Bulletin No. 54.

Western Australia.

FORESTS DEPARTMENT.

FORESTRY

in

WESTERN AUSTRALIA

with notes on the

PRINCIPAL TIMBERS.

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Issued under the authority of
The Minister for Forests,
The Hon. A. A. COVERLEY, M.L.A.

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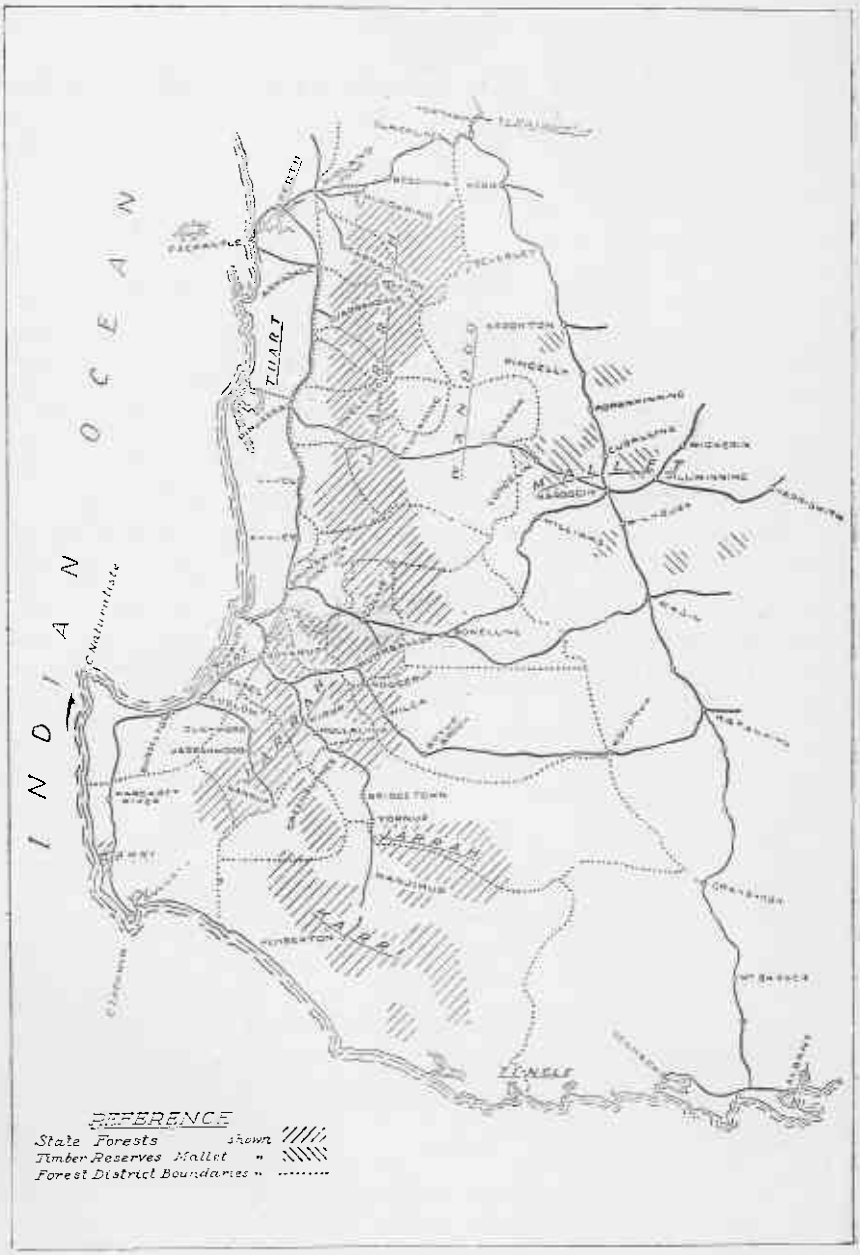
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State Forests shown
Timber Reserves Mallet "
Forest District Boundaries "

Forestry in Western Australia.

TREES AND HOW THEY GROW.

Trees differ widely in appearance, size, bark, leaves, wood, and characteristics of growth. They may range in height from a few feet, as for instance the sandalwood tree, to forest giants of 281 feet, the tallest measured Karri, 364 feet the tallest Redwood of California, and 417 feet for the Douglas Fir of the United States of America. The famous Chestnut tree at the foot of Mt. Etna is quoted by the *Encyclopedia Britannica* as having a girth of 190 feet in 1780. The Banyans, which have many trunks, spread over a wide area.

The tree with the greatest volume is the Big Tree, a sister of the Redwood. One of these, called " General Sherman," has a volume of over 50,000 cubic feet(1). Trees may have flowers which are large and fragrant, or scentless and so small as to remain unnoticed ; they may have huge leaves, one of which would cover a man's body, or wee ones only the size of his thumb nail ; bark nearly a foot thick or else of paper-like quality ; and soft, tearable wood or a hard, dense timber which no nail can pierce. Some species may live only half a century, and others for three thousand years. Different as trees may be in size and structure, however, they are all alike in requiring food, air, and moisture, in order that they may grow and reproduce their kind, and they show their best development when forced to struggle for supremacy with other trees.

Trees develop from seed which, packed in a protective covering, fall from the parent tree. No matter how small this covering or seed vessel may be, there is contained within it a tiny tree with the beginnings of root, stem, and leaf already formed, as well as a supply of food derived from the parent tree on which it lives and grows in its early stages. If the seed reaches moist earth with sunlight above, the conditions are ideal for germination. From the soil water soaks into the seed after which it swells and bursts its covering. Oxygen diffuses through its tissues and a number of chemical changes take place which promote the growth of the seed. Soon the delicate first root goes down into the soil and the heat derived from the soil and air, together with the energy set free from the chemical changes, enables the seed to continue its growth. The bud is pushed out next and the minute leaves of the embryo plant unfold. These are at first pale coloured, like the root, but soon turn green by reason of the presence of a pigment called chlorophyll.

As soon as the young leaves turn green the plant ceases living on its stored food, and a new chemical process begins, by which water and chemicals in weak solution from the soil and carbon dioxide from the air are decomposed, producing sugar and oxygen on which the plant lives and grows. This process is called photosynthesis and can only take place in light, for light is its energy source. The power

(1) The measurements quoted above, except for Karri are from Tiemann, H. D., "What are the Largest Trees in the World?" *Journal of Forestry*, Vol. XXXIII., No. 11 1935.

of leaves to absorb and use the sun's rays makes it possible for plants to produce food from the surrounding elements. The sugar formed in the leaves moves to other parts of the plant and forms other foods while the oxygen escapes to the surrounding air. In addition to taking in air and moisture to make food for itself, the leaf uses the sun's energy to transpire or evaporate water. The amount of water given off by a mature tree through transpiration is enormous.

As the plant grows it continues to take in carbon dioxide from the air and water and minerals from the soil, and makes its own food supply from the combination. Most of the water is lost by evaporation through the leaves, but the mineral substances contained in it remain and help to form the tree's food. As the seedling tree grows and branches, it forms a root system extending through the soil, and boasts a crown of leaves raised on a stem and exposed freely to light and air. Water and salts from the soil move upward through the roots, stem, branches and leaf veins and supply all living parts. The sugars and other substances formed in the leaves move downward. From the sugars other necessary foods, such as fats and proteins, are made and go to form the tissues and structures of the tree. Thus the tree grows year by year in diameter and height, puts forth branches, and is at last ready to produce seed for the perpetuation of the species.

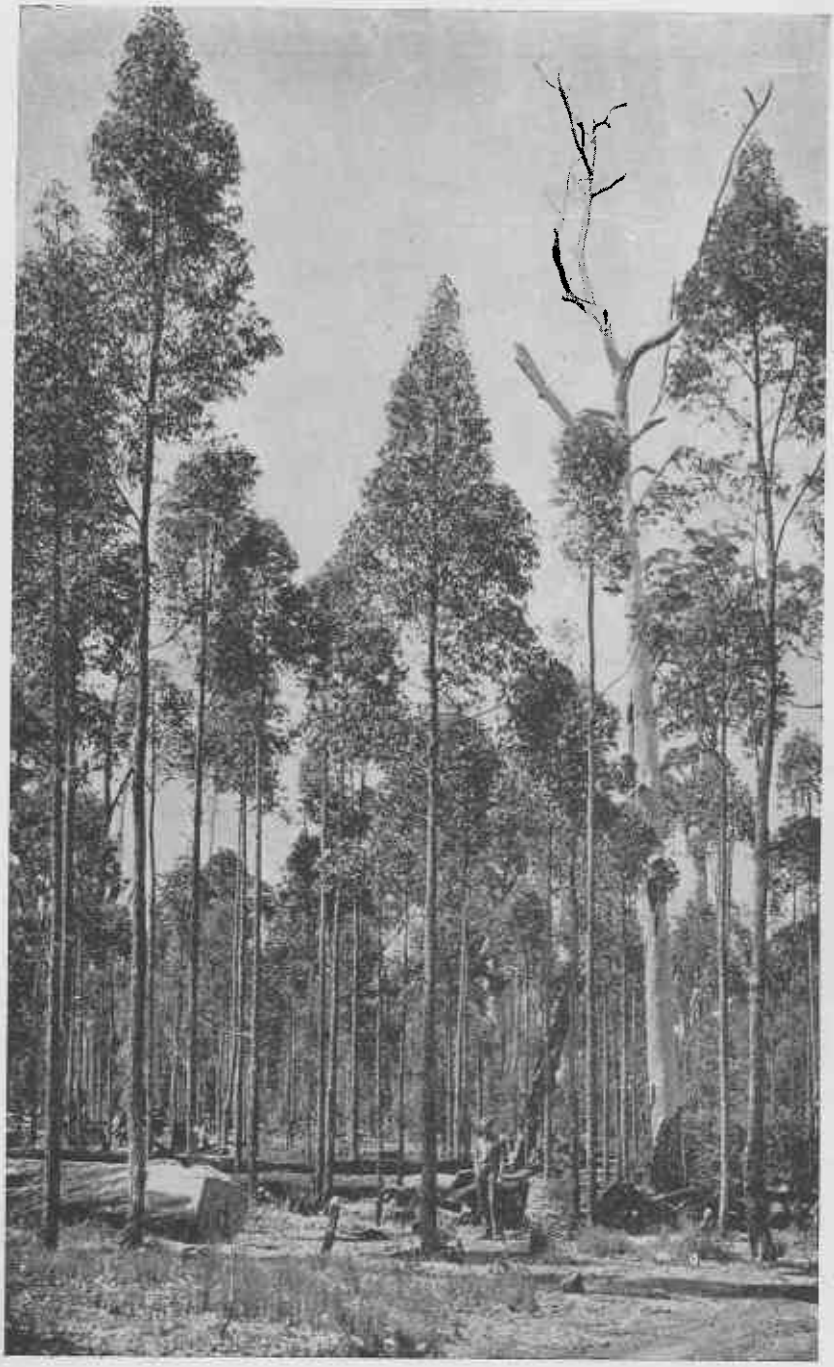
For some years all the wood throughout the trunk of the young tree helps to conduct sap and is consequently called sapwood. Then there forms an inner cylinder of harder, darker wood in which the living elements have died, and which is used now to give support and strength to the trunk. This is known as the true wood, and increases in thickness throughout the years of growth of the tree until, at maturity it is ready to provide the lumber of commerce.

VALUE OF THE FORESTS TO MANKIND.

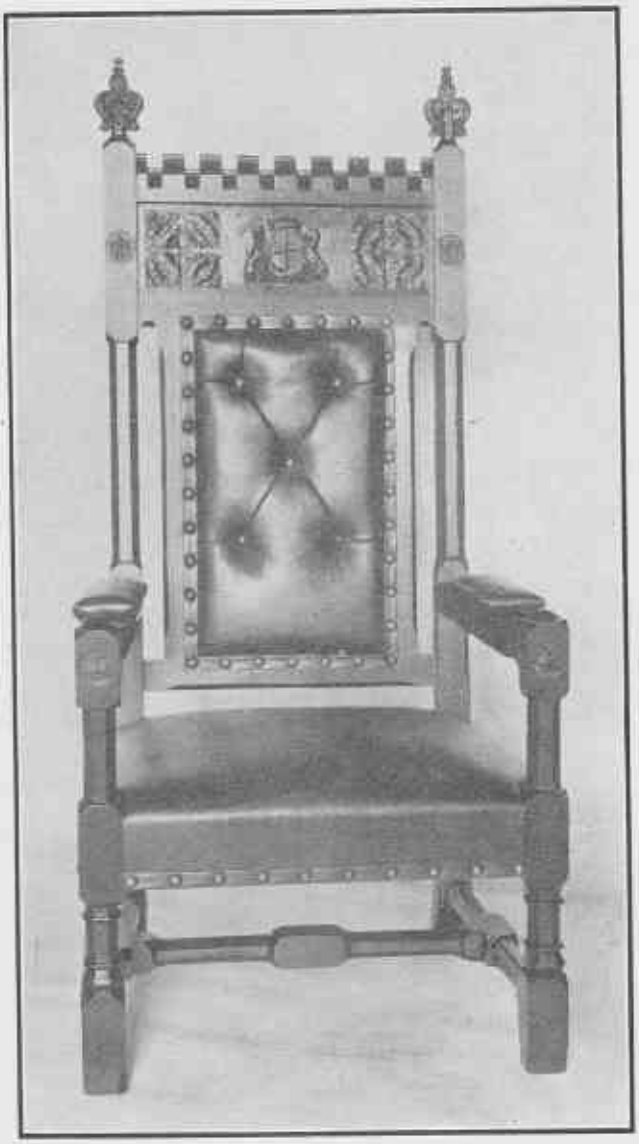
Forests have always, in innumerable directions, been of use and benefit to mankind. They have provided a place of refuge, a shelter from the tropical sun, a source of game and vegetable food, and a protection and regulation of the streams which provide the water supplies of the world. They serve as windbreaks for crops and have proved a boon in many seaboard countries by fixing areas of shifting sands which would otherwise have moved across the land, destroying farms, roads and villages.

But the chief function of the forest has been to provide man with wood and other products for his every need. There is no material more intimately connected with man's welfare than wood. Without it life would be unendurable. Without forests man could never have emerged from primitive barbarism ; he must for ever have remained a cave-dweller. Without timber he could have crossed no great stream, nor traversed the ocean. He would have been condemned for ever to entire ignorance of the lands and peoples beyond the seas which washed his own shores.

For hundreds of generations man has been using wood for all the general purposes of life and, though many substitutes have been invented, the present-day consumption of timber is greater than ever before. We build our houses either wholly or partly of wood, use wood to decorate them, furnish them, and warm them.



Jarrah Saplings following regeneration operations, Dwellingup District.



JARRAH CHAIR

(presented to the Empire Parliamentary Association by the Government of Western Australia, for use in the House of Commons).

This chair shows the suitability of Jarrah for high-grade cabinet and carving work.

Or, if coal, gas or electricity be used as fuel, wood has been employed in the production of that fuel. Our homes are filled with innumerable wooden articles. We are rocked in wooden cradles, play with wooden toys, sit on wooden chairs and benches, eat from wooden tables, use wooden desks, chests and trunks, listen to music from wooden instruments, read newspapers made from wood pulp, printed with ink made from wood, and wear clothes fashioned and dyed with wood and wood products, and when we die we are buried in wooden coffins. Without wood, all the necessities and comforts of civilised man would disappear.

Nor is wood the only gift of the forests. They teem with minor products which are almost as important to man's well-being. From the leaves, bark, and fruit of trees come many well-known medicines; a number of trees exude gums and resins which are useful in making tar and pitch, the "naval stores" used in shipbuilding and repairing, varnish, soap and such commodities; rubber, the use of which has increased a hundredfold since the introduction of motor transport, is derived from a tree, and the wood, bark and gum of certain trees produce the tanning materials and dye-stuffs universally employed. Western Australia has developed Myrtan, a product of Wandoo timber. The millions of newspapers produced in the world each hour are made from wood pulp, as are the various types of paper, cardboards, wallboards, etc. The influence of war conditions is responsible for further development in the field of wood use. "Improved" wood, made by compression of wood after filling the pores with phenolic resins, has become a material with a wide variety of uses formerly filled by metals.

Rotary peeling of logs to provide veneer for plywood manufacture has with modern treatment of the ply, particularly waterproofing and for some purposes compression, yielded materials from which are made the world's fastest aeroplanes, speedboats, aeroplane propellers, etc.

Cellulose and its derivatives yield artificial silk, modern non-inflammable cinema films, components of duco, and a multitude of other products.

Timber is unsurpassed as a crating material and though the public generally may not appreciate it, wooden boxes and cases protect a wide variety of materials from tinned liquids and foods to soft fabrics and fruits. About one-third of the timber output of the United States (50 per cent. during the war) and one-fifth of that of Australia (30 per cent. during the war) is used for box-making. Western Australia uses four million boxes a year.

In fact, if we look around us, we find that every hour of the day we are dependent on wood or other forest products.

WORLD'S TIMBER SUPPLIES.

Primitive man and all the early peoples of the earth, finding large forests of virgin timber ready to their hands, naturally thought that the supply of wood was inexhaustible. They hacked, burned, and destroyed huge areas of woodlands in the belief that this free and plentiful gift of nature would always replenish itself in a degree commensurate with their depredations. As the centuries passed and populations increased, the forests, through cutting and fire, gradually dwindled and wood, especially in the populated areas, grew scarce. Then man began to realise

that wood had a value and different countries set aside large tracts in which the timber was protected for future supplies. It was thus that the first faint glimmerings of a forest conscience were born.

As time went on the nations began to find that it was not sufficient merely to protect large areas of forest land but that, to ensure future supplies, the cut-over forests must be reproduced or, where natural regeneration had occurred, the young forest must be managed in such a way as to produce the best possible crop of timber. So came into being the science of forestry, the purpose of which is, briefly, to help nature produce perpetually, on a given area, the greatest quantities of the most valuable forest products.

Forests are not equally distributed throughout the world. Some countries possess immense forests and others none at all; some well forested countries are very sparsely populated while others are so crowded that their people yearly consume the whole of the timber yield and more; and, again, many countries which are thickly forested have not yet been able to make use of their timber supplies owing to the forests lying vast distances away from centres of civilisation, or even in unexplored regions. The amount of timber per inhabitant is more important to a nation than the total forest area, and those nations which possess no forest of their own, or whose forests do not supply the demands of the population, must import timber from more fortunate or less populous neighbours.

Speaking generally, timber may be divided into two kinds—hardwoods and softwoods. These do not enter into competition to any great extent but are used for separate purposes and are equally necessary in industrial and domestic life. Countries containing abundant supplies of softwoods are able to sell these to other countries lacking them, and the same applies to hardwoods. For instance, Australia's forests are practically all hardwood. As her population requires large quantities of softwoods every year she is obliged to import them from overseas until such time as she is able, by planting locally, to fill the softwood demand. All the States have commenced the planting of pines and it is hoped to extend these every year until an area is planted sufficient to keep up a constant supply of softwood for the Commonwealth.

Within the British Empire the most important hardwood forests occur in India, British West Africa, and Australia. As far as softwoods are concerned, Canada stands pre-eminent in the Empire; her immense conifer forests render her self-supporting in softwoods and, at the same time, able to export large quantities to other lands. The United States of America, being right next door to Canada, is her chief customer and takes a large per cent. of the softwood timber export. It is true that the United States possess about four times as much conifer forest as does Canada, but still it is necessary to import, as the population is so enormous in comparison and America has been, for many years, and is still, cutting out her forests faster than they are growing. America is, in fact, the largest consumer of timber in the world. In view of this fact it is rather an anomaly to find that she also exports a quantity of softwood. This is due to the location on the Pacific seaboard of the third of the great milling areas of the United States, that is the Western forests and the existence of cheap seafreights to Australia for what, though important to Australia, is a very small fraction of the total cut. Australia has obtained the bulk of her softwood supplies from the United States and the remainder from Scandinavia, Canada and New Zealand, but may in the future have to look to other countries or grow her own softwoods.

Besides the United States and Canada, the countries of Northern Europe and Siberia, are rich in conifer forests. The vast region in Siberia has not been fully explored and there is no doubt that large tracts of low quality forest exist. This is very different from the rich forests of the United

States and Canada, but the experience of Finland with utilisation of forests of small trees shows that these forests, at present considered inaccessible, will some day be drawn upon. With a population as large as that of the United States, the local consumption of wood in Russia is enormous. Norway, Sweden, and Finland are well stocked with softwood forests and supply a large percentage of the wood used in the British Empire. Sweden and Finland manage and conserve their forest in such a way as to obtain continuous supplies, which will always be a source of wealth to them.

Other conifer forests exist in Brazil, which is one of the most densely forested countries in the world, Mexico, China, and Japan, but these countries, for one reason or another, are all large importers of softwoods and are of no great account from a world supply point of view.

It is regrettable that only a small proportion of the forest resources of the world is being worked so as to provide perpetual supplies and the vast bulk of the forests are being wasted by ruthless exploitation, lack of protection, and fire. The world's population is increasing all the time, and it appears that the day is approaching when it will be faced with a universal timber shortage. When that time comes nations which are so prodigal of their timbers at present will learn through bitter experience the necessity of handling their timber lands as a renewable crop and using the annual growth instead of cutting out the forest capital.

It is unfortunate that Australia as a whole can produce only two-thirds of her timber requirements within her own shores and as her forests are being overcut must rely more and more on overseas countries for her supplies. Western Australia itself has a surplus above its own consumption, but should, if a similar quantity of cheaper wood is imported from elsewhere, be able to obtain the higher price which her high quality hardwoods command in overseas countries.

TIMBER. A CROP.

Timber is a crop, just as corn and wheat are crops, but it is a crop which often does not mature during the span of a man's life. Therefore, the trees which are planted by, or regenerate naturally during the life of one generation, must usually be reaped by another. That is why man is not always so careful of the forests as he should be, and that, also, is why the practice of forestry is generally confined to Governments rather than individuals, as Governments can afford, better than private persons, to foster an enterprise which may give no final return for 20, 50 or, perhaps, 100 years.

When a forest has reached its mature growth, it is ready to be harvested just as a field of wheat is harvested, and to serve man's purpose by providing him with wood for his needs. It is the work of the forester to harvest the timber and to do so wisely and economically in order that crop may succeed crop in perpetuity and the forest remain permanently productive. There are forests in Europe today which have been cut and regenerated, under scientific forest management, for more than six hundred years and are at the present time more productive and more valuable than ever.

WORK OF THE FORESTER.

The forester does not, as many people believe, confine himself to planting trees. His work embraces every operation necessary to secure or improve future forest crops, whether by planting, protection from fire, or scientific methods of cutting. Simple matters, such as the pruning of young trees and freeing them from overshadowing brush, as well as the abstruse principles of forestry involved in calculating the rate of growth for a forest 100 years hence, all come within his province. He plants trees when trees are needed, aids valuable species in their struggles against undergrowth, harvests the mature trees, and establishes cutting methods that will ensure the cut-over forests again producing valuable products within as short a time as possible.

Sometimes the forester has to build up a forest which has been cut-over and exploited of its best timber and where everything of value has been cut or burnt. Here it may be necessary to plant young trees in order to cover empty spaces in a shorter period than could be done by nature unaided. In extreme cases the forester may have to establish nurseries and raise seeds of the trees best suited to form the new forest. Generally, however, unless the forests have been cut and burnt bare, nature can be relied upon to reforest them within a reasonable time. It then remains for the forester to care for the young regrowth, protect it from fire and disease, and arrange that the trees get the amount of light and air necessary for their best development.

When cutting our forests for sawmilling or other trade purposes, they are found to consist of trees of all sizes and ages, and the art of forestry is closely concerned in ensuring that, in the harvesting of the timber crop, sufficient immature and semi-mature trees are retained to grow on for the next cutting cycle. Regeneration of the forest is secured by natural means.

In cutting the mature forest, the limbs and tops of trees must be properly disposed of by burning of the tops as they form a serious fire menace to the young regrowth. In some countries moreover young trees of a valuable species are choked back by undergrowth and trees of inferior species. Wherever economically possible, these inferior species are cut away to allow the sunlight to reach the more valuable trees. Forestry is a primary industry and well managed forests may be regarded as farms, differing from the usual conception only in that they are growing a different type of crop.

FIRE PROTECTION.

Perhaps the most important and most arduous work of the forester is Fire Control. Fire causes serious damage to trees at all stages of their growth and especially during the early years. Before the passing of the Forests Act in 1918 extensive damage had been done by bush fires and foresters had to design methods for reducing the number of out-breaks and for extinguishing fires in the forest. The Bush Fires Act of 1902 gave extra powers to Government officers to ensure the protection of the forest, but for many years there was an uphill battle against people who were careless with camp fires and those who burnt the bush deliberately for misguided reasons or for some small personal gain at the expense of the State asset, but gradually people are realising that they must assist the work.

Over the past 20 years, the Forests Department has developed a system of fire control which commences with the virgin forest. Before sawmilling, the area

to be cut over during the year ahead is advance burnt by as mild a fire as possible in the cooler periods of the year. This prevents large fires being caused in the summer by the men working on logging operations. After logging, the tops of the trees are burnt up in the winter months, the operation being called " top disposal." Young trees gradually establish themselves to take the place of those felled for sawmilling. The young crop follows and from then it must be jealously protected from fire for many years or it will be so injured that the seedlings and saplings will never make first class timber trees. Firebreaks are made around a group of compartments and these firebreaks are regularly burnt off to provide protection for the regrowth within the compartment.

Nearly 2,000 miles of such firebreak are listed for burning each year. Eleven thousand miles of forest roads and tracks provide access and 600 miles of telephone line, chiefly composed of galvanised wire hung on trees, provides communications. Firebreaks are burnt in the Spring and as soon as the summer sets in the staff are on the " qui vive " to fight any fire which may occur.

Successful fire fighting depends on a number of factors. Early detection and location of the fire so that it can be attacked while still small is ensured by 26 lookout towers on which lookout men live for the summer months and from which information is telephoned to the nearest workers and the District Forester. Some of these towers reach 125 feet in height and some lookouts are built in giant Karri trees up to 193 feet from the ground. Rapid communication is obtained over the telephone service and a few minutes after a fire has started a gang should be ready to move out. Rapid transport is necessary to save time and today motor trucks are ready for this purpose and roads must be continually improved to reduce the time factor.

Trained men and efficient equipment are necessary as fire fighting is a skilled job requiring knowledge as well as stamina. Overseers and men receive training in the use of equipment and, as time passes, the Department is building up outfits of water tanks and motor pumps which increase the effectiveness of small gangs of men but the pack spray and the fire rake, wielded by a strong, willing, trained man, are still the most important factors in defeating the enemy fire. The Forests Department does not keep fire brigades waiting for fires to occur but by its organisation is able to call on employees in the forest and on mill workers and others nearby when required.

Weather plays a most important part in this problem as fires are far more severe on days when wind, temperature, and low relative humidity combine to produce conditions under which fires spread rapidly. Foresters express these conditions by speaking of the fire weather as being low, moderate, average summer, high summer, severe, and dangerous and, according to the conditions expected for each day, take steps to organise work to the best advantage.

It is of course very important to be able to forecast in advance what weather is to be expected for the day and to provide this forecast during the summer a fire weather research station operates in the forest at Dwellingup where all the weather factors are studied and the dryness of the forest fuel is measured by studying the weights of small wood cylinders which, of course, vary with changing atmospheric conditions. As the result of this study of weather factors and the forest fuel, the officer in charge of the weather forecasting is able to send out to all forest districts every morning an estimate of what the fire weather will be.

Forecasts of fire hazard are given for two different regions, the northern, called for convenience the Jarrah Zone, and the southern, called the Karri Zone and applicable to country approximately south of a line through Margaret River, Nannup and Narrogin to Denmark.

The fire weather hazard given by the Divisional Meteorologist is broadcast over the air through the courtesy of Australian Broadcasting Commission and is of importance to farmers and settlers in the South-West as well as the forester.

FORESTRY IN WESTERN AUSTRALIA.

Forestry in this State is in its early stages, though much has already been accomplished. For the first 85 years of Western Australia's experience the forests were cut and burnt without any provision for the future needs of the community. It was only in 1918 that a " Forests Act " was passed creating a Forests Department as a separate entity of the Government Service, and providing for the proper management of the forests by trained men so as to ensure perpetual supplies.

The first step to be taken was a classification of the prime forest country in order to find out how much timber land the State possessed. This classification was carried out, and disclosed the fact that the prime forests—that is forest containing pure stands of timber in merchantable quantities—amounted to only about 3,000,000 acres situated in the South-West corner of the State, much of which had already been cut over by the sawmiller. It was then necessary that this forest should be permanently reserved for future supplies as it would be unwise to spend time and money on reforesting land which might, at any future date, be made available for settlement. Year by year reservations have continued, until at present practically the whole of the prime forest region has been permanently dedicated as State Forests, comprising 3,393,000 acres.

In addition to the prime forest country, there are large areas of what is called " savannah forest " where the trees do not grow in close formation but are scattered at intervals among low scrub or trees of inferior species. Wandoo is an example of this type of forest. It produces a splendid hardwood, but is scattered in its occurrence and makes the milling of the species more expensive. Later on, as the more accessible eucalypts become scarce and values rise, there will be an increasing demand for timber from " savannah forest," which includes also the open Eucalypt forest which provides firewood and mining timber for the Goldfields.

Apart from the area of prime forest permanently dedicated as State Forest, 1,778,000 acres have been reserved under the provisions of the Forests Act for forestry purposes. Included in this area are 1,673,000 acres on the Eastern Goldfields reserved for the provision of mining timber and firewood and to afford protection around Goldfields towns.

The forest area is very small indeed when considered in relation to the huge area of the State—624,588,800 acres. With an ever-growing population the timber demand is steadily increasing and the need for the care and management of the State Forests is apparent.

Wild forests, or virgin forests as they are sometimes called, are beautiful indeed in their stately majesty, but the trees live to fall only in very old age long after the stage of rapid growth has passed and usually after deterioration and decay of the trunk has set in. The forester can increase greatly the yield of timber from a forest by cutting the trees at the right time for maximum growth of the type of product desired and by manipulation of the canopy to achieve that result. Natural forest trees grow closely together when young, and the forester in establishing artificial plantations of introduced species, follows nature by planting the trees closely to eliminate side branches early and to ensure erect straight trunks.

Jarrah and Karri are the two most important timbers of Western Australia and the only two exported in considerable quantities. Fortunately, both these species regenerate naturally and freely so that it is not necessary to do any planting in the cut-over forests, but the young trees must be protected from fire and, at a certain stage, thinned so as to ensure their vigorous growth.

All the operations, including regeneration and other silvicultural operations, protection, and utilisation measures, are set out in what are called " Working Plans," and these are strictly adhered to by the forester in his work. There is one General Working Plan for the general sawmilling in the Jarrah and Karri forests. The aim of this Plan is to regulate the amount to be cut so that the industry is continuous. The present permissible cut in the forests is about 600,000 loads per annum, and this can be maintained for the next 30 years. Ultimately, as a result of the forester's work, this cut will be trebled, but this cannot take place for more than a hundred years, and in the meanwhile a reduction in the cut may have to be suffered for a period at least, after 1975.

The forests of Western Australia are divided for administration purposes into Divisions, subdivided into Districts, where gangs of men are employed on forest works.

Cutting in the forest is controlled through trees taken out by the sawmiller being marked by trained foresters before the fallers commence. Thus in the forest which is set aside for the growth of timber in the future, the trade cutting can be made the first step in the natural regeneration of the stand.

The virgin forest, unlike a plantation, contains trees of all ages and by retention and care of the immature trees a growing stock is provided to make further growth and in its turn be cut at the next cutting cycle. This is very much shorter than the time required to grow from seed to maturity, a period known to foresters as a rotation.

It is seen, therefore, that ensuring reproduction of forests is only the first step in adequate regulation of the cut. Far more important is the maintenance of the growing stock properly distributed by size classes.

The existence of all age or size classes illustrates how wrong is the popular misconception that no great waste occurs in clearing forests for farming provided it has been cut-over for sawmilling.

PINE PLANTATIONS.

The native forests of Western Australia are all hardwoods and we have learnt to use hardwood for a great many purposes, such as fruit cases, building timber, doors, windows, etc., for which in most other countries softwood is used. Paper and cellulose products are nearly all made from softwood and although our hardwoods can be used for paper making, that industry has not yet commenced in Western Australia.

We find it necessary, however, to have softwood for many purposes and have always imported a considerable amount in the form of paper, timber, and manufactured articles. Many years ago, foresters recognised that we should aim to be self-supporting in timber, and about 1920 planting of pines was commenced. In 1945 we have a total of 13,000 acres of pine plantation, some of which is now providing softwood from thinnings and replacing overseas imports for case making, clothes pegs, small turnery, and other uses.

Many problems had to be overcome before a big planting programme could be undertaken. Firstly, what species of pine would we grow as there are hundreds of different species to choose from?. Pines from many parts of the world were tried and many were unsuccessful, while *Pinus radiata* from Monterey (California) which is so successful in South Australia, New Zealand, and South Africa, and *Pinus pinaster* from the Mediterranean, were found to be the most promising for our soils and climate. Experiments showed that it was not a simple matter to grow pines in Western Australia and pine nutrition, deficiency disorders, soils, manures, seed supplies, nursery problems, and planting methods all had to be studied carefully over many years before the Forester became confident to plant large areas. Thus over 25 years our knowledge has been developed, and we aim to plant about 1,000 acres a year which should be sufficient to replace nearly all our softwood imports, except paper and cellulose products.

The methods used in pine growing differ considerably from those used in the natural regeneration of our native forests. Pine seed is sown in nurseries in lines about 15 inches apart and the young pines transplanted out on ploughed land in July. The plants are spaced from 6 ft. x 6 ft. to 8 ft. x 8 ft. apart according to species, thus giving 680 to 1,200 trees per acre. On some soils superphosphate is necessary in the early years, and on other soils special treatment is necessary. The pines grow up and when about 40 to 50 feet high the lower limbs die and pruning and thinning commences, the thinnings being sold for case making. Many people wonder why we plant pines so closely together, but this is necessary in order to kill the lower limbs which would otherwise grow very large and cause big knots in the timber.

Thinning goes on at intervals and between 30 and 40 years after planting the final crop can be felled and the area replanted. If, therefore, we plant one acre every year for say 40 years, we will be able to cut down one acre and replant it each year from then onwards, and thus have a permanent industry. The forester speaks of this as a "sustained yield."

The value of artificial pine forests is best illustrated in South Australia where large mills employing 80 to 100 men are established in these plantations cutting pine only. The timber is used for almost every purpose, for example, houses are built of it.

MALLET PLANTATIONS.

In the early years of Western Australia large forests of Mallet (*Eucalyptus astringens*) existed in the district from Pingelly to the Porongorups. The bark, like Wattle bark, was found to be a valuable tanning material and the forests were stripped for the export of the bark, much of which went to Germany. At one stage the value of the bark stripped reached £150,000 for the year. Unfortunately, the trees were killed and fires prevented their regrowth so that by 1920 the Mallet forests had nearly disappeared and a valuable industry was lost.

After the passing of the Forests Act in 1918, Foresters commenced to study the problem and large areas were reserved for Mallet protection. By 1925 study and experiments had shown that Mallet could be successfully grown by clearing the land and sowing seeds in spots which had been prepared by hoeing.

A big programme followed and by 1945 some 17,000 acres of Mallet plantation had been established in the Narrogin district. Most of this is still young and will not provide bark for some years. There is very little Mallet bark now available

from the natural forests, but the seeds have been sown to rehabilitate the industry and in a few years supplies will be coming forward from the new plantations, provided fire protection is afforded to the area. The plantation of 17,000 acres is subdivided and contains 627 miles of Departmental roads and firelines, 60 miles of telephone line, and a lookout tower which is manned during the summer months.

SILVICULTURAL RESEARCH AND INVESTIGATION.

Research in Forestry is a slow and laborious process consisting, in the main, of a painstaking collection and building up of data relating to the manner of growth of trees under all sorts of conditions.

In Western Australia particular attention has been given to research in connection with afforestation, and with some aspects of the growth and development of the natural hardwoods, particularly Jarrah, that grow in the State.

In addition, as an associated corollary dealing with the development of tree growth, intensive research has been carried out on fire weather problems.

The necessity for the initiation of research projects in afforestation was clearly demonstrated when establishment of pines on our relatively poor soils was attempted on anything like a large scale many years ago.

Early work which proved the importance of the infection of nursery soils with the fungus *Rhizopogon luteolus* was followed by nutritional experiments designed to find a cure, or a remedy for the poor and unhealthy growth which rapidly appeared on plantations of *Pinus pinaster* established on the coastal sandplain.

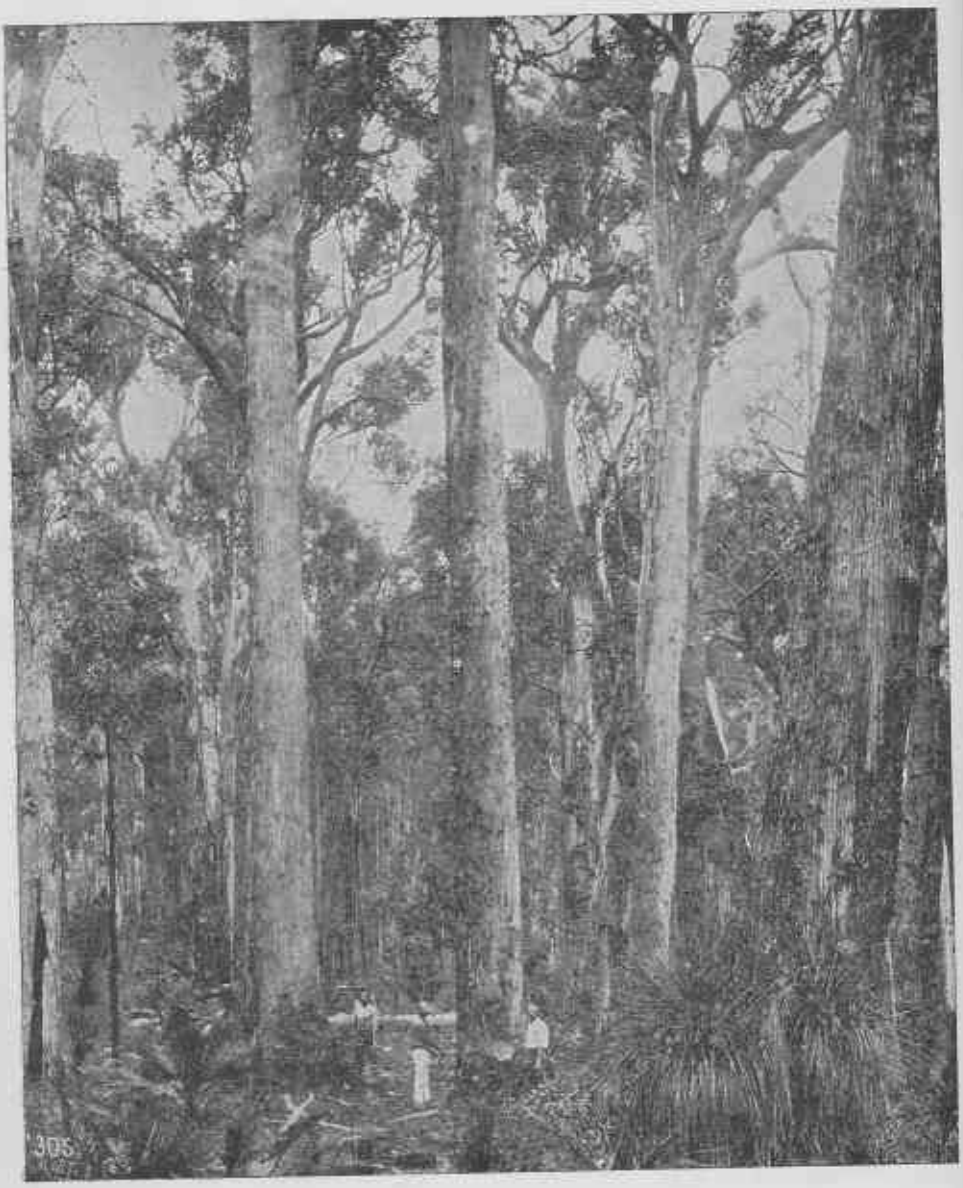
As a result the importance of superphosphate and of the minor element, zinc, in their application to pine growth was established beyond doubt. So far as is known, Western Australia is the only country in the world with a plantation grown entirely by the aid of artificial fertiliser without which the pines would not reach a greater height than three feet. A small sawmill has already been established on this plantation to cut small thinnings for cases.

Other projects were initiated in an endeavour to find some cause, other than a nutritional disorder, for the high number of deaths that inevitably occurred in the first year of planting.

Positive results have been obtained here also, particularly in demonstrating that deep setting is required and that the roots should not be pruned too short.

A study of the growth produced by the various strains of *Pinus pinaster* has resulted in all current plantations being established with the Leiria (Portuguese) strain.

In the field of Jarrah growth, experiments have shown that the rate of growth of Jarrah coppice has not been increased by artificial removal to reduce the number of shoots per stump to either two or one. Jarrah saplings, in general, only attain their best form development under a thin cover of older age classes. The depth of crowns of saplings remain approximately constant in that the crown consists of the growth of four consecutive years, the older growth being discarded in its turn. With increase in height of the Jarrah saplings the percentage of crown by comparison with total height therefore decreases. The maximum height reached in the sapling stage in Jarrah, before the mature crown is developed, so far known is 80 feet, but this will no doubt be exceeded on some sites at least.



Jarrah Forest (Eucalyptus marginata)

Studies of height growth, as an indication of forest quality in Jarrah, have led to the recognition of qualities based on the maximum height of the codominants.

The study of fire weather caused the establishment at Dwellingup of a Fire Weather Station from which forecasts are made each morning of the Fire Hazard for the day. An empirical scale has been built up with the following hazards :— Nil, Low, Moderate, Average Summer, High Summer, Severe, and Dangerous. Controlled burning, the running of locomotives, and details of fire control organisation are regulated according to these forecasts. Through the aid of the Divisional Meteorologist they are broadcast by courtesy of the Australian Broadcasting Commission over the National Network and are available for farmers in the South-West. It has been found, following American practice, that the moisture content of half-inch wood cylinders is a good measure at any time of the actual hazard according to the empirical scale.

The utilisation of timber has also received attention, tests showing that degrees of faults formerly thought to have a serious effect on the durability of sleepers do not affect their life under service conditions and hence sleeper specifications have been modified accordingly.

An interesting development in timber use was demonstrated by the use of dried Jarrah, sprayed with a casein-formalin mixture, for butter boxes. It imparts no taint to the butter and is reported as superior to imported timbers of which the boxes were formerly made. Karri also, when dried and sprayed, is free from taints and is now used in the form of plywood for the manufacture of butter boxes.

BRIEF DESCRIPTION OF THE PRINCIPAL TIMBERS.

The following are brief descriptions of the principal timbers of the State, practically all of which, with some exceptions such as Sandalwood, Sheoak, Pear and Jam, belong to the Eucalypt family :—

Jarrah (*Eucalyptus marginata*).

Jarrah is the principal timber of Western Australia. Though it is found scattered throughout the south-west of the State over many millions of acres within the 20 to 45 inch rainfall belt, the Prime Jarrah Forest extends over only 2½ million acres, along the Darling Range from the latitude of Perth right down to the extreme south of the State in the neighbourhood of Albany. As the tree grows to a height of 120 to 150 feet, with a clean bole of 50 to 60 feet and a girth of 20 feet, large sizes of timber free from blemish are obtainable.

Jarrah has a world-wide reputation on account of its durability. Timbering in the houses built when the State was first established is still sound today and some of the post and rail fences of the early settlers are still standing. Its strength and durability make it very suitable for all classes of structural work, while in the form of sleepers, bridge and wharf timbers, and power and telegraph transmission poles, it finds wide application. A further advantage of Jarrah is its high quality of resistance to fire. It is on Lloyd's list of shipbuilding woods.

The timber of Jarrah is beautiful in grain and colour, can be readily worked, and finishes and polishes well.

It is essentially a furniture and cabinet wood, but its wonderful durability, combined with the plentiful supplies available, led to its extensive use in the early days for the purposes mentioned above, and the suitability of Jarrah for higher

grade uses was overlooked. In furniture, interior trim, carving, cabinet work, cooperage, etc., it gives excellent service, and for this purpose the consumption is steadily increasing. Commercial drying kilns of modern design are operating in the State and produce an excellent seasoned product ensuring that timber for high grade furniture and joinery work is available when kiln seasoned.

Karri (*Eucalyptus diversicolor*).

This tree is the largest and second most important in the forest. It occurs in a limited area—some 250,000 acres being estimated as the extent of the Prime Karri Forest—in the South-West of the State, its northern limit being Nannup and the upper waters of the Donnelly River, where it spreads over the gneissic granite of the region southwards and south-eastwards to Denmark. There is then a gap in the belt and it is to be met with again near the Porongorup Range. Karri also occurs in the West Coast in a narrow strip on limestone formation between Cape Naturaliste and Cape Leeuwin. Near Cape Leeuwin is Karridale from which the first Karri was exported from the State.

Karri is a magnificent tree, both from the standpoint of the timberman and of the tourist, for it attains a height of over 200 feet while the long clean bole has a length of 100 to 140 feet and a girth of 30 feet. The tallest Karri measured has a height of 281 feet and is still standing.

Karri timber greatly resembles Jarrah in appearance, and those without considerable experience in the handling of the two timbers are unable to distinguish between them. Karri is somewhat stronger than Jarrah and consequently superior for superstructural work. It is not so durable in the ground, however, and so it is important that the timbers should not be confused.

While these timbers can be readily distinguished by persons working in them every day, almost the only practical test for other users is the burning of a splinter of each timber in a sheltered position. The Jarrah splinter will char, leaving a blackened mass of charcoal, the Karri splinter will burn away leaving a fine white ash. This test is usually definite. Where verification is required a simple chemical test can be made at the Head Office of the Forests Department.

Besides being on Lloyd's list of shipbuilding timbers, Karri is used for wooden pipes, wagon scantling, and transmission line poles and cross-arms. The "Powellised" Karri railway sleeper has given good service under dry conditions and sleepers on the Great Western Railway, linking South and Western Australia, are in some cases still in use after 25 years. Karri, on account of its high beam strength and its long clean lengths, is used extensively in superstructural work, and for this purpose it is steadily coming more and more into favour. It makes excellent flooring on account of its strength and wearing properties and is also used for furniture, furnishings and interior trim. For these higher grade purposes it can be kiln-dried, and suitable drying schedules for all sizes have been developed. Young Karri has been proved as a raw material in paper manufacture, and the Karri bark carries a high percentage of tannins.

A plywood factory has been established in Perth and uses rotary peeled Karri veneer for the manufacture of its plywood.

One of the important uses for Karri today is in the manufacture of fruit cases. In normal times approximately one million apple and pear cases of Karri and Jarrah are required for export. These are known as dump cases and have dressed ends. These red cases are considered to be an important selling factor for Western Australian apples which in the red box are eagerly sought by buyers.

Karri Forest (*Eucalyptus diversicolor*).

Tuart (*Eucalyptus gomphocephala*).

The small strip of coastal plain between Lake Pinjar on the north and Busselton on the south holds all the Tuart forest. The tree grows only on limestone and the best forest is to be found between the Capel and Sabina Rivers, where some 4,000 acres of first-class Tuart have been reserved as State Forest. Tuart has a height of up to 150 feet with a girth up to 30 feet in exceptional trees.

The timber is pale yellow in colour and has a dense interlocked grain. It resembles Wandoo in mechanical properties and holds the same high place for railway wagon undercarriages, etc. It found favour for motor wagon and motor bus framing, and in this guise it has proved itself eminently satisfactory. Tuart is also suitable for wheelwright work and coachbuilding generally.

Tuart has proved suitable for felloes, spokes, and small wheel stock, and for small turnery, such as insulator pins, clothes pegs, clubs, bobbins, etc.

Wandoo (*Eucalyptus redunca, var elata*).

This tree is to be found in the south-west portion of the State on the edges of the Jarrah belt. It grows in open savannah forest, frequently mixed with Jarrah and Marri. The tree attains a height of 100 feet with a bole of 30 to 40 feet and a girth of 12 feet.

Wandoo gives a very long life, up to 35 years, as a railway sleeper and is used as extensively as the limited quantities will permit.

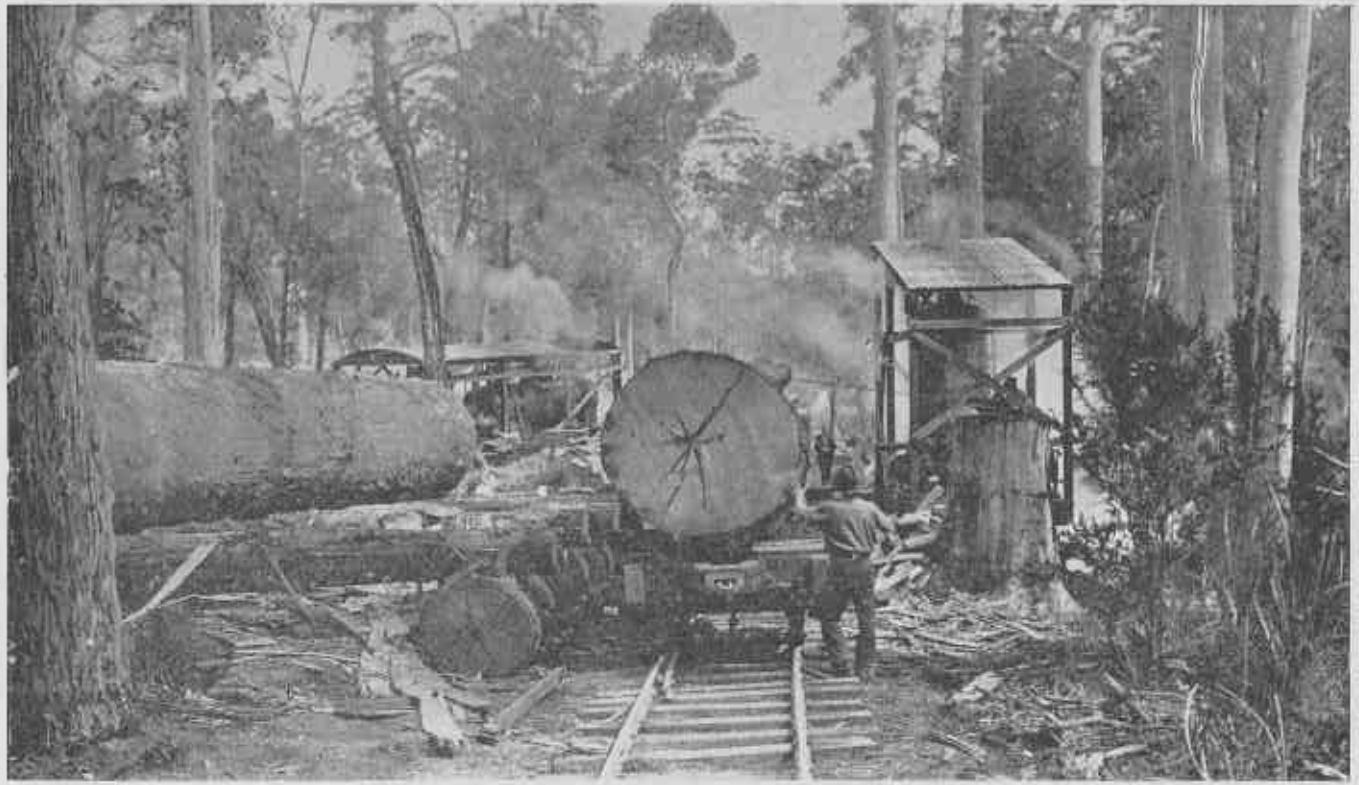
The wood is very hard, strong, and durable. It is greatly prized for railway wagon underframes and for this purpose is used on the State railways in preference to steel. In large sizes its "work" with changing weather conditions is infinitesimal and it has the further advantage of being quite free from corrosive action on iron. Bolt holes, after 20 years' wear, still show the auger marks distinctly. Wandoo is used for bridge and wharf construction, wheelwright and millwright work, knees of boats, and shipbuilding generally. As small turnery it is used in the form of spokes, bobbins, insulator pins, etc. Wandoo wood now forms an important source of tannin which is extracted after maceration of the timber. This product is sold under the trade name of Myrtan.

Marri (*Eucalyptus calophylla*).

Marri is found throughout the Jarrah belt in mixture with Jarrah. It also extends through the Karri belt in which it occurs both in mixture with Karri and as a pure stand of up to 3,500 to 5,000 cubic feet per acre of log timber. It reaches a height of 200 feet and a girth of 30 feet.

Marri has not hitherto been used very much as a timber because of the presence of gum veins. Its colour is a pale straw and its beauty is often enhanced by a waviness in the grain. It makes excellent shafts and is used for the heavy poles of the large whims, and for case making. It has been found very satisfactory for axe handles and small turnery, as in small sizes it is free from gum. It is now used extensively for case manufacture in Perth and there is no doubt this timber will find greater use in years to come. As core-stock in door manufacture it shows considerable promise.

Marri has been considered for paper pulp because it is not used generally for other purposes. When relatively free from kino it can be pulped with little difficulty. When a considerable amount of kino is present, as is usually the case, the consumption of cooking liquor is higher but not unduly so. Its use for pulp will probably depend on what use can be made of it as sawn timber.



Steam Winch Loading Karri Log. Log Hauler in background.

The gum or kino yielded by the species contains a high percentage of tannin and has been used for tanning since the early days. Its use for this purpose would have been more extensive but for the red colour imparted to the leather. Means of decolourising the kino have now been found but the quantities of kino available have not proved sufficient to form an important industry.

Brown Mallet (*Eucalyptus astringens*).

Brown Mallet is a tree 30 feet to 50 feet in height with a smooth, brownish or greyish bark and slightly angular trunk. The bole is straight, reaching 6 feet in girth and up to 30 feet long, the timber pale brown and very dense. The timber is hard and strong and has been used recently for axe handles. The chief value of the tree so far has been in its bark, which yields 40 to 57 per cent. of tannins. It occurs between Pingelly and Tambellup on the Great Southern railway, westwards to Wandering and Arthur, and eastwards to beyond Ravensthorpe, on rises or hills, usually lateritic.

The Mallets of the better rainfall areas along the Great Southern Railway were ruthlessly exploited some 20 years ago and only the fact that the species seed freely at all ages and are largely confined to stony outcrops surrounded by poison plant country has saved them from extinction. Extensive artificial plantations, 17,000 acres, have now been established by the Forests Department.

Red Tingle Tingle (*Eucalyptus Jacksoni*).

Although the small area in which it occurs renders this tree of minor importance, the timber is undoubtedly of value. The tree is to be found between the Bow, Frankland and Deep Rivers, in the extreme south-west corner of the State, but does not extend far inland. Though not unlike Jarrah in appearance, it is considerably larger, growing to a height of 180 feet with a girth of 50 feet.

The timber has been found satisfactory for bridge piles and superstructure but, on account of light weight, pleasing appearance, and good working properties, it is considered too valuable for these purposes. It is well suited for furniture and cabinet making. On account of its remoteness, the forest has not so far been exploited.

Sheoak (*Casuarina Fraseriana*).

A tree attaining a height of 40 to 50 feet, with a bole 10 to 15 feet, and a girth of eight feet.

A sound wood with broad medullary rays which show up and make the timber particularly beautiful when cut on the quarter.

The most important use for this timber is for barrel staves.

It takes a good polish and stands up well and therefore makes an excellent cabinet wood. It splits well and was used almost exclusively in the early days of the State for roofing shingles. A shingle taken from one of the first-erected houses in Perth (after 83 years' use) was found to be in a splendid state of preservation. It grows scattered through the length and breadth of the Jarrah belt, but the total quantity of sawmilling timber is only small.

Sandalwood (*Santalum spicatum*).

Sandalwood is a small tree attaining only a height of twelve to sixteen feet and a diameter of six to eight inches. One species, *Santalum spicatum* occurred practically throughout the State with the exception of the Kimberleys and the extreme South-West. Supplies are now obtainable from the Eastern Goldfields

No. 1 State Mill at Manjimup.

and north of the Murchison River towards Carnarvon. The other species *Santalum lanceolatum* occurs mainly in the extreme north of the State but odd specimens grow as far south as Leonora. Remaining supplies of northern Sandalwood are practically restricted to the mountainous country north of Derby.

In the early days of the State much larger specimens of the tree were found in districts which are now closely settled wheat-farming areas. As each farming district has been opened up, sandalwood has proved of very considerable assistance to the new settlers and to prospectors on the goldfields as a source of immeditae revenue. Supplies are often hauled in 50 to 180 miles to the railway lines running to gold mining centres of the interior.

The wood is a light yellow to brown in colour and the heartwood is strongly aromatic. It is this latter property which has led to its extensive use by the Chinese in the manufacture of "Joss sticks" for burning in religious ceremonies. In addition, much Sandalwood is used in China and India for fancy carved woodwork, the making of trinket boxes, and a host of other small articles. The value of the wood exported to 1945 was £5,375,294.

In the early years the total output of Sandalwood from Western Australia was exported to the Far East, but now Sandalwood oil is produced locally and thus there is now an oil distilling industry in Western Australia.

The artificial regeneration of Sandalwood is possible but not economical and the difficulties have been further increased through the introduction of the rabbit.

Blackbutt (*Eucalyptus patens*),

Small patches of this species occur in the Jarrah Belt, in the gullies and pockets of alluvial soils between laterite hills. It is not plentiful. The tree attains a height up to 100 feet, with a bole of 40 to 50 feet and a girth up to 20 feet.

The timber is not unlike Jarrah in properties, but is of a pale yellow colour and though durable, is probably not the equal of Jarrah in this respect. As a railway sleeper it shows considerable promise. It is sawn for many purposes, particularly cases, farm implements, and railway truck building, and it is also used to a certain extent for furniture.

Yate (*Eucalyptus cornuta*).

A tree attaining a height of 50 to 60 feet with a bole of 25 to 35 feet and a girth of nine feet.

This species yields a light coloured timber of exceptional strength. It is probably the strongest timber in the world and in one test for tensile strength the breaking load was 17½ tons per square inch, 3½ tons less than that usually specified for wrought iron of ordinary quality. It is used for wheelwright work generally and is preferred where the strongest shafts for frames of carts are required. It has been turned for axe handles. It occurs at Busselton, Donnelly River coast, Lake Muir, and Mount Barker district. That it is not used more generally is due to the limited quantities available.

York Gum (*Eucalyptus loxophleba*).

A tree which attains a height of 40 to 60 feet, a length of bole of 10 to 15 feet, and a girth of six feet.

A dense, hard, heavy wood with very interlocked grain. The wood is by far the best nave, maul, and mallet wood in Australia, while it may be used very successfully for felloes and other wheelwright and wagon building purposes. The wood

is of a yellow-brown colour and carries a beautiful figure. It grows in open or savannah forests and it is to be found in the 20-inch rainfall belt. It is most common about Bolgart, Toodyay, Northam, York, Narrogin, to Broomehill. Its presence is regarded by farmers as an indication of good agricultural soil for wheatgrowing and also good grazing country for sheep.

Coolibah (*Eucalyptus microtheca*).

Coolibah grows throughout a very extensive region in the North-West Division of this State but it is confined to sites in the vicinity of creeks and rivers and on alluvial flats subject to periodic inundations. It attains its best development near the lower portions of the Fitzroy and Lennard Rivers although a limited number of good trees are found in favoured situations such as depressions near billabongs on the upper portions of the Fitzroy River. The trees occur as isolated specimens or in small groups but never in close formation.

Generally the tree branches close to the ground and logs of greater length than about eight feet are rare. A very high proportion of the larger trees are hollow. It has been used extensively for the construction of buildings, stockyards, etc., when strength and resistance to attack by fungus and termites is necessary.

It is an extremely hard and dense timber, its weight at 12 per cent. moisture content being 82 lbs. per cubic foot.

As a result of extended trials by the Admiralty authorities it has been found that Coolibah is entirely suitable for use in those parts of shipbuilding where great hardness and resistance to friction are required, such as lining of stern tubes, for which *lignum vitae* is generally used.

River Banksia (*Banksia verticillata*).

A tree attaining a height of 50 to 60 feet, with a bole of 15 to 20 feet, and a girth of eight feet.

This tree yields a light-coloured timber with a particularly beautiful grain. The medullary rays are wide, so that when cut on the quarter it shows a beautiful oak-like figure and is much prized for furniture work. It is one of the lightest timbers of the State. It occurs along the banks of the larger rivers and streams in the South-West and is rarely to be found growing far away from running water.

Native Pear (*Xylomelum occidentale*).

Native Pear grows along the sand-plain country between the Darling Range and the coast and is found in small scattered clumps or as isolated trees. It has a height of 20 to 25 feet, with a very short bole.

The tree yields a deep brown wood with a beautiful figure and, consequently, a most ornamental appearance. It is a very fine furniture and cabinet wood and when finished with a wax surface resembles moire silk. Like sheoak, the tree suffers badly from fire, and it is therefore difficult to obtain trees of a girth greater than about two feet.

Yellow Tingle Tingle (*Eucalyptus Guilfoylei*).

This tree, although very similar to the Red Tingle Tingle in appearance, attains a height of only 80 to 120 feet, with a girth of 12 feet. It is found on the fringe of, and at times, penetrating into, the Red Tingle Tingle forest.

The timber has been found satisfactory for piles and bridge superstructural work and from a study of the strength properties, it will probably prove suitable for all purposes for which Tuart is now used.

Morrell (Red Morrell) (*Eucalyptus longicornis*).

Morrell is one of the numerous species which produce valuable timber and while they do not figure in the export trade nor even find their way in any great quantity to the Perth market, they have played a very big part in the economy of the interior of the State.

Unfortunately, the best sections of this inland forest have been destroyed in the clearing of land for wheat growing and the only areas of any great extent now available are in regions considered too dry for agriculture.

Morrell occurs in dry country in the 11-20 inch rainfall belt, and is found over a very large area extending from Meckering in the West to Karalee in the East, and from Three Springs in the North to Katanning in the South.

The tree attains a height of 60 to 90 feet with a fair bole occasionally reaching 35 or even 40 feet in length. Logs are generally of good form but the larger ones are usually hollow. The wood is hard, dense, and interlocked and is of a reddish-brown colour. It finds a ready market as a mining timber either in the round or sawn and it has also been used extensively as firewood for various industrial plants but the difficulty of splitting the larger trees frequently prevents their being used for this purpose.

Much of the Morrell country which has been cleared, particularly that in the Eastern Wheat Belt, has proved very disappointing for wheat growing as the fluffy surface soil and the pervious subsoil rapidly dry out under drought conditions.

Scrub growth below a stand of Morrell is usually sparse and generally includes blue bush or salt bush.

Two other species of Morrell, viz., *Eucalyptus melanoxylon* (Black Morrell), which occurs in the Eastern wheat belt, and *Eucalyptus oleosa* (Redwood) on the Eastern Goldfields are used extensively for firewood at the pumping stations and on the Golden Mile.

Gimlet (*Eucalyptus salubris*).

This tree is found both associated with other species, usually Salmon Gum, or in stands of pure forest. The name is derived from the spiral flutings which characterise many of the smaller trees. It is found over the greater portion of the wheat belt and on the Eastern Goldfields and as it is confined to the heavier loam soils extensive areas of Gimlet forests have been destroyed to make land available for agriculture.

The timber is light brown in colour. It has great transverse strength and is therefore used in great quantities as lagging timber in mines where it is called upon to support considerable loads of rock. The older and larger trees are almost invariably hollow so that it is seldom used other than in the round. In the wheat belt it is used for building sheds, yards, etc.

On the Goldfields an inferior allied species Silver Gimlet (*Eucalyptus campaspe*) occurs in considerable quantity.

Raspberry Jam (*Acacia acuminata*).

This tree occurs through the higher rainfall agricultural areas. It usually grows in the vicinity of granite outcrops and its presence is taken as an indication of comparatively good soil. The tree is only a small one with a height of 15 to 20 feet, a short bole, and a girth of up to three feet.

The tree derives its name from the remarkably strong scent possessed by the wood which resembles that of crushed raspberries. The timber is hard and extremely durable, fence posts, which are its principal use, having been found in good order after seventy years' service.

The colour which is a rich red-brown is very similar to that of Eastern States Blackwood (*Acacia melanoxylon*) and as the grain is good and the timber takes a high polish it is prized for small cabinet work and turnery. Very pleasing effects are obtainable by utilising the contrast of the light yellow sapwood and dark heartwood.

In a less obvious way Jam has played an important role as the best host plant for Sandalwood, which parasitises on the roots of other plants. Much of the best Sandalwood the State has produced has come from Jam country throughout the wheat belt.

Salmon Gum (*Eucalyptus salmonophloia*).

This tree attains a height of about 70 feet with occasional specimens up to 90 feet, while the bole, which is as a rule straight and well formed, in some specimens reaches a length of 40 feet and a girth of nine feet.

It has a very wide range covering practically the whole of the wheat belt from Meckering eastwards and extending through the Eastern Goldfields and for over a hundred miles east of Kalgoorlie.

It was used to some extent as a building timber in the early days of Coolgardie and Kalgoorlie but its hardness when dry rendered it difficult to work and when rail transport became available it could not compete with Jarrah.

It finds its main use in the mining industry where its extreme hardness and strength make it eminently suitable for mining timber either in the round or sawn. Practically the whole of the sleepers used on the Goldfields Firewood Supply Ltd's, woodline are of Salmon Gum.

It forms a rather open forest, being commonly associated with Gimlet and to a lesser extent with Morrell.

Isolated trees produce surprisingly dense crowns, providing good shade, and with their gleaming salmon coloured trunks and shining leaves give touches of colour to many an otherwise drab area.

Salmon Gum grows on a medium or heavy loam which is also considered the best wheat land, hence the greater part of the best Salmon Gum forest has been destroyed in the interests of agriculture.

Mulga (*Acacia aneura, Acacia craspedocarpa, etc.*).

The name Mulga is applied to a number of different acacias of the lower rainfall areas of the State.

They are found mainly north of the 30th parallel of South latitude. Under the best conditions Mulga attains a height of over 30 feet but over extensive areas it is stunted and scrubby.

The wood is heavy and resistant to insect and fungus attack and it is used extensively and almost exclusively as the fence post timber throughout the pastoral areas. It is prized for turnery work and turned ornaments, etc., featuring its rich dark brown wood and contrasting cream sapwood, are found in almost every home in Australia.

Mulga produces a particularly good charcoal which when burnt slowly in the large meiler kilns is characterised by a bright shiny fracture and a distinct metallic ring when struck.

The leaves, seed pods, and in some cases the seeds, provide valuable stock feed and the lopping of Mulga to provide feed for starving sheep is often resorted to in times of drought.

A number of valuable but lesser known species are found on the Eastern and Dundas Goldfields where they are extensively used as mining timber. The most noteworthy of these species are :—

(1) *Eucalyptus Flocktoniae* (Merrit) .... 65 feet.
(2) *Eucalyptus transcontinentalis* (Boongul) .... 70 feet.
(3) *Eucalyptus brachycorys* (Ribbon Gum) .... 50 feet.
(4) *Eucalyptus Brockwayi* (Mahogany) .... 80 feet.
(5) *Eucalyptus Le Souefii* (Blackbutt) .... 45 feet.
(6) *Eucalyptus Clelandi* (Blackbutt) .... 40 feet.
(7) *Eucalyptus Dundasi* (Dundas Blackbutt) .... 50 feet.
(8) *Eucalyptus Stricklandi* (Yellow-flowered Blackbutt) 40 feet.

Numbers 1, 2, 3, and 4, are smooth barked species and any of them should be suitable as planting subjects for the drier areas. Numbers 1, 2, 3 and 5, are found on the more sandy soils but not on sandplain soil. Numbers 4 and 7, occur both on light loam and also on the basic stony soils of the hills in the Norseman District. No. 8, occurs on laterite hills which are unsuitable for almost all other trees.

NOTE : In the early chapters of this pamphlet free use is made of the publication "Forests and Mankind" by Charles Lathrop Pack and Tom Gill (The Macmillan Company, New York, 1929.).

This Bulletin is a reprint, with alterations and additions, of earlier publications in the same form, of the Forests Department.

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