 3.3; in forty years nearly £50: but in fifty years mounts up to over seven times, and in sixty years to over ten times. So that, with the high cost of planting in Australia, very little planting can be allowed to stand over sixty years.

D. E. HUTCHINS.

APPENDIX V.

INTERSTATE COMMISSION OF AUSTRALIA.

REPORT.*

TIMBER.

INTRODUCTION.

Our timber industry presents features of exceptionally grave importance from an industrial point of view. The national aspect of the question hitherto has received but scant attention, notwithstanding the fact that, in the absence of immediate provision for afforestation and re-afforestation, the industry in respect of Australian timbers is, within a brief period of time, practically doomed to extinction.

Excepting perhaps the State of Western Australia, it is highly probable that within a period of thirty years, at the present rate of consumption, we shall for all practical purposes exhaust our accessible marketable supplies of all the more valuable timbers; and from the present outlook it is not unreasonable to anticipate a later period when Australia will depend upon other countries for her supplies of eucalypt hardwoods.

Our policy hitherto appears to have been based upon the assumption that our timber resources are inexhaustible. It cannot be too strongly emphasized that although we have magnificent timbers, which in beauty and utility for many industrial requirements are unexcelled, the forests upon which we may rely for these timbers are comparatively very limited in area. They are scattered for the most part in isolated localities, on the ranges adjacent to the coast.

Reference to page 446 of the *Official Year Book*, No. 6 of 1912, will show that, with the exception of the United Kingdom, Algeria, and Cape Colony, Australia has less forest area, in proportion to total area, than any other settled country. It is but 5·35 per cent., compared with European Russia 43·04 per cent., New Zealand 25·65 per cent., Canada 22·33 per cent., Norway 21·50 per cent., Sweden 52·20 per cent., and the United States 24·08 per cent.

In regard to Western Australia, it was estimated by the State Royal Commission on Forestry in 1904 that the jarrah forests were being depleted at the rate of 60,000 acres per annum, and that the areas of cut-over jarrah and karri forests had by that year amounted to about 530,000 acres and 150,000 acres respectively. It may, however, be borne in mind that when that estimate was made the exports of Western Australian timber abroad and to other States were 96,865,000 super. feet. In the year 1913 the output had risen to 147,885,000 super. feet., an increase of 53 per cent.

The State of Western Australia is more fortunate than any other State in its available accessible supply of marketable hardwood timbers, and yet Mr. C. C. Richardson, Acting Inspector-General of Forests, in his report for the year ended 30th June, 1913, said: "Up to the end of the year under review, the area reserved for timber amounted to about one million acres. Unfortunately, in spite of all my recommendations, this area is only temporarily reserved, and it is a regrettable fact that to-day there is not one permanent reserve for timber in Western Australia. . . Western Australia has now arrived at the stage when it is sheer folly to sacrifice the forests of the State even in the interests of land settlement, and it is to be hoped that in the future a more vigorous policy of reserving permanently large areas of forest country will be possible. The people of to-day hold the forests in trust for the generations to come after them, and if we are to profit by the lessons of the past, it is for us to look beyond the present to the future."

South Australia is singularly deficient in commercial timbers.

In New South Wales, Queensland, Victoria, and Tasmania waste and depletion proceed with rapid and fatal progress, and many Australian timbers of exceptional beauty and usefulness for cabinet and furniture work will at no distant period be practically unobtainable. We are exporting immense quantities of our useful timbers for road blocks, railway sleepers, and other purposes.

* In the Appendix (printed separately) to this Report will be found the evidence; indexes to witnesses and subjects; rates of duty—present and past; applications received; statistical and other general information relating to Commonwealth production, imports, exports, and comparative statement—imports and exports; and production; and wages in the Commonwealth and other countries.

An illustration of the high value placed upon our eucalypts, and an appreciation of their wide utility, is to be found in a report published in 1902 by the United States Department of Agriculture. In the introduction to that work, which is entitled *Eucalypts Cultivation in in the United States*, it is said—

"The eucalypts are now grown in America, especially in the South-Western United States, more extensively than any other exotic forest tree. During the past forty years they have been planted here and in other parts of the world for ornament, for sanitary improvements, for shade, for wind breaks, for fuel, for oil, and for timber, and incidentally they have been useful in many other ways. In fact, they have probably served more æsthetic and utilitarian purposes than any other forest trees that have been planted on this continent. These trees have been studied and extolled alike by botanists, gardeners, and foresters. They are worthy of all the attention that has been given them, and deserve to be better known. The late Baron Ferdinand von Mueller, Government Botanist of Victoria, Australia, a most renowned student of the great Australian genus eucalyptus, prophesied in his scholarly *Eucalyptographia* that "the eucalypts are destined to play a prominent part for all time to come in the sylvan culture of vast tracts of the globe, and for hardwood supplies, for sanitary measures, and for beneficent climatic changes all countries within the warmer zones will with appreciative extensiveness have to rely on our eucalypts during an as yet uncountable period.' All who have lived where eucalypts grow can realise fully the force of the prophecy and the great value of the genus to mankind both present and prospective."

The Huon pine of Tasmania, which a witness claimed to be "the best pine in the world," is now said to be "a thing of the past." The cedar of the North-Eastern Coast of Australia, a timber unexcelled in lightness, beauty, and durability, has to all intents and purposes entirely disappeared. It is the same with ironbark. In a report of the Forestry Department of New South Wales for year 1913 it is said—

"Ironbark has been aptly termed the 'King of Hardwoods.' It is the most valuable of the New South Wales hardwoods. It comprises several species, and the best of these is that which is found on the Bellinger, viz., grey iron bark (*E. paniculata*). The supply of ironbark in New South Wales is nearer exhaustion than that of any other hardwood, and, as a matter of fact, the timber trade looks to the Bellinger and Nambucca Rivers to supply the bulk of its requirements in the future. . . It does not regenerate well, and is being ousted in re-growth by blackbutt. Moreover, it is being cut, for the purpose of girders, in the immature stages and before it has commenced to seed freely. . . The conclusion is that within ten years the supply of ironbark on the Bellinger River will be exhausted."

The difficulties of the local sawmillers, as represented by those applicants of the Eastern States and Tasmania, who have applied for increased duties, are due to the fact that, having cut out the reasonably accessible timbers, their cartage now is much more costly, the haulage by road being in some cases excessive, and under such conditions they are unable to compete with the imported timbers.

It is time that methods should be devised to check the present destructive waste and provide for the future. This most desirable object will only be rendered less attainable by any increase in the present duties on imported timbers.

A revenue (largely through royalties) from cut timber to the amount of £254,586 was collected by the States during the year ended 30th June, 1913. A large proportion of this unfortunately represents a revenue derived under a system involving the depletion of an important national asset. The following table illustrates this aspect of the question.

In the *Official Year Book*, No. 7 of 1913, the revenue and expenditure of the State Forestry Departments is shown for each State. From these statements the following results may be gathered :—

	Forestry Departments, 1912–1913.			
	Revenue.	Expenditure.	Surplus.	Excess Expenditure.
	£	£	£	£
New South Wales	96,145	42,154	53,991	..
Victoria	51,146	56,899	..	5,753
Queensland	63,467	5,397	58,070	..
South Australia	5,609	22,858	..	17,249
Western Australia	33,805	10,469	23,336	..
Tasmania	4,414	760	3,654	..
	254,586	138,537	139,051	23,002

It will be noted that South Australia presents a conspicuous contrast to the methods of forest administration followed in other parts of the Commonwealth, but it has to be remembered that this State is lacking in commercial timbers.

A large proportion of the above expenditure has in most of the States been incurred in collecting royalty and in regard to matters other than afforestation and re-afforestation.

It cannot be too strongly emphasised that, whatever may be the prospects in the future of afforestation on a scale commensurate with our requirements, we cannot at present, however heavy the duty may be, possibly hope to displace to any appreciable extent the importation of softwood timbers. Increased duties will probably lessen importations and reduce the demand for labour, but they will also lessen the demands for Australian timber. Our hardwoods are used in conjunction with the softwoods ; each has its particular uses, and the more softwood is used in construction the greater is the demand for hardwood. Assuming, however, that increased duties will lead to a largely increased consumption of Australian timbers (and that is the prime reason advanced by applicants for increased duties), then the process of depletion of our limited resources will be greatly hastened, and in return for a slight temporary increase in the present employment in one branch of the industry that source of employment will within a brief period suffer grave diminution.

In considering this question from the one aspect of employment, it must be borne in mind that timber is the indispensable raw material of many of our flourishing industries, and that every addition to its cost tends to their detriment and restricts their usefulness as employers of labour. The cost of timber materially affects our mining industry, and it largely influences the cost of production in our building, furniture, coachbuilding, boxmaking, and other trades. It is an important item in respect of boxes, casks, and crates, as containers in connection with our export produce trade, which should be specially safeguarded from all possible hindrance and disadvantage. Finally, and not least in importance, it is a material factor in regulating the rents of the smaller houses, tenanted, but more rarely owned, by those of modest incomes.

The question for serious determination is what methods may best attain the greatest benefits to the total sum of industry in providing the maximum amount of employment, in avoiding waste of effort, and in conserving our assets of valuable raw material, so that they may be utilised to the most profitable advantage.

Owing to the wide range of industry covered by its investigations, the Commission found it impossible to devote particular attention to the question of afforestation and re-afforestation. The evidence, however, strongly emphasises the necessity for immediate action.

Apart from the grave prospects in respect to our own timber supply in the future, there is growing alarm at the possible danger of exhaustion of the supply in the great timber-producing countries of the world.

The matter no longer admits of procrastination, and whilst the Commission is not in a position to express an opinion on the precise measures which should be locally adopted, it can at least be said that the subject is of great national importance, and can only be successfully dealt with by the Federal Government and by the Government of each State of the Commonwealth in earnest co-operation.

The timber resources of the United States are immeasurably greater than those of Australia. Notswithtanding this, the most earnest thinkers and patriotic citizens of the United States look with alarm and anxiety upon the rapid depletion of their forests and the serious outlook for the future. A number of addresses were delivered by prominent Americans at the Forest Congress, held at Washington in January, 1905, and as the views expressed are equally applicable to Australia, brief quotations from portion of these addresses should prove of value in directing attention to this interesting question of public policy.

Mr. Theodore Roosevelt, then President—"If the forest is destroyed it is only a question of a relatively short time before the business interests suffer in consequence. All of you know that there is opportunity in any new country for the development of the type of temporary inhabitant whose idea is to skin the country and go somewhere else. You all know, and especially those of you from the West, the individual whose idea of developing the country is to cut every stick of timber off of it, and then leave a barren desert for the homemaker who comes in after him. That man is a curse and not a blessing to the country. The prop of the country must be the business man who intends so to run his business that it will be profitable for his children after him. . . . I do not in the least underrate the power of an awakened public opinion ; but in the final test it will be the attitude of the industries of the country which more than anything else will determine whether or not our forests are to be preserved. . . . I ask, with all the intensity that I am capable of, that the men of the West will remember the sharp distinction I have just drawn between the man who skins the land and the man who develops the country. . . ."

His Excellency J. J. Jusserand, Ambassador of France, said—"The forest has one singular and providential advantage over most of the earth-produced elements of our industries. When we have exhausted an iron mine, a gold mine, an oil well, a supply of natural gas . . . . it is finished. Not so with the forests. It is in our hands to improve or impair them, to kill them or to make them live."

Mr. J. T. Richards, Chief Engineer, Pennsylvania Railroad Company—"Each year the timber from which these (sleepers for railroads of the United States) are manufactured is farther from the base of transportation. Many of the former sources of supply have already been entirely exhausted. . . . The time is now ripe for the railroads to consider the question of what course they are to pursue in the future."

N. W. McLeod, President National Lumber Manufacturers' Association—"Consumption is annually increasing, not only from the increase in population, but from a material increase *per capita* consumption as well. On the other hand, the supply is annually decreasing. If this be true, all Government timber lands should be withdrawn from sale or entry and placed under conservative management—all mature timber being for sale, provided proper protection is given the young timber. In this way at least a partial supply of timber for future generations can be perpetuated."

INDEX.

A.

	Page
Abies and *Picea* spp.	246
Absentee—The—forester, Australia	46
Acacia decurrens var mollis	247
Acacia melanoxylon—Blackwood	247
Accessible plantations wanted for South Australia	288
Acorn growing	62,385
Adelaide Arboretum	155
„ University: forest degrees	284
Advice on tree-planting	271
Agriculture and forestry	219
„ and geology	218
Aid—Australian—to Arboriculture	269
Aleppo pine—*Pinus halepensis*	82, 83, 256
„ in Cyprus	107
Alienation—Reckless forest	19
„ Results of forest	17
„ Some of the best Tasmanian forest not yet alienated	341
Almond tree—*Prunus amygdalus*	262
Annual forest report	144
„ „ Victoria—double-barrelled	320
Arbor Day	152
Arboretum—The forest	153
„ The group	153
Arboretums in South Africa	154
„ other countries	154
Arboriculture and forest nurseries	183
„ on farms	260
„ and private forestry	268
„ Government aid to	268
„ Australian aid to	269
„ South African aid to	269, 271
„ What it is	183, 383
„ Extra-tropical manual of	267
„ in South Australia	289
„ in New South Wales	311
„ in Victoria	328
„ in Tasmania	358
Areas—Gross forest	180
Arizonica—Cupressus	250
Ascension—Tree-planting produces water on	208
Ash—Karri	86
„ *Fraxinus* spp.	253
Ashbolt, A. H.	187
Australian forestry—800 to 3,000 acres per man—employment in an ordinary forest	205
„ „ production five and a-half million pounds	213
„ „ Low yield of	213
„ „ General summary of	362
Australian roadside trees	275
Australia—Wattle plantations in	112
Australia's choice of forest—three classes of forest	111
Australian timber—home use and export	188
Auction sales of timber in Western Australia	222
Australis—Pinus	255

B.

"Backwoods" idea—The wild forest and the cultivated forest	163
Bamboos for paper-making	199
Bamboo tubes in nursery work	129
Barking—Ring	230
Beauty enthusiasts cost the French Government £560 in Paris suburban forests	330

Page

Beauty of forest scenery lost in Tasmania 342
Belgian forestry 158
„ „ and forest employment 203, 204
Big trees of Victoria 315
Blackwood forest in Tasmania.. .. .. 341, 355, 339
„ Opalescent—in Panama trophy 351
Blacks—Bush fires lit by the 41
Blackbutt of Western Australia (*Euc. patens*) 87
Blue Gum—Yield of on the Nilgiris, S. India 104
„ Tests wanted for 233
„ forest in Tasmania 356
Board—Western Australia—of forestry 220
Bosquets of Versailles 28, 155, 360
Botanical names should not be changed till botanists are in entire agreement 166
Botanical Gardens, Melbourne 327
Botanist—Government—on backward state of Tasmanian forestry 344
Botany and forestry 165
Box substitute *Pittosporum bicolor* 262
Bright side of Tasmanian forestry 356
Brisbane—Timbers in the forest office 298
British Association—Experience of the 149
„ „ and Tasmanian forestry 329
Brown's—Mr. Ednie—work 246, 283
Brussels—Suburban forest of Soignes 157
Buffaloes for timber hauling 116
Bulk of the imported and Australian timber in cubic feet 187
Bundaleer plantation, South Australia 286
Busaco Cedar—*Cupressus lusitanica* 251
Business aspects of forestry in Tasmania—Some 343
Bush Fires in Tasmania 32
„ „ New South Wales 31
„ „ Victoria 30

C.

" Cadre " for the yearly forest report 145
Canberra—Arboretum for 156
Camphor tree—*Cinnamomum camphora* 250, 297
Canary pine—*Pinus canariensis* 82, 122, 255, 285
Cape Town—Fire-protection of Table Mountain at 338
Capital required to organise the wild forest 210
„ idle—of the virgin forest 178
Carbo instead of paint for forest cottages 52
Carob—*Ceratonia siliqua* 249, 268, 384
Cedar of Queensland—Scandalous destruction of 291, 296
„ New South Wales—loss of 305
Cedarberg, South Africa—Fire-protection at 35
Celery-top pines 333
Charge—Forester's 45
Chestnut—Sweet—*Castanea vesca* 248
Chinese " coffin " tree—*Persea nanmu* 298
Classes of forest reserves—various 4
" Cleaned-up " forest—A fallacy of the 28
Clean-fellings 76
„ and abolition of felling sizes 221
Clear-cutting—New South Wales Conservator on 75
„ Victorian Conservator on 75
Climatic effect of forests 103
Cluster-pine—*Pinus pinaster* or Maritime pine 79, 81
„ for coast sands 124
„ in the State forest of Leiria normal " stand " 81
„ objection to in Jarrah forest 80
Coast-belt—Australian wooded 362
Coast sands—Cluster-pine for 124
Commissions—Royal—on forestry 217
Compiegne suburban forest is the third largest State forest in France 157
Concessions—Forest 100
Conferences—Conservators' 144
Conifers—Planting of 125
Conservative lumbering 99

Page

Coorong—Pine planting on the; some 640,000 acres 185, 289, 321
Coppice reproduction and fire 91
Corbin—facts and figures 178, 284
Cork Oak—*Quercus suber* 264
Corsicana—Pinus laricio var. 258
Cost of plantations 399
„ „ in South Africa generally, interests, etc. 133, 400
Cost of 100 years of bad Forestry in Australia 167, 176, 379
Cottage—The Forester's 50
„ of wood and iron to be avoided 51
„ Daga and waterproof, preparation for 51
„ Cost of 51
„ Forester's, and tourists 64
Countries—Dry—Stand of timber in 106
Cows for hauling timber in German forests 116
Cracking of timber 322
Credit—Tasmania—loss of public 344, 354
„ National—forest finances and thrift 209
Creswick forest school 284, 322
"Cultivated" forest—The 108
„ „ in Australia, no conception of 108
„ „ Most European forests are 109
„ „ yields 110
„ „ Employment in 109
„ „ and "wild" forest 109, 163
Cupressus sempervirens 251
"Cut and mulch" weeding 131
Cutting plantations—Age of 122
Cypress pine in South Australia 288
„ „ New South Wales 306
„ „ Tasmania 333
Cyprus—Aleppo pine in 105
„ Roadside trees in 275

D.

Daga for forester's cottages 51
Decurrens—Acacia—var. mollis 247
Defence—Foresters armed for 46
Degrees—Forest in Adelaide University 284
Demarcation—how to demarcate—three points 1
„ Settlement and forest 4
„ Loss in postponing 4
„ National credit and forest 4
„ Rural development hindered 5
„ Advice of Indian Foresters 6
„ in Victoria 6, 321
„ in Japan 10
„ in East African Highlands 10
„ in South Africa 10
„ A weak forest 8
„ A strong forest 11
„ Settlement without forest 71
„ No discrimination or 363
„ Forest—Summarised 368
„ Progress in 369
„ in Western Australian forests 281
„ in Queensland 292
„ in Tasmania 332
Dense evergreen forest 75
Density of planting 130
Deodar—*Cedrus deodara* 249
Depopulation—Rural 200
Depth of soil 132
Deterioration and forest fires 38
Distribution of young trees at cost price 269
„ „ trees and seeds to the public in South Africa 269
„ „ „ „ „ „ South Australia 290

	Page
Domain at Hobart	360
Dorigo forest, New South Wales—Destruction of	304
Douglas pine—*Pseudotsuga Douglasii*	263
Douglas and Blackwood—yields compared	331
Doubtful expenditure on thinning and "cleaning-up"	132, 367
Drift-sand, planting in South Africa	Appendix II.
Drought—Forest grazing and	26, 27, 59
Dry country transplants	130
„ plantations in Western Australia and South Africa	89
Drying—Gain in strength of timbers on	232
Durability of timbers	233, 237

E.

East African Highlands—Forest demarcation of	10
Economics—Forest	178
Education—Forest—wanting in Australia	179
„ „ in Tasmania	342
Employment in the cultivated forest	109
„ forest, one man per 100 acres in Bavaria	109
„ rural—and the forest industry	200
„ forest—now, and with better forestry	202
„ in forests of Belgium and Germany	203
„ forest, one man per 800 acres Australia	205
„ Permanent—apart from officials and timber-working	204
„ in the forest being organised	205
„ in an ordinary Australian forest 800 acres to 3,000 acres per man	205
„ the strongest reason for State forestry in England	205
„ Forestry in Australia—summary—1,700 foresters and some 10,000 labourers in the organised Australian forests	207
„ Temporary, putting the forests into order	207
„ Permanent, in the organised forests	207, 375
„ Permanent forest—in Germany	376
„ Temporary—in the forest	376
English forestry	200, 330
„ „ Employment the strongest reason for State forestry	205
English Oak—*Quercus pedunculata*	264
Errors—Past, in Victorian forestry	314
Estarelle forest—Fire-protection	23
Eucalpyts and pines grown together for West Australia	83, 136
Eucalpyt forest, The—good timber area in Australia, say 100 million acres	12, 362
European forests—"Stands" of timber	103
„ „ nearly all cultivated forests	108
„ „ loss of export trade in timber and bark	171, 185
„ „ private	277
„ „ standard for forest reserves	369
Exotics—Plantations of, not enough	13
„ Planting of, in indigenous forests	
Expenditure—Forest	180
„ in the past, a criticism of Australian forests	213
„ in South African forests	215, 283
„ Tasmania and Victoria, ill-balanced	219
„ advisable £40,000,000	380
„ in Victoria—and forest revenue, 1914	323
Export—Loss of, trade in timber and bark to South Africa, South America, and Europe	170, 171
„ of timber to countries outside Australia	184
„ of timber	188
„ Mallet bark	240
„ Tasmania	315
„ of timber—Tasmanian loss of	351
„ „ „ from Australia—loss of two millions or three million pounds yearly	363
Extra-tropical Australia—No official statistics on	15
„ arboriculture—No text-book in	384
„ trees—Wealth in	384

F.

Page

Famine in timber—Australia left without resources in case of a 191
Federal forest service 195
„ forestry for the waste forest area of Tasmania 14, 331, 361, 373
Felling when the sap is down 95
„ sizes—Clean-felling and abolition of 221
„ areas, Western Australia 222
Field—The trees of the 268
„ „ „ their profit to the Tasmanian farmer 358
Fifteen per cent. (15%) standard of forest reserves—74 million acres 13, 370
Filling up the Jarrah forest with pines 81
Finance—Forest— 208
„ „ national credit and thrift 208
„ „ in South Africa 210, 214
„ „ in Portugal 215
„ „ in France 216
„ „ faulty in Western Australia 282
„ „ in New South Wales 310
Fires—Forest— 364
„ „ occasional may not do much harm 22
„ „ in India 21
„ „ Watch-towers for 22
„ „ Tea-drinking and 24
„ „ and permanent fire lines 20, 25
„ „ Other measures against 25
„ „ The popular notion 28
„ „ in Australian forests—their prevention 29
„ „ in Victorian forests—mischief caused by 29, 318
„ „ in Tasmanian forests 32, 335
„ „ The whole loss is Government neglect 33
„ „ and water conservancy 34
„ „ accidents in South Africa 35
„ „ in North American forests 37
„ „ and railway engines 37
„ „ and forest deterioration 38
„ „ and forest regeneration 40
„ „ lit by "Blacks" 41
„ „ General conclusions 42
„ „ Mountain-top outlook against 47
„ „ and coppice reproduction 91
„ „ give costly timber to work 365
„ „ habit *versus* grassed strips 365
„ „ a temporary evil only 366
„ „ of the "Blacks": forest improving in N.W. Tasmania with the stoppage of 42, 365
Fire-paths in India 25
Fire-protection—Easier in Western Australia 20
„ „ the trinity of 22
„ „ in the Estarelle forest, South France 23
„ „ in Portugal 23
„ „ at Creswick 29, 30
„ „ in South Africa 35
„ „ in the Cedarberg, South Africa 35
„ „ complete 43
„ „ and the largest trees in the World 42
„ „ and grazing 367
„ „ in South Australia 288
„ „ in Victoria: organization necessary 318
„ „ of Table Mountain, Cape Town 338
Fire-watchers 27
Five hundred and eighty-eight and a-half million pounds (588½) loss in the next 30 years through bad forestry 176, 364
Floors, Hardwood—A reminder 197
Forest Regulations of Western Australia 220
Forest Coast-belt—Why destroyed 362
Forest Department—Public inconvenience of no 143
„ „ Bad effect of politics on the 193, 195
„ „ and forest revenues 182, 381

Page

Forest Department—in Queensland 295
„ „ Absence of in Tasmania, and the loss of tourist traffic 351
Forest League 160, 165, 330
Forest Management 69
Forest School—A Federal 139
„ Adelaide 284
„ Sydney 312
„ Creswick 284, 322
Forest service—A Federal 49, 196, 372
Forest planting—Victoria, 3½ million trees ; South Australia, half a million trees ; New Zealand, six million trees ; South Africa, 40 million trees yearly .. 321
Forestry and Agriculture 219, 385
„ „ Botany 165
„ „ Geology 218
„ Ignorance in Australia of 149
„ and grazing 117, 367
„ in the various Australian States .. .. 280 to 361
„ in New South Wales 301
Forests—Australian—the most valuable trees not yet in 126
Forester's charge—30,000 acres 45, 49
„ „ Cedarberg, 120,000 acres 45
Forester—The resident 46
„ The absentee 46
„ Land for the 53
„ The—in charge of the forest Station 141
Forester's career at home and abroad 141
Foresters—Some 1,666 required for Australian forests when fully organised .. 49, 207
Four per cent. (4%) interest table 409
France—Forest finances of 216
Fruit cases—Tasmania's loss in 352
Furniture—Import of £354,257 yearly 187, 189, 377
Future forestry work in Western Australia 382
„ „ the routine of in Australia 281

G.

Game—its rarity in Australian forests 65
„ and fire-protection 67
„ follows forest organization 66, 371
Geology—Agriculture and Forestry 218, 219
Germany—Five million population living on 35 million acres forest 201
„ Forest employment in 204
Goats and forest grazing 60
Gold—Bad forestry will cost Australia more than all the gold won from Australian soil .. 177
Grants—Timber 280, 332, 346
Grassed strips instead of fire habit 365
Grass roads in organised forests 55
„ in Queensland 298
Grazing—Forest 57, 367
„ and population 57
„ in Australian forests—bad effect of 58
„ and the scrub danger 59
„ light, in distant forest 59
„ and drought insurance 59
„ and goats 59
„ certain trees make good 62
„ Summary of results in Australian forests 63
„ and fire-protection 367

H.

Hamel plantation—Western Australia 135
Hardwoods and softwoods in Australian forests 125
„ „ the most durable: popular mistake 126, 162
„ and "Tasmanian Oak" 334
Hauling timber with cows in Germany 116

Page

Hickory—*Carya spp.* 254
History of forestry—New South Wales 301
Historical forestry in Victoria 312
Hobart—A suburban forest for 339
„ streets 359
„ Domain 360
Home production of Australian timber 172, 188, 363
Huon pine 332

I.

Ignorance of forestry in Australia 149
Ilex-Quercus 263
Immorality—public—of the present position in Queensland 299
Improve and use the Forest—Tasmania 346
Impregnation of timber in South Australia 285
" Improvement thinning " ; " cleaning-up " or " re-afforestation " 367
Imports—Timber—cost of three and a-half million pounds 167, 186
„ „ growth of the timber bill 184, 187
„ „ 3,400-ton steamer arriving daily 189
„ „ loss over 363
„ „ one and a-half million pounds, New South Wales 307
„ „ Tasmania 349, 361
„ „ Same timber grown in Tasmania 361
„ Two bases for estimating the future 167
„ of logs and slightly worked timber in recent years 184
„ of Australian timber in cubic feet.. 187
„ of furniture, £354,257 187
„ of a quarter million pounds yearly of Tan bark 377
„ of paper: three million pounds 378
„ of turpentine and oil 378
India—Fire-paths in 25
„ Sandalwood of Western Australia and 241
„ Sandal monopoly for Western Australia like that of 243
Indian foresters' advice to demarcate.. 6
Indigenous forests of South Africa—planting exotics in 401
Industry of forestry—Rural 81
„ Protection for a great rural: the tariff 192
„ Tasmanian value of the forest 348
Industries—Subsidiary wood 186
Insignis pine—*Pinus insignis* 122
„ for the Jarrah country 81
„ for paper pulp 198
„ Its botanical name 258
„ Attacked in South Australia by a fungoid disease like *Diplodia pini* .. 258
„ Mount Burr and Penola 286
„ Maximum young growth Kuitpo 8in. x 76ft. at 10 years 287
Iron—Yate timber weight for weight stronger than 235
Ironbarks in South Africa and Western Australia 253
Irregular forest easily got rid of in Australia 74
Island wanted for the rabbit experiment 406, 408

J.

Japan—Forest demarcation in 10
„ Working-plans in 70
" Jardinage " or " Selection " fellings 75
Jarrah forest of Western Australia usually on poor soil 77
„ „ General character of the 77
„ „ Population wanted 79
„ „ Filling up withpines 79
„ „ Insignis pine for the 81
„ „ a shade-bearer for the 82
„ and Karri—to distinguish 85
Julius', Mr. C. A.—Timber tests 224
„ „ tests should be completed 237

K.

Page

Kalgoorlie goldfields—firewood and trees 88
„ Forest management 89
„ arboretum 89
„ and dry country plantations 90
Kanthack, F. E. 28
Karri forest easy to manage 84
„ regrowth 84
„ giant trees 84
„ and Jarrah, to distinguish 85
„ forest, Blackwood for the 247
Kimberley, South Africa—Dry-country plantations at 90
"King Karri" 84
King William Pine 333
Kuitpo plantations—Insignis 8in. x 70ft. at 10 years 287

L.

Labour—Forest—must be well cared for and organised 376
Labourers—Forest—required for fire work 48
„ „ „ forestry work 207
Land for the Foresters at the Forest Station 53
Largest trees in the World and fire-protection 42
Launceston—Arboretum for 155
„ Gorge 359
Lawsoniana-Cupressus—(Lawson's Cypress) 251
League—Australian Forest 160
„ „ „ should use politics 160
„ „ „ should help to build up a forest literature 161
„ „ „ short text-book of Australian forestry wanted 161
Leases—Timber—in Tasmania 354
Libraries—No forestry at the Australian 150, 151
Literature—Australian—No forestry in 150
Loan—A specific forest 209
„ An early forest 210, 211
„ A Tasmanian forest 349, 361
Loblolly pine—*Pinus taeda* 262
Locomotives—Government—and Tasmanian forest fires 337
London streets in Southern latitudes 383
Losses—Forestry—in export trade, timber and bark 170, 171
„ „ 588½ million pounds in next 30 years 176
„ „ in Tan bark exports 185
„ „ „ „ 185
„ „ least in Western Australia 185
Lumbering—Conservative 99

M.

Macedon—Planting conifers at 125
Maiden, J. H., on seasoning of timber, etc. 230
Mallet-bark tree 91
„ and Sandal 239
„ export 239
„ tan, value of 240
„ Treatment of forest 240
Manual of Australian forestry 161
Management—Forest—and Working-plans 73
„ of various forests of Australia 76
„ Government—for private forest 278
„ Tasmanian loss in forest 351
Manhood—Tasmanian—and forestry 357
Manuring forest plantations 134
Measurement—Log—Western Australia 222
Mediterranean milch goats 60
Melbourne Botanical gardens 327
„ water conservancy—forest, no management 325
„ timber seasoning kilns 197

	Page
Meteorological forest stations—Work	47
Metric "Tickey"	92, 173
Mill and forest value of timber	93
„ sites—Western Australia	222
Millar's Karri and Jarrah Co.	57
Minimum felling girth for timber	95
Mining timber	88
Minister—The—in charge of forests	196
Mitis—Pinus or *P. echinata*	258
Money in extra-tropical tree-planting	267
Monopoly—Sandal—for Western Australia like that in India	244
Mount Burr—Insignis pine at	286
Mount Wellington Forest, Hobart	338
Municipalities—Tree-planting, aid to	268, 272
Muricata-Pinus (Bishop's pine)	259
Museums of New South Wales—Good forest	310
Municipal forest—Government help in management of	272

N.

Names—Botanical	166
Natal Black Wattle	347
National debt of Australia (State and Federal) only half the loss over bad Forestry during next 30 years	176, 177
Native forests *versus* forest plantations	370
Nature reserves and public parks burnt	44
Neglect of the forest by Government makes timber working costly	380
New South Wales fire-protection	31
„ „ Conservator on clear-cutting	75
„ „ forestry	301
„ „ history of forestry	301 to 307
„ „ forest wealth wasted	305
„ „ forestry for the national parks	308, 309
„ „ timber importation of one and a-half million pounds	307
„ „ sawmilling	309
„ „ good forest staff	310
„ „ good forest museums	310
„ „ forest finance	310
„ „ arboriculture	311
Nilgiris, South India—Yield of Bluegum on	104
Ninety (90) years of wasted opportunity—Queensland	291, 297
North America—Forest fires n	37
Nurseries—Details of work in South Africa	128
„ Bamboo tubes of South Australia	129
„ and plantations: expenditure in the various Australian States	183
„ wanted in Australia as in South Africa—163 Government nurseries distributing five or six million trees yearly	384

O.

Officials—Forest—required for Australia	372
Olive—*Olea europoea*: the industry a social question	255
O'Loghlen, Peter, M.L.A.	175
One hundred years bad forestry—Cost of—588½ million pounds	167, 168, 176
Oregon pine and Fir forests for the highlands of Tasmania	361
Organization of Australian forests	44
„ Cost of labour involved in	49
„ Permanent staff required	49
„ complete—would cost some four million pounds yearly and bring in 16 million pounds	207
„ partial—one million to two million pounds yearly	207
„ of the wild forest—capital required to organise	210
„ Game follows forest	371
„ and forest playgrounds	371
„ and tourists	371
„ in Victoria—necessary for fire-protection	318
Oyster Bay pine (Cypress-pine of Tasmania)	333

P.

	Page
Oxen—The forest	62
Pacific Sandal	244
Paint—Carbo instead of	52
Pamphlet wanted on West Australian timbers	238
Paper pulp and softwood region of Tasmania	14
„ making, and softwoods in Australia	198, 199
„ Bamboos for making	199
„ Import of three million pounds	185
Paris—Suburban forests of	157
Parks—National—forestry for—New South Wales	307
„ „ Western Australia	9
„ „ Tasmania	336
Paspalum fire-paths	297
Penola, South Australia—Insignis pine at	286
People's playgrounds—Loss of—with destruction of the accessible forest	363
Permanent fire-lines	25
„ employment in the organised forests	207
Perth—An arboretum for	156
Pines—naturalised—in the Southern Hemisphere	121
„ wild	121
„ for poor, dry soils	123
„ planting in Australia	123
„ to fill up the Eucalypt forests of Australia	83
„ five—for the jarrah forests of Western Australia	83, 135
Pine planting and rabbits	82
„ „ on the Coorong sands	289, 321
„ „ and Prickly-pear	294
Pig grazing	62, 263, 265
„ rearing and Oak planting—one-third million pigs in Portugal	62, 263, 264, 265
Pinchot on the wild forests	109
Pittosporum bicolour (a " Box " substitute)	262
Pit-sawing	101
Plantations—Forest—cost and risk of	13
„ „ age of cutting	122
„ „ for Australia	127 to 133
„ „ cost of	122, 133, 134
„ „ replacing failures	134
„ „ manuring	134
„ „ area in Western Australia—30in. rainfall	136
„ „ in South Africa	137
„ „ *versus* indigenous forest—enormous cost of—958 million pounds to replant the nine million acres of forest reserves of Victoria and New South Wales	100
„ „ Employment afforded by	207
„ „ of South Australia	285
„ „ in New South Wales, scarcely begun yet	307
„ „ in West central Tasmania	361
„ „ in South Africa	399
Planting—Tree—and arboriculture	267, 383
Planting Conifers at Macedon	125
„ Density of	130
„ some useful trees for—Western Australia	246
„ seeds and advice	271
„ prizes for private	272
„ aid to Municipalities	272
„ roadside	274
Population and grazing	157
„ wanted for the Jarrah forests	78
„ and turpentine industry	79
„ in the 30 years' period	173
„ and forestry in Western Australia and Germany	201
Police work of the forest	383
Policy—Forest—for Western Australia	281
Pole cutting only with a " Working-plan "	92
Politics and the Forest League	160
„ and forestry	193
„ bad effect of on the Forest Department	195

	Page
Political management—Railways freed from	193
„ control—Evils of	193
Ponderosa pine, good growth Victoria	261
Popular misconceptions	162
Portugal—Fire-protection in	23
„ Forest finances of	215
Portuguese Oak—*Quercus lusitanica*	264
Private forests—Prizes for tree-planting in	272
„ „ "Working-plans," seeds and young trees from Government	273
„ „ in Europe	268
„ „ Government management of	272, 278
Prickly pear and pine planting	295
Produce—Forest—other than sawn timber	185
„ Australian forest: value of about five and a-half million pounds	212
Protection for Australian timber and millers	190
„ of the forest against fires and grazing	367
Public opinion—to form—on forestry	152
„ „ on forestry—absent in Tasmania	344, 345
Pulp—paper—The three million pounds importation of	185, 186
„ „ from waste softwood in Queensland	185
„ „ Insignis pine for	199
„ „ from hardwoods in Tasmania	345
„ „ area of Tasmania	361
Pycnantha-Acacia—Best tan Wattle for Western Australia	248
Public—inconvenience of—no Forest Department	143
„ opinion on forestry	149, 152

Q.

Quarter—Timber cutting on the	226
Queensland—Forestry in	290
„ present State forest area	290
„ scandalous destruction of Red cedar	291
„ best forest lost to the country	291
„ good system of selling timber	292
„ work ahead	292
„ forest demarcation in	292
„ lost wealth in trees	293
„ Forest Department of	294
„ working of the forest	295
„ Government and private working	296
„ sleeper working	292, 295
„ three valuable trees nearly extinct	296
„ area of forest reserves required	299
„ forestry—two unique advantages	299
„ public—immorality of the present position	299

R.

Rabbits—Destruction of rabbits in organised forests	68
„ and forestry	205, 405
„ swarm on Kerguelen Island	405
„ and vermin in extra-tropical countries	406
„ South African vermin destroy all	406
„ debit and credit side of in Australia	407
„ safe experiment on an island	406
„ and pine planting	83
Railways freed from political management	193
„ and forestry—returns of each	213
Rainfall and timber areas in Australia	11, 12, 13, 14
Redemption of alienated forest	19
„ . . . . Forest—The keynote of forestry in South Australia	284, 288
„ . . . „ „ and forestry, Queensland	299
Red cedar—destruction in Queensland	291
Red-gum of Victoria—Yate twice as strong as	236
Redwood—Californian—*Sequoia sempervirens*	266

	Page
Re-growth—Karri	84
„ Forest—A sample of—with photo.	344
Regeneration—Fire and forest	39
„ " Working-plans " and forest	74
„ in groups	74
Replacing failures in plantations, not done in South Australia	134
Reproduction of Sandalwood	242
Reserves—Forest—Various classes of	3, 180
„ „ percentage required for extra-tropical Australia	11
„ „ on 20 per cent. standard—98 million acres	12
„ „ on 15 per cent. standard—74 million acres	13
„ „ Location of	14
„ „ Sandal	245
„ „ Areas of	369
„ „ no decision by the State Governments *re* area	369
„ „ European standard for	369
„ „ Western Australia—area required for	280
Resin and Cluster-pine in Gascony	79
„ „ planting in the Coorong	289
„ „ in North-East Tasmania	361
Revenue from game in forests	67
„ of plantations in South Africa	399
„ of State Forest Departments	181
„ forest—and expenditure—of Victoria, 1914	324
Roadside trees wanted in Australia	274
„ „ in Cyprus	275
„ „ What trees to plant for	276
„ „ for Tasmania	358
Roads—Forest	53
„ Trees wanted for wide	54
„ of grass, economical for forest work	55
„ and tourists: Victorian forests	319
" Rotation "—The forest—in native forests of South Africa	72
Routine of future forest work in Australia	382
Royalties—General discussion of—in Australia	92
„ Australian—only quarter the £0·01 standard, computed from timber worked	92
„ low in Western Australia	93
„ relation to the primary value of timber in the forest	173
„ Statistics of	173, 182
„ Forest revenue obtained by the State against the timber worked in each State, 1912	182
„ Politics and	193
Rural depopulation and forestry	204
Russia—" Working-plans " in	70
Richardson, C. G.	283, 413

S.

Salaries and Works—Forest expenditure on	214
Sawmillers misunderstood and badly treated	99, 100, 221
„ in Western Australia—Undue tax on	221
„ in New South Wales	309
Sandalwood and Mallet	239
„ of Western Australia; value, £60,000 a year	243
„ of India and Western Australia compared	242
„ distillery at Torbay	242
„ reproduction	242
„ Indian	243
„ Pacific	244
„ monopoly for Western Australia like that in India	244
„ reserves	245
„ Summary	245
Sap—durability and Julius' experiments	229
Sap-Felling when down	95
Schools—Foreign—extra-tropical forest	140
School—Forest—Adelaide	284
„ New South Wales—Forest	312
„ Forest—Creswick	322

	Page
Schooling at the Forest Stations	48
Scotch Pine—*Pinus sylvestris*	261
Scrub—The—danger	59
Seasoning timber—Julius' experiments	229
„ „ Maiden on	230
„ „ kilns at Melbourne	197, 231
„ „ by electricity	232
„ „ natural	232
„ „ artificial	231
„ „ General Rules for	231
„ „ Water system of	232
Season—Western Australian Regulation requiring timber to be felled out of	221
Security—general or specific—for a Forest loan	211
Seeds—How to be provided and used	117, 271
„ Government Store at Capetown	117
„ the genuiness of	117, 271
„ Sources of supply of	118
„ The packing of	118
„ The only cheap Pine seed	81
„ and advice on tree-planting—Government aid	271
„ £3,000 worth of seed sold yearly in South Africa	128
Selection—fellings	71, 75
Selling Queensland timber—Good system of	292
Settlement not helped but impeded by bad forestry	4, 177
„ without forest demarcation	71
Settler—Australian—Forestry will bring better times for him	206
Shade-bearers for the jarrah forest	82
Sheep *versus* forestry: sheep one-tenth the employment in Australia	57, 203
Shrinkage of home forest produce—one million pounds shrinkage and one million pounds indirect loss	174
Shrinking of timber	232
Silky Oak	296
Silver Fir and wood pulp in Tasmania	331
Six million pounds (£6,000,000) yearly timber bill	170
Sleepers—good use of half-round in Queensland	292
„ Sensible	292, 295
Sleeper timbers—holding power of spikes	234
Sleeper-hewers' and paling splitters	101
„ „ waste	101, 292
South Africa—Forest demarcation	10
„ „ Fire-protection in	35
„ „ Fire accidents in	36
„ „ Plantations in	137, 399
„ „ Yield of plantations in	399
„ „ drift-sand planting	401
„ „ Planting exotics in indigenous forest of	401
„ „ vermin not dangerous to introduce	405
„ „ vermin destroy all rabbits	405
„ „ "Wild" and "cultivated" forests—yields compared	110
„ „ Wattle planting in	113
„ „ forest finances	214
„ „ forest expenditure, 1912–13	215
„ „ Aid to arboriculture in	270
„ „ roadside trees	274
„ „ loss of market for Australian hardwood	170, 171
South America—Loss of export of timber and bark to	171
South Australia—early errors in forestry	283
„ „ revenue and expenditure	284
„ „ difficulties in forest work	284
„ „ timber impregnation	285
„ „ Pine plantations in	285, 288
„ „ Canary pine in	285, 288
„ „ accessible plantations	288
„ „ Fire protection in	288
„ „ redemption of alienated land	288
„ „ Cluster Pine in	289
„ „ arboriculture and free distribution of trees	289
Societies—Forest—of other countries	161

Page

Social centres—Forest stations become 47
„ question—Olive culture is a 255
Softwoods now costing £10,000 a day to import 119
„ Home supplies of 119
„ planting in Australia 119
„ and Hardwoods in Australian forests 125
„ destruction in Queensland of the three valuable 296
„ New South Wales—loss of.. 305
„ planting: 20 times more area wanted in Victoria 320, 321
Soils—Poor dry—for pines 123
„ depth of 132
Sowings—Pine—in South Africa 127
Staffs—The Forest—required for Australian forests 49
„ Forest—field—of the various Australian States 180
„ New South Wales—The good forest staff of 310
" Stands " of timber low in Australia 102
„ „ in European cultivated forests 103
„ „ normal for Cluster Pine, in the State forest of Leiria 103
„ „ in Apalachian forest 104
„ „ in dry countries 106
„ „ various " stands " for comparison 106
„ „ Summary of 107
State forestry in England—Employment the strongest reason for 205
„ „ Area of Queensland 290
State forest areas—See Forest Reserves 179
Stations—Forest—Selection of 45
„ „ Minor uses of 46
„ „ Meteorological use of 47
„ „ Schools at 48
Statistics—Forest .. .. 179 to 183
„ Forestry—of Tasmania 329
Steamer—3,400 ton—Imported timber arriving daily 189
St. Kilda Road—15 times the width of the " Corso " and with few trees 328
Stone Pine—*Pinus pinea*, a most useful tree for Western Australia 259
„ „ soft-shell variety 261
Strobus-Pinus—Weymouth Pine 261
Spacing young trees 130
Subordinate staff 140
Suburban forests—their popularity and usefulness in Europe 156
„ „ of Europe 156
„ „ of Compiegne 157
„ „ of Paris 157
„ „ of Brussels—Forest of Soignes 157
„ „ Other 158
„ „ Great utility of—in Australia 158
„ „ Cost of 159
„ „ for Sydney 158
„ „ for Hobart 158
Sugar Gum—*Eucalyptus cladocalyx*, the dry country road tree 253
Summaries—Western Australian timbers 236
„ Sandal 245
„ Roadside and private tree-planting 72, 277
„ Australian forestry 440
„ Tasmanian forestry 360
Sustained yield of forests, in the " Working-plan " 72
Sydney—An arboretum for 155
„ A suburban forest for 158

T.

Taeda-Pinus or Loblolly Pine 262
Tan bark—Bad forestry costing Australia about quarter million pounds yearly 185
„ Wattles in Natal and in Australia 111
„ extract in a solid form 114
„ The chemical risk of the Industry 114
„ Tariff protection for 114
„ Loss in imports of 184
„ Loss in exports of 185

	Page
Tan bark—Import of a quarter million pounds	186
„ and timber tariff	192
„ Value of Mallet bark	239
Tariff—The present—Australia—on timber and tan bark	185
„ the budding forestry of Australia must be protected	190
Tasmanian forestry—An ill-balanced public expenditure	219
„ „ Tasmania and Vitcoria—a contrast	331
„ „ Oregon and Fir forests for the highlands	330
„ „ Reforesting of the central West highlands	331
„ „ Forest finances	348 to 351
„ „ Employment of highlands in	331
„ „ Forest fires uncontrolled and a public misfortune	335, 336, 339
„ „ The National park will be burnt out	336, 337
„ „ North-West forests improving with the stoppage of the fires of the Blacks	337
„ „ Forest fires and Government railway locomotives	337
„ „ Forest demarcation not yet begun	340
„ „ Forest education absent	337, 339, 342, 357
„ „ Lost beauty of the country	335, 343
„ „ Some business aspects of	341, 343, 345
„ „ and the British Association	329, 346
„ „ Paper-pulp production	345
„ „ Use and improve the forest	346
„ „ Wattle bark industry	346, 347
„ „ Value of the Forest industry	348
„ „ Imports of timber and tan bark	350
„ „ Exports of timber and tan bark	350
„ „ Loss in forest management	351
„ „ Absence of Forest Department and loss of tourist traffic	352
„ „ Loss in timber export	351
„ „ Loss in fruit industry	352
„ „ Loss in timber working	351, 353
„ „ Loss of public credit	354
„ „ The timber leases	354
„ „ Bright side of	348, 356, 357
„ „ A forest loan	355
„ „ What to do	355
„ „ Blackwood and Blue-gum nearly all destroyed	356
„ „ some of the best forests not yet alienated	357
„ „ Public opinion *re* forestry	357
„ „ enterprise in working the timber	357
„ „ and Tasmanian manhood	357
„ „ Arboriculture in Tasmania	358
„ „ Roadside trees in Tasmania	358
„ „ Trees of the field—their profit to the farmer	358, 359
„ „ Trees in towns of Tasmania	359
„ „ General Summary	360
„ „ Federal Forestry for Tasmania	360
„ „ Tasmania can grow exactly the timber now imported	361
Tasmanian Oak—a furniture wood—rather better than English Oak	334
Tea-drinking and forest fires	24
Temporary employment—putting the wild forests into order	207
Tenure—A strong forest	16
„ Fixity of—for the demarcated forests	16
Text-book of Australian forestry wanted	161
„ of extra-tropical arboriculture	161
Thinning—Uselessness of book rules	132
„ and "cleaning-up"—doubtful expenditure	72
„ doubtful in Victoria	72
Three classes of forest—Australia's choice	110
Thunbergii-Pinus—Japanese Cluster Pine	262
Timber working—No timber working without a "Working-plan"	97
„ „ in South Africa	99
„ „ Horses, Mules, Oxen, Buffaloes	115
„ „ in each State	181
„ „ at present gives little employment	207
„ „ in the organised forest and other workers	376, 380
„ „ Cost increased by Government neglect	380
„ „ and timber grants in Western Australia	221

	Page
Timber tests—Mr. Julius'—should be completed	233, 237
Timber bill of Australia, three and a-half million pounds	168
„ England, 43 million pounds	168
„ South Africa, one and a quarter million pounds	168
„ Germany	169
„ Australia increasing to six million pounds	169
„ One year's—would plant all the ground required to grow the timber	179
„ Growth of	187
Timbers of Western Australia and Julius' tests	220 to 238
Timber "stands" in Australian and cultivated forests of Europe	103
„ Australian—imported—cost of	167
„ „ failure of home supplies now occurring	171
„ „ statistics of—worked in the forest and net forest revenues of each State	182
„ exported to countries outside Australia	182
„ Bulk of the imported and Australian—in cubic feet	184
„ Australian—for home use and export	184, 185
„ „ home production of	184
„ „ and tan bark tariff	185, 190, 192
„ famine may find Australia left without resources	191, 192
„ cheap imported taking the place of superior home timber	197
„ Greater use of Australian	199
„ regulations of Western Australia	220
„ grants—ten years—Western Australia	221
„ requiring to be felled out of season, West Australia	222
„ of Western Australia, weight, heaviness and strength	227
„ cutting on the quarter	226
„ inflammability	234
„ A printed pamphlet on Australian	238
„ Waste in	375
„ Queensland—good system of selling	292
„ Low prices in Victoria forests	322
Time to fell	229
Torulosa-Cupressus—Himalayan Cypress	252
Tourists—Australia—best part now closed to	63
„ Forest cottages and	64
„ and forests	64
„ and organisation of the forests	63, 319
„ and roads in Victorian forests	319
„ traffic—Tasmanian loss of	352
Tourism	64, 352, 371
Towns—Tasmanian—Trees in	359
Tozae Oak—*Quercus tozae*	266
Training of junior forest officers	140
Transplants in dry country	130
Treatment of Mallet bark	240
Trees of the field	62, 268
„ money in extra-tropical planting	268
„ distribution to public—163 nurseries and six million trees, South Africa	271, 273
„ Queensland—three valuable ones nearly extinct	296
Trinity of fire-protection	22
Tropical Australia—no official statistics	15
Trouble—Special—in Australian forests from politics	194
Tuart—*Eucalyptus gomphocephala*	88
„ Special protection for	88, 223
Turpentine—industry and population	79
„ and resin	185
„ and oil imports	378
Two trees planted where one grew	165
Twenty per cent (20%) standard—98 million acres reserves	13

U.

Unemployed	201
Useful trees for planting in Western Australia	246 to 266
Use and improve the forest	166

V.

Page

Vermin—Less abundant in Australian forests when they are organised 68
„ South African—proposed introduction 17 years ago to destroy rabbits 406
Virgin forest—The idle capital represented by the 6, 190
Victorian forestry—Demarcation best in Australia 31
„ „ Mischief caused by forest fires 31
„ „ Ill-balanced expenditure 218
„ „ Historical 312, 313
„ „ A sound public opinion on 313
„ „ Past errors of 314
„ „ Big trees 315, 316, 317
„ „ Doubtful thinning 317
„ „ Requires organisation of the forests against fire 323
„ „ The " double-barrelled " Annual Report 320
„ „ wants 20 times more Softwood planting 320, 321
„ „ Low prices for timber 322
„ „ A new era in 321
„ „ Revenue and expenditure 323, 324
„ „ Yield of the State forests 322, 324
„ „ and arboriculture 327
Victorian and Tasmanian forests—a contrast 323
„ Conservator on clear-cutting 75

W.

Walnut—*Juglans regia* 254
Warping of timber 322
„ „ forest—at Melbourne 324
„ holding power of forest humus 325
Water conservancy and fires 34
Waterproof preparation for forest cottages 51
Wattle plantations in South Africa 112, 402
„ „ in Australia 112
„ bark tariff 192
„ plantations easily destroyed 365
„ bark in Tasmania 347
„ Natal Black—a field crop 366
„ *See* also " Tan bark " 111, 114, 184, 185
Wealth in extra-tropical trees 384
in trees—lost in Queensland 293, 300
Weeding—The " cut and mulch " system 131, 385
Western Australia—National Park of 9
„ „ Planting area of 30in. rainfall 136
„ „ Energetic timber working 98
„ „ Forest finance in 217
„ „ The timber regulations of 220
„ „ A forest Act wanted 220
„ „ Board of Forestry 220
„ „ Undue tax on sawmillers 221
„ „ Timber grants of 221
„ „ auction sales of timber 222
„ „ Log measurement 222
„ „ Regulation requiring timber to be felled out of season 222
„ „ Felling areas 222
„ „ Areas of mill sites 222
„ „ Free forest destruction for a Government Department 223
„ „ Unnecessary restrictions in forest working 224
„ „ Timbers of 243
„ „ Sandal; value £60,000 export 241
„ „ Sandal of India compared to 246
„ „ Some useful trees for planting in 246
„ „ has lost less over bad forestry than the Eastern States .. 280, 364
„ „ Forestry in 280
„ „ has only half the normal proportion of timber forest 280
„ „ Faulty forest finance of 282
„ „ A forest policy for 283
Westminster Hall—Karri beams for 238

	Page
Weymouth Pine—*Pinus strobus*	199
White beech of Queensland—*Gmelina Leichardtii*	296
White ants in Australian forests: absent Cape and Tasmania	367
Whyte Park—finest pine-planting in Australia	287
Wide roads—waste of—in Australia	54
Wild forests—Low yields of	110
„ Pinchot, on the idle capital of	109
„ The poor—of Australia and valuable cultivated forests of Europe	163
„ Capital required to organise	210
Wirrabara plantations—South Australia	286
Wives of Foresters' and the Forest Station	53
Works and salaries—Forest expenditure on	214
Worked timber—Australian royalties only quarter the £0·01 standard	92
Working of the forest improves it	165
„ „ Queensland	295
„ Tasmanian—loss in timber	354
„ „ enterprise in timber	357
"Working-plans" and forest management	69
„ „ in Russia—large expenditure on	70
„ „ in Japan—work accomplished	70
„ „ No cutting in Australian forests without some sort of "Working-plan"	97
„ „ for private forests—Government help in	278
Wandoo, White-gum—*Euc. redunca*	87
„ special protection for	223
Worcester—Dry country plantations in South Africa at	90

Y.

Yate and the minor timbers of Western Australia	86
„ twice as strong as Victorian Redgum and weight for weight stronger than iron	235
Yield of plantations in South Africa	399
„ of the "wild" and "cultivated" forests in South Africa, America, etc.	110
„ of Australian forests—Present low	110
„ of the Victorian State forests in 1913	213

By Authority: FRED. WM. SIMPSON, Government Printer, Perth.