FORESTS DEPARTMENT WESTERN AUSTRALIA

AUSTRALIAN FOREST RESOURCES AND THEIR ASSESSMENT

with special reference to the

FOREST INVENTORY OF WESTERN AUSTRALIA

by

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AUSTRALIAN FOREST RESOURCES AND THEIR ASSESSMENT WITH SPECIAL REFERENCE TO THE FOREST INVENTORY OF WESTERN AUSTRALIA.

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1. Summary.

The paper questions the amount of data which is needed by the Commonwealth and other authorities and proposes direct financial assistance to the States for the provision of maps and data. A brief explanation of Inventory work, in the eucalypt forests, as it has been covered in Western Australia, is given, and a plea for uniform adoption of South Australian Site Quality mapping methods for pine plantations is made.

2. Policy Questions and Finance.

The 1959 Australian Forestry Conference proposes to deal mostly with Forest Policy. It is pertinent, therefore, to ask some questions under the heading of financing the Inventory.

The States which have Fiscal Autonomy under the Australian Constitution finance and manage their own forests and therefore may wonder, - Why are we asked for management details of our forests? To whom are they of use? To whom are they given and if to F.A.O. and other countries, why?

If the facts, which we from the States supply, are used to any advantage to the State or to their forests, we might ask to be shown how they are used and if detailed statistics are really needed by the Commonwealth, why do we not get direct financial assistance towards the production of these facts, particularly perhaps by the use of R.A.A.F. 'planes for photography and army co-operation in forest mapping?

If detailed statistics are to be collected, bound, printed and stored in the archives of the Commonwealth, who is to have access to these, and is it sound policy to have such facts available to the Trade and to other countries who may be future enemies?

One may be terribly frank in saying that the State receives virtually no assistance from the Commonwealth in the matter of collecting Management data, although of course some useful assistance is received under the headings of Research and Forest Products.

Foresters normally expect to be provided with maps from other authorities, but due to the lack of suitable maps, the Forests Department of Western Australia, and no doubt others, have perforce had to build up topographical and vegetation maps over the past decades and to continue to expand and revise this work.

The maps produced serve not only Forestry, but also many other spheres of public and private enterprise, and are even called upon by the Army when training in forest country, as there are no other maps of a large portion of forest and Crown lands. Over millions of acres in Western Australia these are the only maps of any value to war operations.

Substantial subsidies are being paid by the Commonwealth to the Lands Departments of the States for the production of various types of maps of military and economic use. So far in W.A. these have been outside the Forest Zone, and there would appear to be a sound case for a direct subsidy to Forest Authorities for maps produced by them, both topographical and vegetational.

This mapping is, of course, a first essential to a forest inventory and should be recognised as work of national value, apart from its value to the State Forest Inventory.

Kessell (1) has supported the view that some of the revenue from the tariff from timber should be returned to the States as a stabilising fund, and the writer now points out a specific field for payment for work done.

In short, the forest mapping and inventory of Western Australia depends upon State officers and State finance, and if the Commonwealth really needs details it is fair that the work should be subsidised in the same way as National Mapping.

3. Development of Forest Inventory Methods in W.A.

A Forest Inventory, perhaps particularly of a eucalypt forest, is not an undertaking which is completed, but a continuous work of building and correcting data. At best, the inventory can be but a stocktaking and forecast for a forest area at a specific date and under specific definitions, as interpreted by workers at that date.

The Inventory of Western Australia commenced seriously about 1920 under the direction of Lane-Poole, then one of the few professional foresters in Australia, and over four decades been carried on by various methods.

Up till about 1940 the strip assessment method on about a 2½% basis was used, but generally such assessments were not of long-term value, due to the booking of only those logs then considered to be merchantable and to the lack of a uniform school of thought amongst assessors.

In 1940 permanent line assessments were commenced, with a view to more accurate records and as a basis for growth studies. This work continued until 1953, but proved abortive, due again to the difficulty of uniformity by assessors and to a misconception as to the staggering extent and cost of such work. Some 661 miles were established, cost rising as high as £40. per mile, but still no real picture of the forest was obtained.

The use of air photos to stratify the forest was commenced about 1945 and soon proved to be the most likely method of obtaining quick and better results.

By 1951 when a conference of Management Officers from the State and Commonwealth was held in New South Wales, fairly definite methods had been decided in Western Australia, and the work of stratifying the forest from that date proceeded rapidly, to the present stage where approximately half-a-million acres per year is carried out by a small staff, with sampling in the field by three teams of assessors, whose standards are kept consistent by frequent visits from Working Plans officers and liaison with treemarking and log landings.

Typical photo marking,
Western Australia.

Jarrah and Karri forest.

Note: Species only (without classification of height and density) are shown on this block.

Scale approx. 1:15800.
20 chains = 1 inch.

4. Methods now in use.

The essential differences between the assessments now made and those of the past are that small plots or lines are used to sample areas of forest previously type mapped (or stratified) from air photo studies. With relatively few assessors a uniform standard is attained and all possible information, including even dead trees and regrowth notes, is recorded. A specimen page of one of the field books used is attached to illustrate data recorded, together with illustrations of the type of photo and the Type Map produced.

It has been found possible in Western Australia to adhere fairly closely to the decisions made by the 1951 Conference which resulted in general agreement between States and the Commonwealth to follow broadly the lines of the F.A.O. Inventory - Ref. F.A.O. Forestry and Forest Products Studies. No. 1. Planning a National Forest Inventory; J.D.B. Harrison, 1950.

Following the 1951 Conference, a brochure was published by the Commonwealth Forestry & Timber Bureau. Ref. National Forest Inventory - Plans, Forms and Definitions. Forestry & Timber Bureau. 1951.

The method accepted for assessment of Australian Forest Resources was briefly based upon air photo interpretation and a stratification by height and density classes. This method, with slight adjustments, has been found satisfactory in Western Australia for virgin forest. Height classes adopted were:-

Class I.	170' and over
II.	130-169'
III.	90-129'
IV.	50-89'
V.	10-49'
VI.	Under 10'

In Western Australia the classes used are:-

Jarrah, Wandoo, etc.		Karri, Tingle	
Class A+	110'-130'	Class A	Over 170'
A	90'-110'		
B+	70-90'	B	130'-170'
B	50-70'		
C	Under 50'	C	Under 130'

Thus, a symbol K.A.2 would mean karri forest of over 170' co-dominant height and of density 2.

Stratification of second growth forest provided some problems, but after considerable research it has been found possible to follow the general stratification specifications, but particular attention has to be given to percentage of crown cover of the various strata in the stand structure, and where an upper strata crown cover percentage exceeds 40%, more intensive field sampling becomes necessary.

In Western Australia, it has not been possible to base the inventory on Military Map sheets, as coverage is not available for the major forest areas.

For practical purposes planning sections have been adopted as the basic units of inventory, but all data is collected in such a form as to be readily summarised in accordance with National Forest Inventory requirements. What those requirements really are has been discussed in the opening paragraph.

Field sampling is based upon stratification by height classes as mentioned, and field trials showed that with a sampling intensity of 0.3% of net forest area, sampling errors of $\pm$ 10% gross volume are obtained for each stratum. Standard tables are used for volume determination in the field to reduce subsequent office work.

5. Extent of Work Covered in W.A.

Area photographed	9,829,000 acres
Balance required flying	6,170,000 "
Area standard mapped	5,488,000 "
Other sketch mapping	901,000 "
Area covered by Class 1 assessments	3,300,000 "

Apparent discrepancies in figures of this nature are due to -

(a) Flying must be done over large areas of private property to include State Forest areas and to get information re private property.

(b) Although "standard mapping" may not be done, some areas do not warrant the expense.

Sketch mapping is sufficient for some areas with low forest potential.

(c) A reasonable Inventory does not have to await the standard mapping of the whole 16 million acres which will ultimately be flown and of which perhaps 8 million acres will need standard mapping for greater precision.

Reference to blue prints below.

Blue print A - page 9.

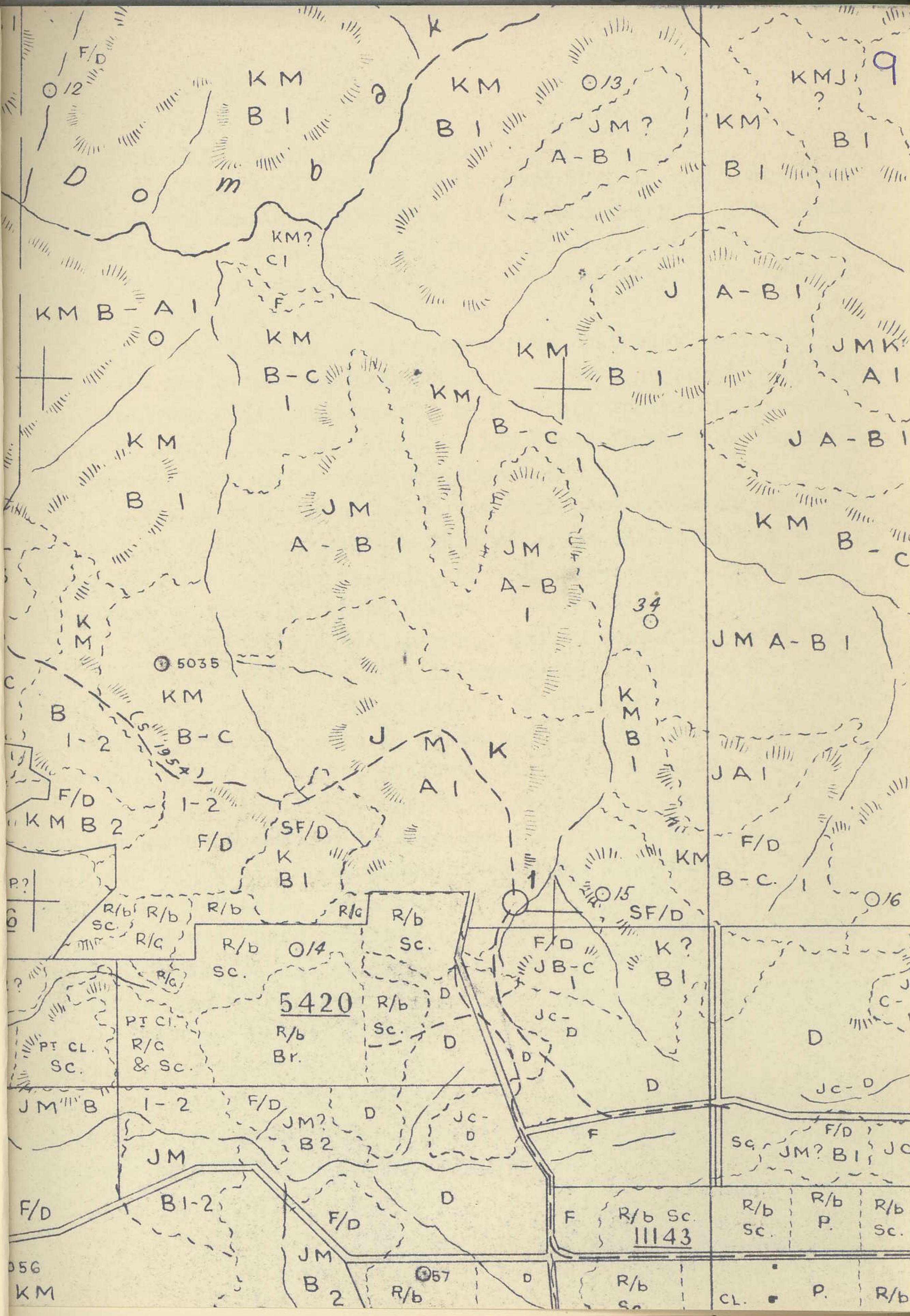
Blue print at 20 chains to 1 inch shows typical pattern of karri-jarrah-marri forest. When coloured, of course, the types are more readily seen.

Private property on this print is recognised by boundaries and location numbers shown.

This type of map provides useful topographical data, as well as types.

Blue Print B - page 11 (Greystones)

This shows a typical "Site Quality" or "Productive Index" map at 10 chains per inch of a pine plantation. The pattern of Site Qualities is seen to be complex, as is the soil pattern in Western Australian plantations.


9
F/D
12
KM
BI
Dombe
k
KM
BI
13
JM?
A-BI
KMJ
?
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BI
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KM B-AI
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JM
A-BI
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A-B
I
JA-BI
KM
B-C
JM A-BI
34
KM
5035
KM
B-C
KM
B
1-2
KMBI
J M K
AI
JAI
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F/D
SF/D
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BI
KM
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15
16
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P.?
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R/b
R/c
R/b
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& Sc.
R/b
Br.
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Sc.
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JM
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2
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D
R/b
CL.
P.
R/b

6. Pine Plantation Inventories.

The use of Air Photos at 1:15800 R.F. in the indigenous forests proved so successful that it was thought that they could be used for pine plantation S.Q. mapping and in 1951 the writer mapped the plantations, about 10,000 acres at that time, from photos and field work.

It was rapidly seen, however, that although photos at this scale and even at 1:8000 could be used to separate qualities in a broad way, site qualities 1 to 4 (South Australian measure) had to be lumped into one class called "Good Forest" or "Fair Average Quality", which term was adopted.

The maps prepared by this method proved useful and were rapidly and cheaply produced. They provided the basis for a number of years for the planning of thinnings, etc. and for the assessment of the plantation asset.

In 1955 it became apparent, due to marketing questions, that a more detailed site quality knowledge was desirable, particularly with P. radiata, which gives, in the best qualities, phenomenal yields of up to 12 loads (600 cu. ft. O.B.) M.A.I. per acre, and in the worst quality, virtually nothing.

It was therefore decided to prepare S.Q. maps by more detailed ground work and to this end the writer, and later Mr. F. J. Campbell, visited South Australia to study the methods used by Mr. N. Lewis. Ref. (2) (3).

It was found possible to adopt with slight adaptations the Site Qualities and methods of South Australia for both the P. radiata and P. pinaster plantations of Western Australia.

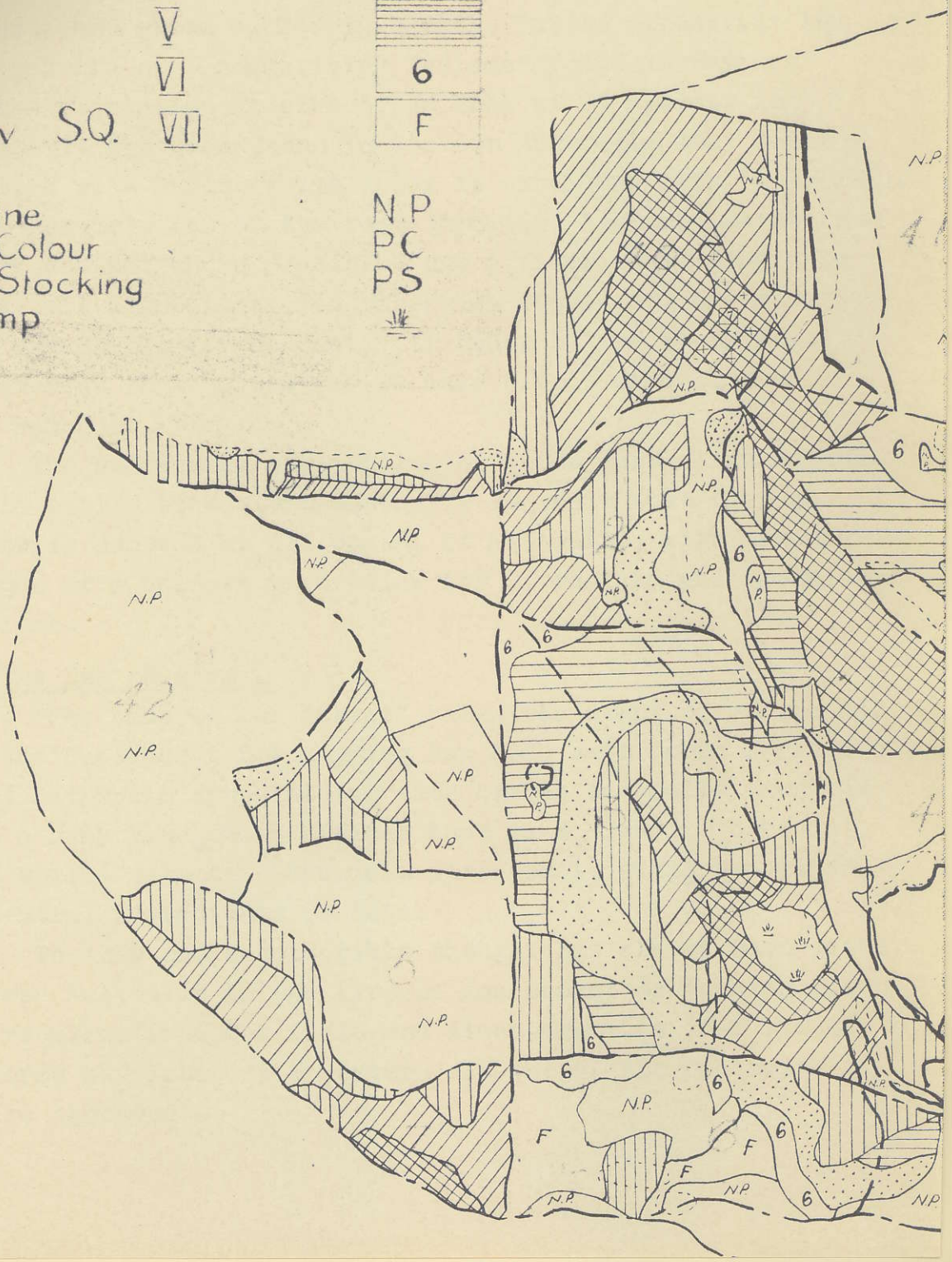
Following this decision to adopt South Australia's "Productivity Index" method and strata, the approximate 20,000 acres of Western Australian plantations were mapped in 1957, and these maps and yield tables were used to produce reasonably accurate 10 year plans for thinnings.

LEGEND

Site Quality I
II
III
IV
V
VI
Below S.Q. VII

6
F

No Pine N.P
Poor Colour PC
" Stocking PS
Swamp



A regular system was inaugurated to map all compartments as they came of an age to make this possible. Under Western Australian conditions this is considered to be P. radiata 9 to 10 years, P. pinaster 15 to 20 years.

It is not considered necessary in this paper to repeat the methods and yield tables in detail, but to illustrate the complex pattern of "Productivity Indices" found in Western Australian plantations a plan of an area of P. radiata is attached. It has been found in Western Australia that soils correlation with Productivity Index is excellent with P. radiata.

Possibly one of the most important lessons learnt from this work is that where possible, one officer must adjudicate types at all plantations, as otherwise local officers always tend to use S.Q.I. (or Productivity Index I) for their best areas, whereas these areas may be only S.Q. 3 or 4 on the adopted schedule.

The successful application of South Australian methods and yield tables to Western Australia suggests that they should be uniformly adopted by all States of Australia, with the obvious advantages of a uniform yard stick for P. radiata and P.pinaster plantations.

7. The Use of Forms.

The "man in the street" hates the sight of a form and blames the Bureaucrat for dogging his life with forms for him to fill in, but while sympathising with him as one walks down the street, a busy Management Officer must find a way to have reports boiled down to consumable size, while still containing the essential ingredients or data.

To this end considerable thought has always been given in Western Australia to the type of Assessment or Working Plan report required from the field and since examples of a few of these forms may interest foresters elsewhere, the following forms are appended -

(a) Field book used for initial assessment by specially trained assessors in virgin or near virgin forest. (Other types are used for forest where the constitution of the forest is largely affected by trees below 60" G.B.H.

(b) Land inspection form as used by relatively untrained personnel to report on forest areas.

(c) Form 420, which is the first summary of a Working Plan area which reaches the Management Branch.

(d) Form 420 (c) which sets out the Working Plans Officer's views on the life of a permit area.
These view are of necessity very brief and are, of course, supported by other data sheets.
It is claimed that the main virtue of this form is that it enables a Superintendent to see briefly whether a permit area has a large excess or deficit of forest.

REFERENCES:

1. Kessell "Forestry Finance". Institute of Foresters Second Conference, Canberra. A.C.T. September 1958.

2. N. Lewis. Permanent Sample Plot Practice in South Australia. Australian Forestry Vol. XVIII No. 1. 1954.

3. N. Lewis. Management for Sustained Yield of State Pinus radiata plantations in South Australia. British Commonwealth Forestry Conference 1957.

Chains.	Forest Type.	Codom Height.	Loads Marketable, J., K., etc.		Loads Removed J., K., etc.	Loads not marketable over 60 in., J., K., etc.			N
			60 in. to 90 in. J. 60 in. to 108 in. K.	Over 90 in. J. Over 108 in. K.		Standing Green.	Standing Dead.	Fallen trees last 10 years.	Pot Marketab Over 60 in.

Loads. Not Marketable over. 60 in.	Notes Re Undergrowth.	Notes on Fire Damage.	Piles and Poles over 50ft.	Notes on Forest Stocking.	Soil Type.	Topography. 10 chains = 1 inch.

LINE No..... ZONE.....

Date..... Assessor's Signature.....

1218/10/55—500 Bks.

FORESTS DEPARTMENT.

Form F.D. 8[illegible]
(Revised June, 193[illegible])

Field Officer's Report on Application for Land.

Forest District..... *Land District*.....

and Location No..... *H.O. Corr*.....

Plan No. { *Lands*..... *Total Area reported on—Approx*.....acres.

Forests..... *Area applied for*.....*acres, by*.....

1. What past cutting has taken place ? ....

2. Is remaining timber recommended for hewing or milling ?

   (b) Estimated royalty value per load ....

3. If accessible to existing mill, give particulars and probable year when mill will be obtaining logs in locality.

4. Value for Departmental or Government requirements (sawmill site, overseer's quarters, etc.). Particular attention should be paid to water supply requirements.

5. Was applicant present during inspection ? ....

6. Is the applicant, to your knowledge, the holder of or interested in any adjacent properties ? If so, give Location Nos. ....

7. Are you prepared or in a position to recommend any area in lieu of that applied for ? ....

If so, a *complete additional report* on such area is required, and statement indicating whether applicant is aware of proposal, and whether acceptable to him.

RECOMMENDATION.	Approximate Area. Acres.	Shown on Plan No..... BORDERED as under :—
(1) For immediate alienation		
(2) Alienation subject to marketable timber being reserved to Crown		
(3) Reserved until marketable timber removed		
(4) For permanent dedication as State Forest		

GENERAL REMARKS (including notes regarding nature and value of any improvements) :—

COMMENTS AND RECOMMENDATIONS BY OFFICER FORWARDING TO HEAD OFFICE.

Types of Forest, Scrub, Swamp.	Indicated as under on Plan I.	Approx. Area. Acres.	Estimate of Loads per acre in round (full volume measure).			Quality of Timber. (Standing and Removed.)	Po
			Over .....girth.	Under .....girth	Removed.		
barked							
ed for Cultivation							

Plan I.—Type Map.

N

d.)	BRIEF NOTES ON. Poles and Piles.	Saplings and Advance Growth.	Understorey and Ground Vegetation.	SOIL TYPES. Descriptive Note.	Indicated as under on Plan II.	Remarks.

15

Plan II.—Soil Map.

N

Date..... Signature.....

Attention of officers carrying out land inspections is drawn to the following points :—
(1) Volume of dead, damaged, and over-mature trees is frequently of importance in arriving at a proper idea of the quality of the forest and its value for reforestation, and in such cases this information should be included in the report.
(2) An effort should be made to qualify such descriptions as "poor," "good," "open," "sparse," "scattered," "dense," by stating average heights, number per acre, etc., by figures in brackets following the descriptive name.

Signature of Field Officer making Report.....

Forwarded through.....

Form 420 A 1959

TO MANAGEMENT.

From W.P.O. .....
Date .....
File .....
Permit or W.P.A. No .....

REVISED WORKING PLAN DATA.

Replacing preliminary/revised report dated .....

1. Gross Area

2. Location (attach sketch)

3. Tenure

4. Loads per Acre for Forest Types.

Type	Loads Marketable			Loads Un-Mkt. ≤60"		Marri >60"		Removed	
	36-60	60-90/108	Over 90/108	St.G.	St.D & F.	Pot. Mkt.	Un-Mkt.		

5. Volume-Area Statement using figures from 4.

Type	Area	Loads Marketable				Lds. Unmkt. >60"	Marri >60"		Total Unmkt.
		36-60"	60"-90/108	Over 90/108	Total		Pot. Mkt.	Un-Mkt.	
Totals									
	Total Marketable over 60"				lds.				

6. Average loads/acre removed for past 5 years. .....lds.

7. Estimated % of Marketable Volume over 60" which mill would take at present time .....% .....lds.

Signature .....

This report accompanies Form 420C and Support Sheet dated .....

Form 420C. 1959.

PERMIT NO. ..... NAME .....

1. Area ..... acres.

2. Gross loadage over 60" including marri. ..... lds.

   Marri over 60" ..... lds.
   Non-marketable jarrah or karri ..... lds.
   Total non market-able ..... lds.

3. Total loadage marketable jarrah or karri. ..... lds.

4. Permissible cut. .....

5. Average intake over last 5 years. ..... lds.

6. Remaining life without considering growth -
   (a) Remaining life on jarrah or karri at Permissible Intake. = ... yrs.

   (b) Remaining life on Actual Intake = ... yrs.

7. Additional life considering growth -

   (a) Allowing % M.A.I. on trees over 60" G.B.H. = ... yrs.

   (b) Additional life allowing % M.A.I. for half of period on trees 36" to 60" G.B.H. = ... yrs.

   Volume estimated .....

   (c) Additional life if 50% of marri can be used. ..... yrs.

   Total life before trees now under 36" G.B.H. need to be considered. = ... yrs.

8. For information. -
   (a) Mill commenced .....
   (b) Estimated date to end first cycle .....
   (c) Total volume removed to end December 1958. ..... lds.
   (d) Total area cut over to December 1958 (Include treeless areas in (d)) ..... acs.

Signed .....W.P.O. .....

Date .....