



FOREST FOCUS

No. 30 OCTOBER 1983

Insert

Before the principle of sustained yield was introduced to Western Australia, the timber industry flourished unchecked. The Boranup karri forest was clearfelled to supply the Karridale Mill of M.C. Davies at the turn of the century.

Contents	Page
Sustaining the Yield by R. J. Underwood	3
Street Trees of Perth by B. J. White	15
Wooden Gold - Early Days of the Sandalwood Industry by L. T. Talbot	21

Forest Focus No 30, September 1983

Published for Mr P J McNamara, Acting Conservator of Forests, Forests Department of Western Australia, 50 Hayman Road, Como.

Articles in this publication may be fully reprinted - with acknowledgement, except in the case of commercial promotion material, when permission must be obtained.

Page preparation and offset plates by Gibbney's Graphics 1980.

Printed in Western Australia by the Government Printing Office at ISSN 0049 - 7320. Written by Forests Department officers. All maps are produced by Forests Department Mapping Branch.

Editor: M. R. L. Lewis, M.A. (Hons.) (Cant.)
Assistant editor: H. K. Bradbury, B. A. (Murd.)

Boranup today is a fine regrowth forest, and is managed for conservation of flora, fauna and landscape values. It is a popular tourist attraction in the south-west corner of the State.



C. Winfield

SUSTAINING THE YIELD

How do the ideals match the realities of forest management in W.A.?

R. J. Underwood

In an old forest magazine, SYLVAN there is a story about Germany's great poet, Friedrich von Schiller. Schiller, taking rest at Illmenau, Thuringen, in the year 1830, met by chance a forester who was preparing a plan of management for the Illmenau forest. A map of the forest was spread out on which the cuttings for the next 220 years were projected and noted with their number. By its side lay the plan of an ideal coniferous forest which was to have materialized in the year 2050. Attentively and quietly the

poet contemplated the telling means of forest organization, and especially the plans for far distant years. He quickly realized, after a short explanation, the object of the work and gave vent to his astonishment. "I had considered you foresters a very common people who did little else than cut down trees and kill game, but you are far from that the fruit of your quiet work ripens for a late posterity."⁽¹⁾

(1) Quoted by H.S. Graves in "Science Newsletter" December 20 1926.

Schiller was observing the preparation of a sustained yield plan for a forest. Developed in Europe in the 17th Century, to this very day the formulae and techniques involved are taught as an ideal to every young forester.

In its most simple expression sustained yield management means balancing the harvest and the growth of a forest so that valued products are produced each year indefinitely. Since the concept was first developed, it has become almost a doctrine of faith for succeeding generations of forest owners and managers - the foresters' credo, if you like.

But like many other doctrines, sustained yield forest management has proven harder to practise than to preach. Moreover, there are many people today who challenge the relevance of a rigid sustained yield model for forests that are managed for multiple uses in modern society.

How well **has** the doctrine of sustained yield stood the test of time and translation to foreign fields? In particular, what is the situation in Western Australia where our restricted area of valuable forests have been under more pressure for agricultural clearing than for conservation for most of the 150 years since European settlement?

These are the questions we will try to answer in this story - a story about the ideals and the realities of forest management in W.A.

Forests, Timber and Conservation

Although the forests of Western Australia have long been managed to provide a wide range of benefits to the community (including protection of water catchments,

provision of areas for recreation and solitude and maintenance of habitat for native plants and wildlife) one of its most vital roles has always been, and continues to be, the **supply of timber**. If we seem to concentrate on timber too heavily in this story it is not because the other products of the forest are forgotten, but because the story is easiest to tell from the timber slant.

Perhaps no other material is as useful to mankind as is timber. Almost everyone uses it in some form every day: in books, newspapers or lunchwraps, as writing paper or cardboard, as furniture, as an essential constructional material in homes, office, school or factory, for warmth or for cooking, for power generation and transmission, for bridges, wharves and railways, tool

The principle of sustained yield was developed in Europe in the 17th century. This second rotation spruce forest in Germany is one hundred and fifty years old and ready to be harvested and replanted yet again.

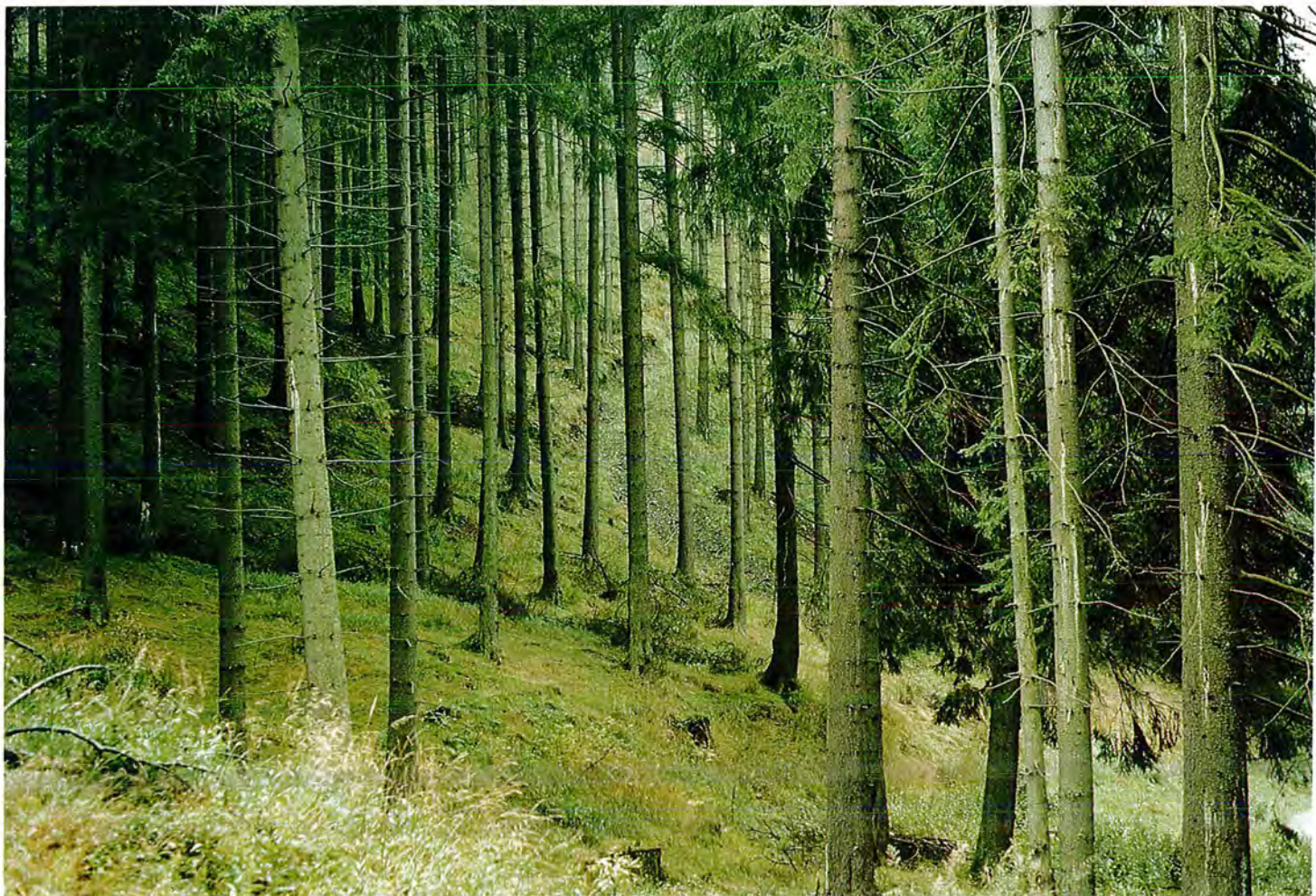
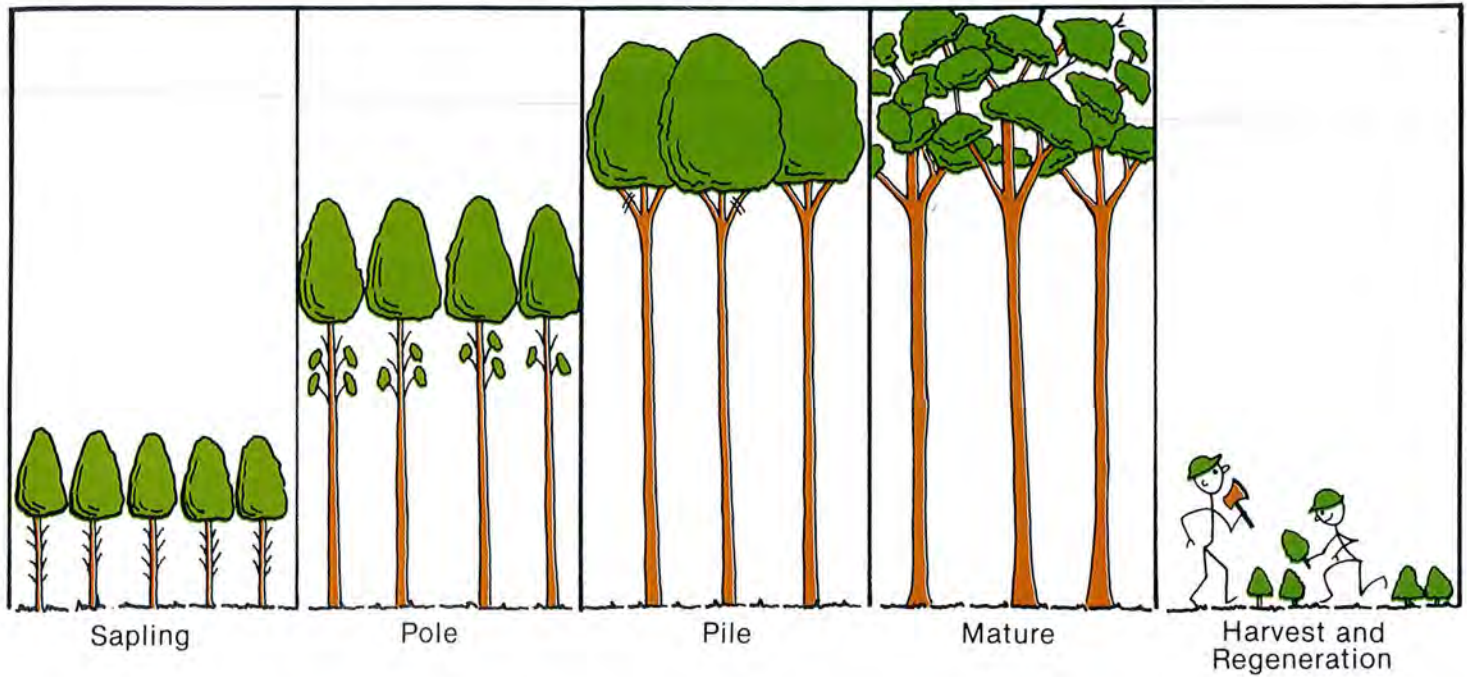


Fig. 1

THE IDEAL MANAGED FOREST



handles or musical instruments. The list seems to be never-ending.

One early Western Australian forester wrote, in 1925:

Without timber life would be shorn of most of its joys and comforts; without it man would never have emerged from barbarism; fire as a means of preparing food and providing warmth would have been unknown, and travelling that included the crossing of wide rivers, or of seas would have been impossible.²

In addition to this manifold utility timber has yet two further priceless attributes. **First**, it is a renewable resource. Unlike even the richest deposit of minerals which, once mined out can never be replaced, forests can continue to yield timber for all time. **Second**, the properly managed timber harvest will not affect all the other prime values of the forest, such as soil and catchment protection, recreation and the provision of fauna habitats.

(2) S. L. Kessell in "A Primer of Western Australian Forestry".

With proper management, the production and utilization of all forest values can be sustained indefinitely.

Long regarded as the cornerstone of forestry, sustained yield management has recently become embodied in world conservation philosophy. The International Union for Conservation of Nature and Natural Resources has defined "Conservation" as

the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.³

The History of the Sustained Yield Concept in Forestry

Despite the beauty and utility of trees and timber, the **clearing** rather than the **conservation** of forests has been the preoccupation of societies across most of

(3) IUCN: World Conservation Strategy.

recorded history. Although the Romans were keenly interested in forests and tree planting for nuts and timber, and the nobility of the Middle Ages created forest reserves where they could ride and hunt, it was not really until the middle of the 17th Century, that the first formal attempts at "modern" forest conservation and management began in central and western Europe. The most innovative concept to emerge from this period was that of "sustention" or sustained yield of timber.

The concept evolved in Germany in the years after the end of the disastrous Thirty Years War in 1650. At that time, Germany consisted of over three hundred small, land-locked independent states, mini-states, and independent townships governed by princes, counts, abbots, bishops and civic councils. These were poorly serviced by roads and river transport; there were no railways. During the period of stability which ensued at the end of the War, populations increased, cities, towns and hamlets were rebuilt and there was a great expansion in industry and public works. Suddenly the



H. Bradbury

Most of the jarrah forest in Western Australia has been harvested once. Prime jarrah regrowth such as this 60-year-old near Mundaring will be available again for harvest around the year 2050.



Photo Courtesy Millars Pty Ltd

Boranup Mill, 1899. This was one of three large mills operating from the Boranup forest between about 1877 and 1920. When the forest was cut out, the mill was closed.

year's growth. Where such a situation prevailed and was constant year after year, the forest was said to be "normal". All over Europe the idea of management for sustained yield caught on and was espoused by forester, forest owner and local community alike.

These developments in the Central European countries in the 18th and 19th centuries were not paralleled in Britain or in North America or Australia. As a great maritime trading nation and the possessor of forest-rich colonies where timber was plentiful and free, Britain had no need for scientific forestry at this period. (Indeed it was not until the British Isles were blockaded by German submarines in World War I that the British recognized a need for domestic national forests). In North America, as in the coastal fringes of Australia where European settlement was concentrated, the vast natural forests were regarded as limitless, or worse, a liability, to be sawn up, ringbarked or otherwise destroyed to make room for the settler.⁴

In Western Australia, the native forests were exploited without a thought for the future for nearly a century after first settlement. It was not until 1918 that a Forests Act "for the better management of forests" was passed and the first Conservator of Forests appointed. However, a further thirty years were to elapse before State forests were secured in the face of persistent demands for more

depletion of local forests became a serious and widespread problem. In one region it was said "it was not possible to find a sufficient tree upon which to hang a forester!"* Even worse, the timber famines were accompanied by flooding, erosion and landslides where ancient forests had been recklessly cut from mountainous regions.

From these problems, modern forestry was born. Conservation ordinances were introduced, forests were planted, protected

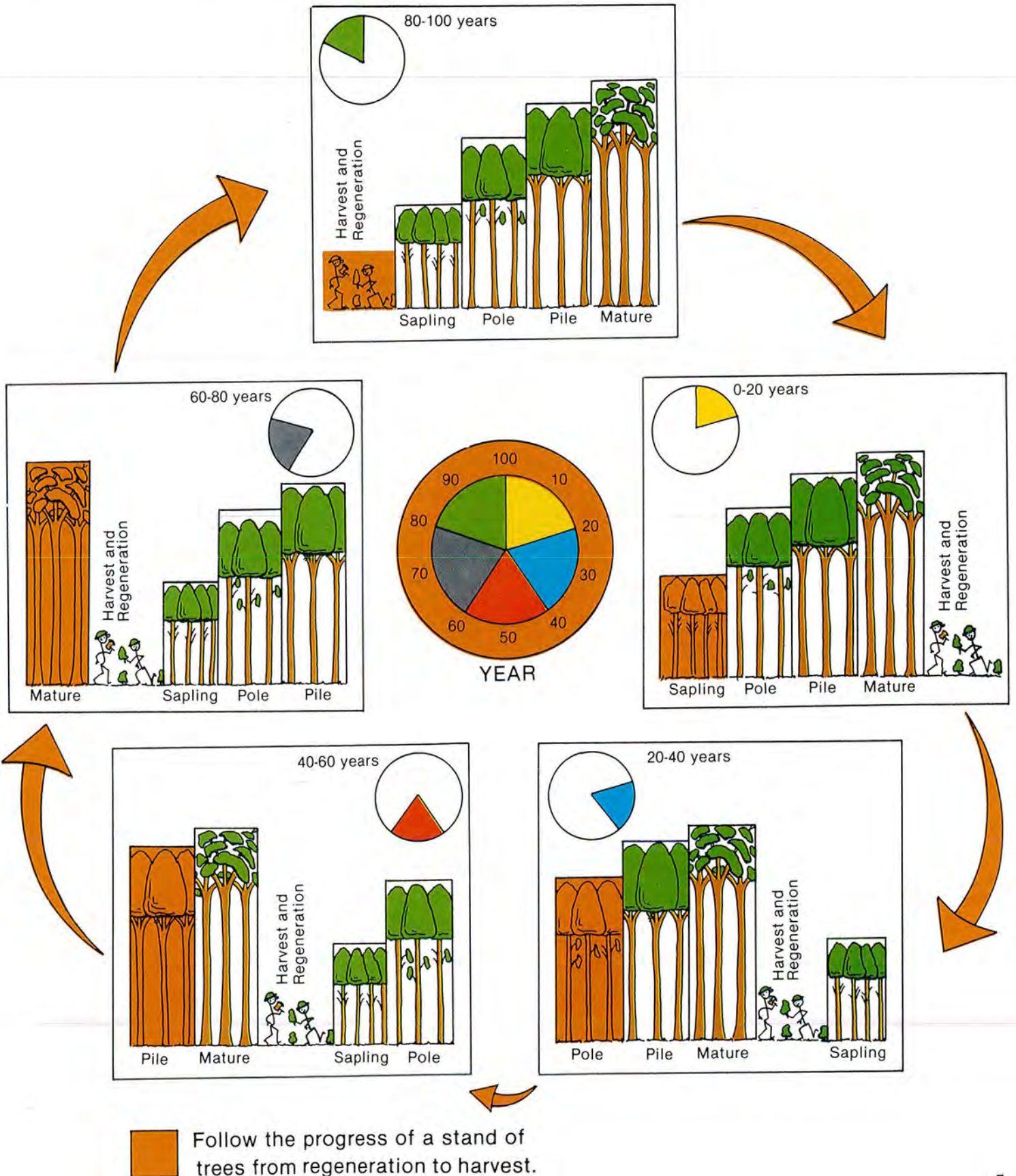
and tended according to working plans, and the idealized concept of local forests forever supplying the needs of local communities emerged. Foresters began to measure tree volumes, assess growth rates and timber yields, determine the most appropriate age at which trees should be felled (i.e. the "rotation"), and prescribe the annual allowable harvest for each product for each forest. The sought-after situation for every forest was one where each year's harvest exactly equalled each

* A forester in those times was a gamekeeper whose main duty was the prevention of poaching by the peasantry. Forests were owned by the landed aristocracy, or by the Church or Town Councils.

(4) C.E. Lane-Poole in Woods and Forests Department Annual Report.

Fig. 2

“The ideal forest after it has been converted to sustained yield.”

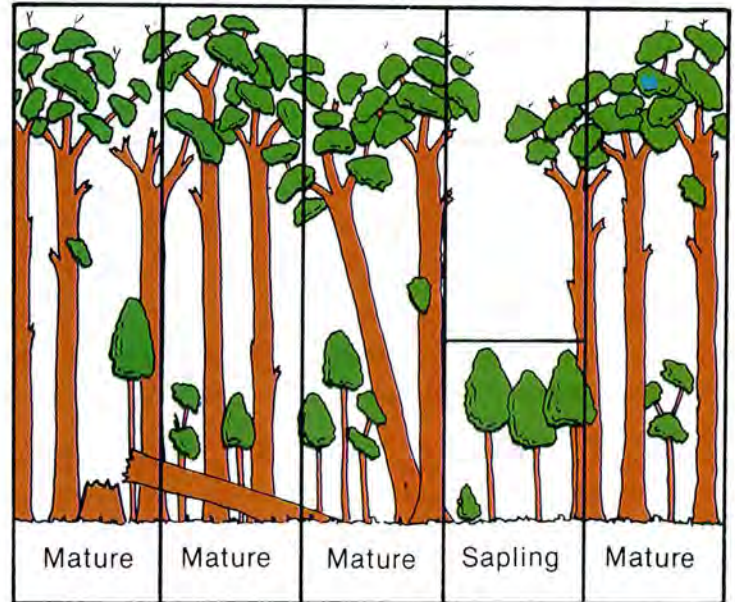


UNEVEN DISTRIBUTION OF AGE CLASSES IN AN UNCUT FOREST

Fig. 3

A typical uncut forest never occurs with the “ideal” range of age classes and takes many years to convert. It will require initial cutting levels above or below the final sustained yield.

If equal areas are cut during this conversion period, yield will not be constant. Usually, equal volumes are logged, thus requiring adjustments later to the managed forest.



agricultural land. It was not until the late 1970s, nearly 150 years after settlement, that a groundswell of popular public interest in forest conservation emerged.

It is interesting to observe that one of the major elements of popular concern today is with the question of sustained yield management, as exemplified in the bumper sticker slogans which call for the “saving” of native forests from mining or overcutting.

How Sustained Yield Works: the Ideal

The principle of sustained yield timber management can be simply explained but it is less easy to implement in the forest and has rarely been achieved for any length of time anywhere in the world.

In simplistic terms, the sustained yield of a forest is the volume of timber that can be harvested each year for an indefinite period. A common analogy is that of money in the bank: if, say \$100.00 is invested and earns \$10.00 interest each year, \$10.00 can be spent by the investor each year “forever”

without ever affecting the value of the capital.

Imagine a small forest which has been managed for sustained yield of sawmilling quality logs (sawlogs) for a long time. The forest is carefully measured and found to carry 50000 cubic metres of sawlogs.

By further careful measurement it is determined that the forest is growing an extra net 500 cubic metres of sawlogs every year. (The net increase is made up of growth of young trees to a size big enough to mill, **plus** growth in the dimensions of existing large trees, **less** losses of timber volume through death and decay of old trees - not an easy figure to determine!)

The sustained yield of sawlogs for this forest is then said to be 500 cubic metres. This means that so long as the area and fertility of the forest remains the same, and provided the area which is cut each year is restocked with trees so that the overall net growth of timber remains at 500 cubic metres of logs suitable for milling, **then**, 500 cubic metres of logs may be harvested each year for as long as you like without depleting the forest.

What Really Happens

The sustained yield concept, in its purest mathematical form (i.e., annual harvest must equal annual growth) has a universally appealing simplicity. This is because it represents “working conservation” at its best: the sustainable utilization of a natural resource for the long-term good of society.

The sustained yield scheme of management offers attractive advantages: timber is always available to the local consumer; industry gets an even flow of raw material; the forest owner can predict works programmes and income for years ahead; and forest-based communities have an assured and stable future.

Indeed the concept is so appealing that an outcry can arise from a concerned public when it appears that sustained yields are being exceeded. This has happened recently in Western Australia, with claims from some quarters that “overcutting” of the native forest is a serious problem. In particular, concern has focussed on the karri forest, where stands are being felled to produce sawn timber and pulpwood. Part of this concern stems from a wholly

understandable repugnance to the sight of beautiful trees being cut down.

Very few people prefer the view of a clearfelled "coupe" to a lofty stand of trees; and if the regeneration process is not understood, it is easy to imagine clearfelled forest as being destroyed.

In the minds of many people "clearfelling" means "overcutting" and both are synonymous with "overgrazing". The latter is a term used in agriculture to describe a situation when prolonged grazing on an area can lead to irreversible degradation of soils and vegetation.

Of course it is possible for cutting without regeneration, especially when **combined** with grazing, to lead to forest destruction. This has happened in many of the ancient countries surrounding the Mediterranean Sea since Biblical times, and is a serious problem even today in developing countries of the "Third World", where population pressures exceed the productivity of the land⁵.

However, clearfelling does not mean overcutting. Parts of a forest can be clearfelled in a planned and systematic manner without ever resulting in overcutting. And overcutting, does not by itself degrade a forest, unless regeneration measures are not undertaken. Cutting followed by reforestation does not destroy a forest. Even overcutting (that is, exceeding the sustained yield harvest) has no degrading effects so long as adequate regeneration is established. The undesirable effects of overcutting are social and economic, not environmental, since it may lead to discontinuous timber supplies rather than permanent loss of forest. Deliberate overcutting may even be necessary for a certain period of time in order to achieve the goal of restructuring a forest to achieve sustained yield.

Fig. 4

The yield of a forest may be made up of different products, and the proportion may vary with age and size.

In an uncut forest the proportion of low grade material is often higher than in a managed forest, because of its age and past effects of fire and disease.

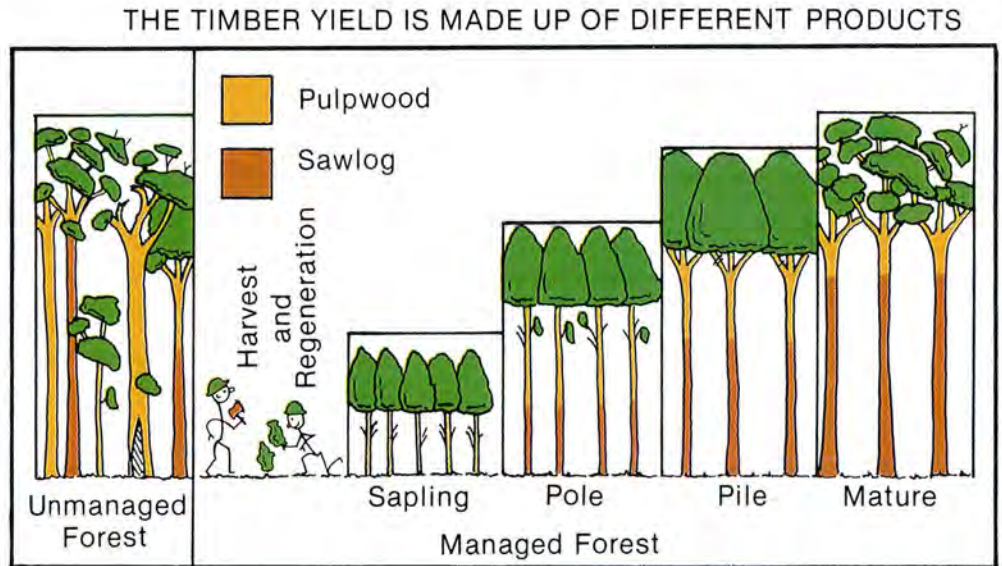
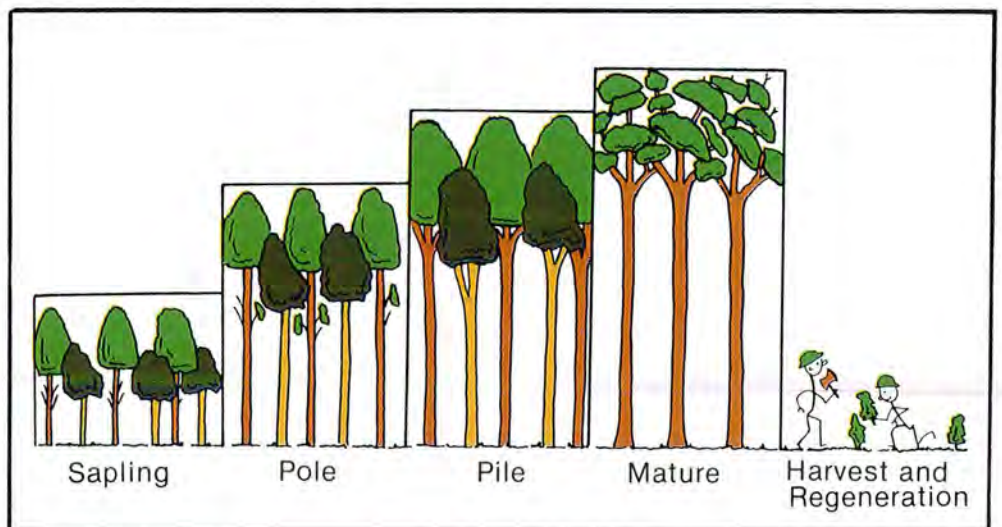


Fig. 5

The forest may also consist of different species and different sites, each with different growth rates and characteristics.

THE TIMBER YIELD MAY VARY ACCORDING TO THE SPECIES



(5) Forest Sector Policy Paper, World Bank, 1978.



C. Winfield

The process of harvest, utilization and regrowth in the karri forest.

Top Left

The mature tree is felled.

Centre Left

Logs are yarded and loaded onto trucks.

Below

The karri sawlog provides a huge volume of timber.

Top Right

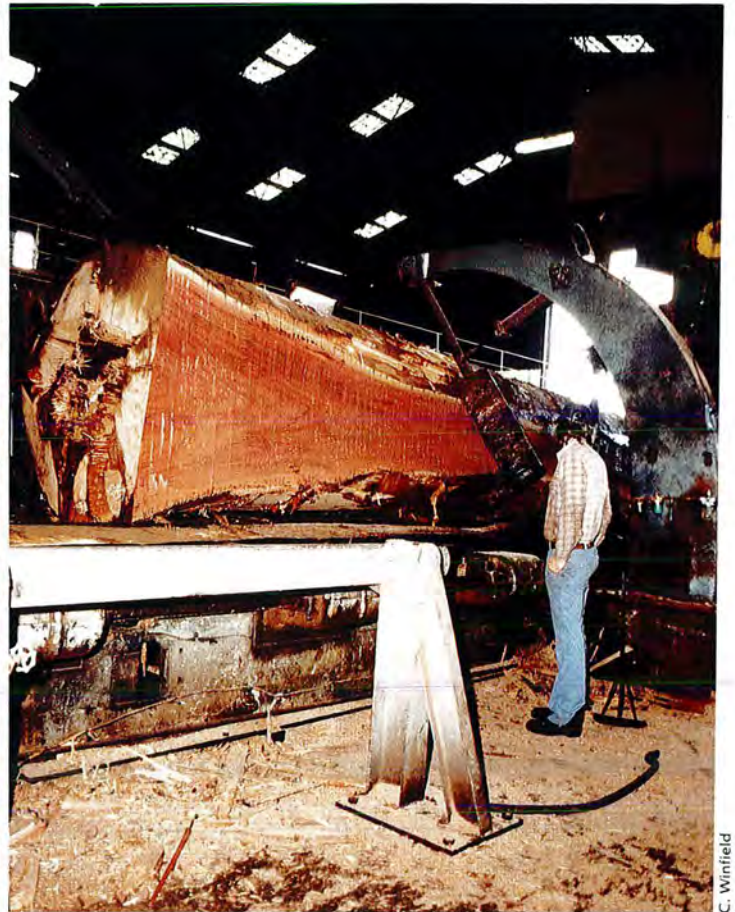
The majority of karri timber is used for beams in roof construction as karri is available in very long lengths and is strong enough to span large distances.

Bottom Right

Fire under seed trees in the logged karri area — the first step in regeneration of a new forest.



C. Winfield



C. Winfield

Overcutting in the Karri Forest

The situation in the karri forest serves to illustrate one of the major difficulties in the "construction" of a sustained yield forest. The problem is that **in a virgin forest⁶ there is no net growth of timber.** The virgin forest is in a state of natural equilibrium where the death and decay of old trees is balanced by the regrowth of younger ones. In other words the sustained yield figure for a virgin forest is zero. Therefore as soon as harvest begins, yield (products removed) exceeds growth. If a forest is being properly managed, harvest must be accompanied by regeneration (replanting or reseedling) of the areas cut over. Many years then elapse before the regrowth forests are old enough to yield the desired product. Therefore for every virgin forest, there must be a "conversion period", that is a time during which the forest is converted to a condition when sustained yield management is possible. Conversion periods of up to 250 years or more are necessary for

some forest types. (See the opening paragraph of this story.)

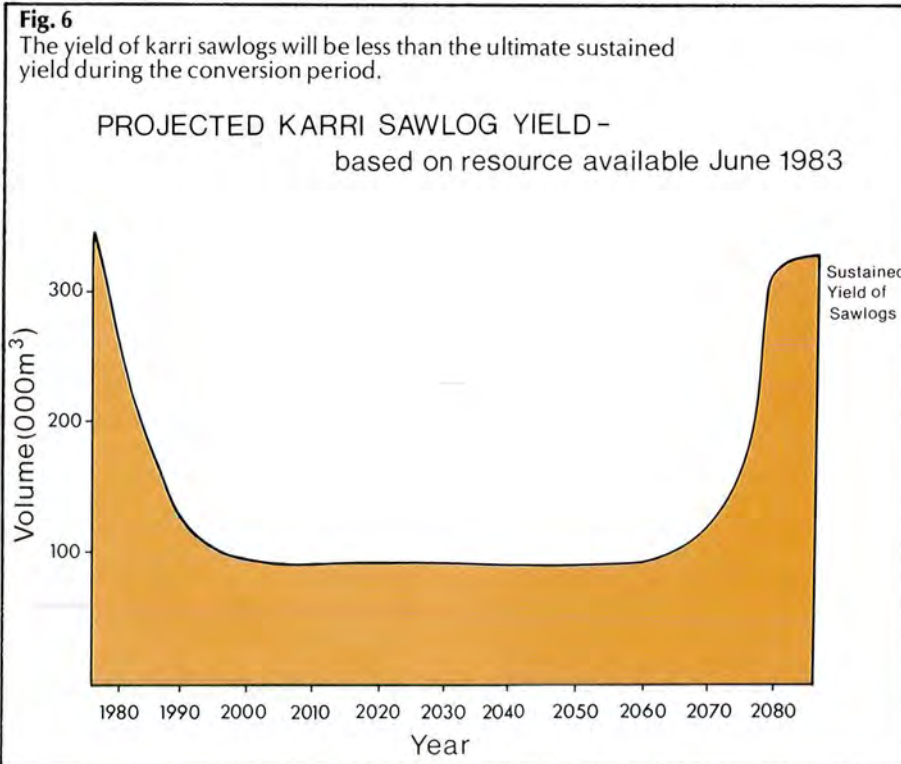
The karri forest is being "overcut" at the moment because the harvest of large sawlogs exceeds the present growth of large sawlogs. However, as the graph shows (Figure 6) the present level of sawlogs cut is part of a long-term plan to achieve sustained yield around the year 2080. During this conversion period, karri sustained yields will decline for a period, but will then increase substantially as volumes become available from the regrowth stands.

Has the advent of woodchipping in the karri forest led to overcutting? The answer to this question is no. Woodchips are produced from logs unsuitable for sawmilling and therefore play no part in the sustained yield calculations for sawlogs. If sawlog and woodchip log production are taken jointly, the karri forest is actually being undercut, not overcut.

(6) A virgin forest in this instance means one which has not been cut over. Karri forest cutting is still concentrated in virgin stands.



C. Winfield



R. Underwood



C. Winfield

New Karri forest approximately 8 years old (right) will be ready to harvest in about a hundred years' time.

Are There Other Difficulties with Applying the Sustained Yield Concept?

In addition to the problems of turning a virgin forest into a "sustained yield" forest, there are a number of other difficulties in matching the reality to the ideal of sustained yield forestry.

Firstly, the sustained yield model is purely a mathematical one, based on the area of forest, its growth rate and the dimensions of the products involved. The influence of the market, and of political and economic factors is completely ignored in the model. Timber consumption by the community does not follow the strictures of arithmetic, but varies according to the laws of supply and demand, the economic climate, the fluctuations in the interstate and international

trade and commerce from year to year, and the impact of changes in customs or technology.

Secondly, a strict compliance with sustained yield formulae may be undesirable in times of national crisis or stress. Many world and local examples can be cited of situations where an "overcut" of the forest was necessary in times of war, or following population explosions or industrial or political revolution. It may also be necessary to exceed the sustained yield cut following a natural disaster in the forest, such as the great bushfires in Victoria in 1939, the terrible ice-storms in Europe in the early 1970s, and the Mt St Helen's volcanic explosion in the NW Pacific coastal forests of the USA in 1980. In these situations huge volumes of timber must unexpectedly be salvaged almost "overnight" to avoid their wastage, and overcutting is the inevitable result.

There may be other times when a forest owner may deliberately choose to overcut the sustainable yield for a few years. For example, in the case of privately owned forest it may be necessary to generate some urgently needed income or to take advantage of a sudden market opportunity.

So we see that while the pure sustained yield system has advantages and wide appeal, it is not easy to fit into the real world. Market or economic influences, or a natural disaster in the forest may often dictate a need to overcut for a limited period of time. Conversely there may be times when the market doesn't **want** the cut, or for one reason or another the forest simply fails to produce expected yields. In such situations an undercut will be forced on the forest owner by factors beyond his or her control.

The end result is a juggling process with harvests and growths varying

NATURAL DISASTERS DISRUPT THE YIELD

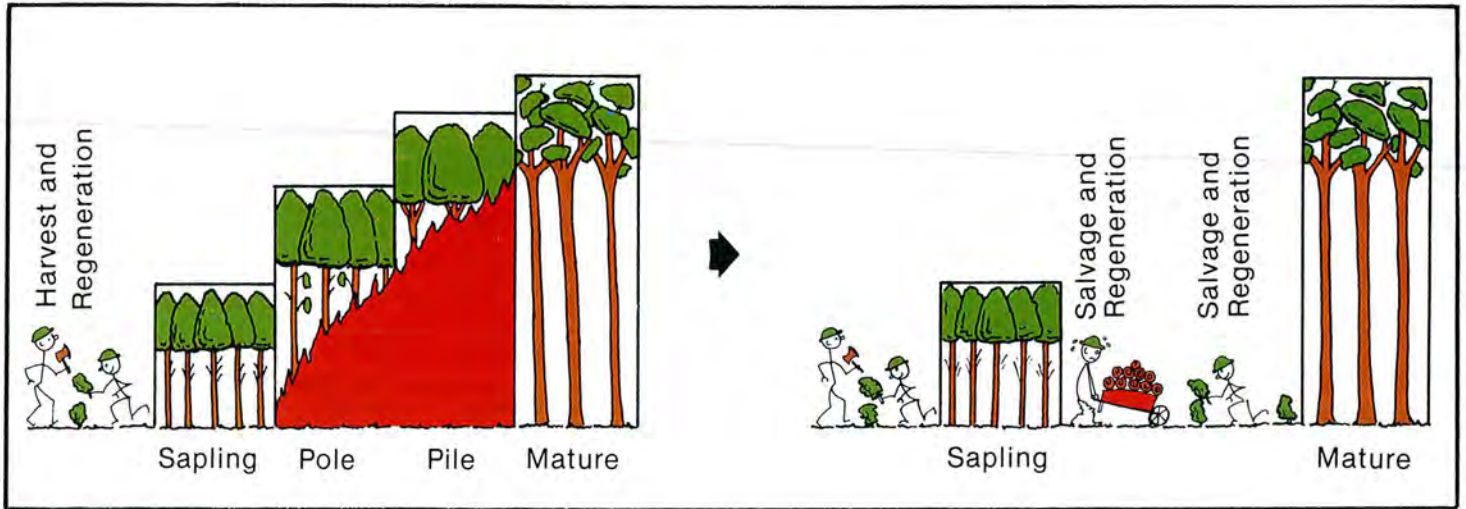


Fig. 7
Even in a well regulated forest a natural disaster may require the salvage of more than the sustained yield. Adjustments must be made later to restore the "normal" forest.

from year to year, with the aim being an equalization over periods of ups and downs.

The preference of the forester, in most cases, is to undercut by a small margin whenever he or she has a say in the matter. This provides the security of a reserve of timber which can be used to meet an unpredicted and pressing need, and provides a buffer against a natural disaster such as fire or wind storm. A great advantage of timber, compared with many other "crops", is that it does not spoil if harvest is delayed. Perhaps the most difficult problem in planning a forest for the future is to predict the needs and the values of future populations. This is an unusually difficult time to make predictions about the future, because of rapid social, economic and technological changes. A good example is the problem encountered by geographers in predicting population trends in Australia.

Foresters have no greater skills in foretelling the future than anyone else. However, they are accustomed to thinking and planning a long way ahead, and to reviewing and modifying their plans at frequent intervals.

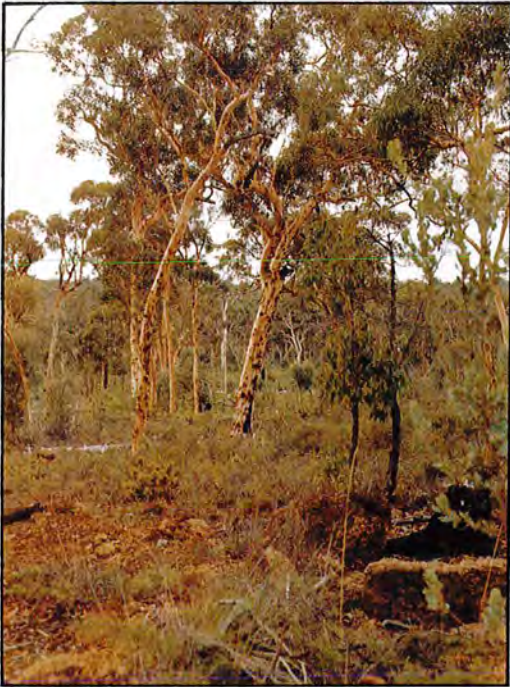
A sustained yield plan for a forest may be disrupted by natural disasters. In 1978, cyclone Alby severely damaged pine plantations near Nannup, necessitating an urgent salvage of timber at a greater cutting rate than originally planned.



F. McKinnell



H. Bradbury



H. Bradbury

Twenty-year-old wandoo regrowth in the catchment of the Helena River. These areas were heavily logged for sawlogs and woodchips (for tannin extraction) during the 1950s and regenerated in 1963.

Powderbark wandoo glows pink in the autumn. The wandoo forest is currently *undercut*. The primary use in the area is water catchment protection; secondary uses being recreation, conservation of flora and fauna and scientific study.

Despite these difficulties, both history and instinct point to timber being a perennially useful material. Timber substitutes, such as steel, aluminium, concrete and plastics are all environmentally less desirable and consume far greater energy in their manufacture. Moreover, the forests from which timber is available on a perpetually renewable basis also offer a wide and satisfying range of social, recreational and protective functions.

Every enterprise and every society needs goals and ideals. Management in response to day-to-day impulses can only lead to chaos. The principle of sustained yield management, however difficult to apply, represents a desirable goal for forestry in Western Australia. Like the rulers of the independent States and principalities in the Europe of the 17th and 18th centuries, the State of Western Australia (on behalf of the people) has chosen a policy of long-term self sufficiency in timber supplies.



References

1. "Science Newsletter", December 20, 1926.
2. Kessell, S. L., **A Primer of Western Australian Forestry**, Government Printer, Perth, 1925.
3. International Union for Conservation of Nature and Natural Resources (IUCN), **World Conservation Strategy: Living Resource Conservation for Sustainable Development**, Switzerland, 1980.
4. Western Australia, **Annual Report of the Woods and Forests Department for the year ended 31st December, 1917**, Government Printer, Perth, 1919.
5. World Bank, "Forestry Sector Policy Paper", Washington D. C., 1978.

Landscape No 6. The Deep River flows almost entirely through State forest, to empty into the Nornalup Inlet near Walpole. Hugh Chevis, a Forests Department researcher at Busselton captured the early morning light on the Deep below Fernhook Falls.



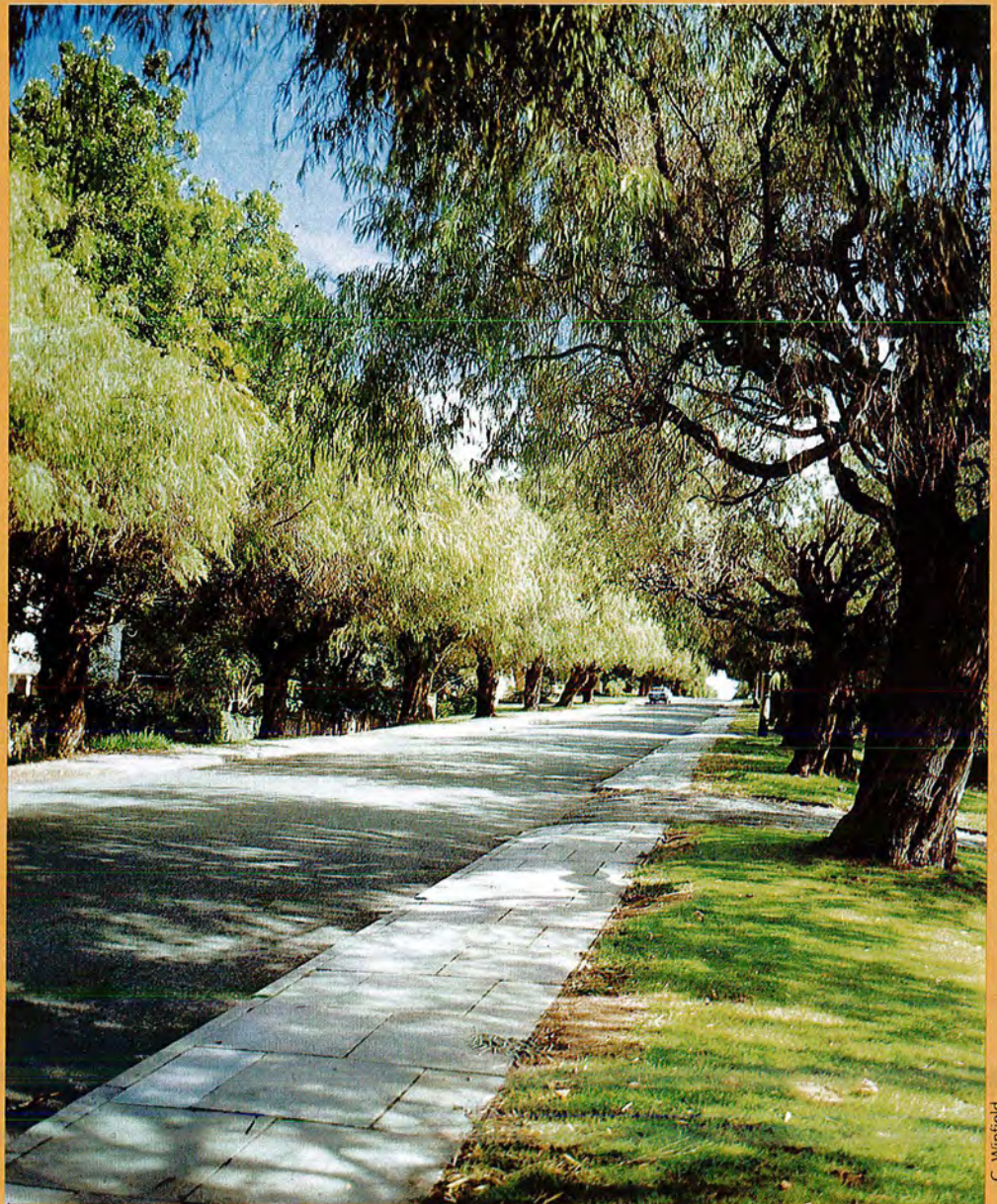
STREET TREES OF PERTH

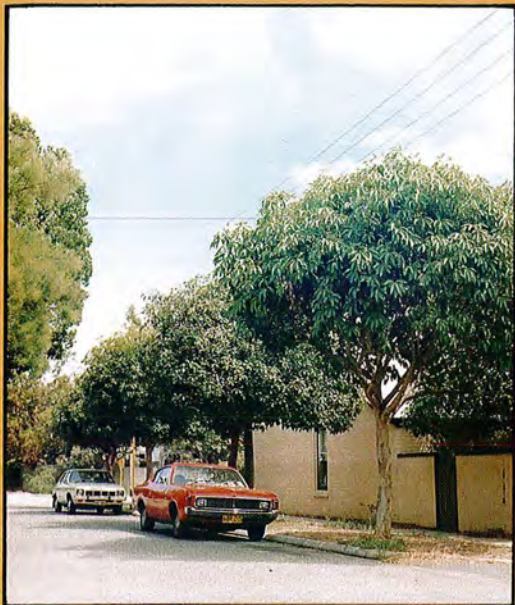
by
Barney White

Why are some suburbs green and pleasant places, whereas others appear desolate? Trees can make the difference, but to be effective they must be large and frequent enough to exert a visual and environmental influence. "Urban Forestry" is the term used to encompass the theme of how the benefits of forests can be melded into city living. Its scope is very wide and can vary from the management of working commercial forests within metropolitan subdivisions down to what individual trees should be planted in a back yard. Street trees are but one aspect of this challenging subject.

Street trees must be special because they have to cope with a greater array of enemies than perhaps any other plant. Vandals can wreck them with minimum inconvenience. Pedestrians on one side and vehicular traffic on the other prune their crowns to bizarre shapes. Underground, water mains, telephone and power cables, and gas mains gnaw at their

Peppermint Grove, a suburb of Perth, was aptly named as peppermints grow naturally there. They have also been planted throughout the suburb as a street tree. Note that the trees on the left hand side have been pruned to avoid powerlines.





The brush box (*Tristania conferta*) is often given a box shape in Perth suburbs, on the side of the street that supports powerlines.

roots. Overhead powerlines restrict crown growth and have created the mushroom shaped street tree so familiar to urban dwellers. In recent years the street tree has been liberated somewhat by more developers choosing to put the powerlines underground. Thankfully the aesthetic benefits apparently out-weigh the extra costs, which must be borne by the purchaser of the block.

Perhaps the most ubiquitous trees planted in the streets of the Perth Metropolitan Area are brush box (*Tristania conferta* R. Br.) and Western Australian peppermint (*Agonis flexuosa* (Spreng) Schau.). Both have been used for some considerable time and continue to be planted, particularly in variegated and other special forms. Both are closely related to the eucalypts.

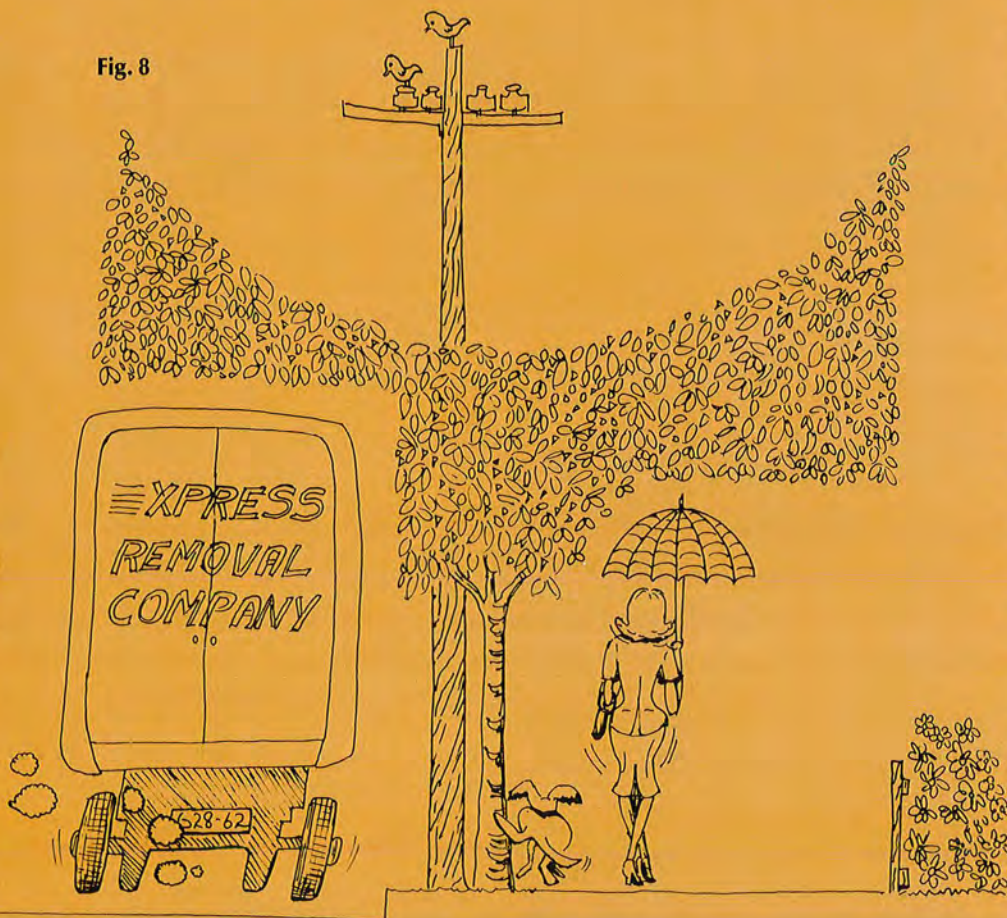
Brush box is native to Australia, though not to Western Australia. Its natural home is on the fringe of rainforest in northern New South Wales and Southern Queensland, where it grows to be a large girthed tree commonly over 40 metres in height. It is cut for timber, along with other associated species. There it enjoys wet tropical summer conditions, quite the opposite to the unremitting summer drought of Perth. Left to grow unpruned and unwatered brush box in Perth tends to be short (10 - 13 metres) and sometimes stag-headed.

Its remarkable capacity to withstand regular and severe pruning makes brush box a popular street tree with city authorities. The typical mushroom shape, created by pruning to avoid powerlines, is so familiar that many are surprised to find that it looks quite different when left to grow naturally. Its deep green leaves also cast a welcome dense shade, and the tree is generally free from disease.

Seaside campers and holiday makers know well the welcoming dappled shade cast in midsummer by the native peppermint. Geographe Bay, near Busselton, is probably the centre and peak of its natural occurrence, though it occurs along the coast as far north as Perth, and both inland and along the coast much further to the south. It is not surprising that quite early in our European history people sought to extend the comfort provided by its cool green leaves and the safe height of its branches to the surrounds of their houses and the verges of their suburban streets.

As with brush box, overhead powerlines have forced the typical mushroom shape on peppermint street trees. Likewise, peppermint has the fortunate capacity to thrive despite regular and heavy pruning. The graceful, semi-pendulous, well proportioned shape of the naturally grown tree contrasts with that imposed by the tyranny of overhead powerlines.

Fig. 8



The Ideal Street Tree?

Not quite! Further requirements: sheds no leaves, nuts, fruit, bark or flowers; produces no hayfever; harbours no insects or noxious fauna; requires no pruning or spraying; and grows no roots.



WOODEN GOLD

Early Days of the Sandalwood Industry

by
Len Talbot

Sandalwood has been used extensively in the Orient for many centuries; particularly in India and China where, because of its aromatic properties, it is highly prized for use on ceremonial occasions when joss sticks made from it are burned as incense.

Just when the sandalwood trade between India, China and the Indonesian Archipelago began, no-one seems to really know, but it is known that Europeans became involved in the trade almost as soon as they appeared in the area. In 1511 the Portuguese occupied Malacca and established a trading base there from which they hoped to be able to monopolize the spice trade between the East Indies and Europe. It wasn't long before Portuguese merchants from Malacca were sending their ships down to Timor and Flores to buy sandalwood for the trade they had established with China.¹

By the early part of the nineteenth century the British were involved in the trade, having established sandalwood plantations in Mysore, India. Their chief market for the wood was Singapore and it was this trade that indirectly led to the establishment of a sandalwood industry in Western Australia.

This magnificent sandalwood tree grows on private property north-east of Perth. Sandalwood of this size is now a rarity in Western Australia.



C. Winfield



Sandalwood at the foot of William Street, ready for shipment to China, 1864.

In 1843 a report reached Perth, telling of the high prices being obtained in Singapore for the wood of a tree very similar to one found growing east of the Darling Range.

Up until that time the settlers in the Avon Valley, being ignorant of its value, had been using sandalwood for firewood and as a building and fencing material, or else simply grubbing it out and burning it when clearing their land. This was

occurring at a time when the colony was desperate for an increase in exports to help balance its trade.

Governor Hutt, delivering a speech at the opening of the Legislative Council on 15 June, 1843, spoke of the enormous imbalance of trade against the colony, which, he explained, had to be paid for by sending money out of the colony, or by issuing extra Treasury Bills. He emphasized that the colony

Once coated with sandalwood powder, joss sticks (rear) are set to dry in the sun. This factory at Butterworth, Penang, also uses the powder for making insect repelling coils (foreground).

could not continue to trade under such circumstances and that it was essential that some additional commodity be exported to help overcome the imbalance.

It was thought that the best chance of increasing exports would be to use the limited capital available in exploiting the still untapped, but abundant, resources of the forests. However, although several former colonists, particularly Sir James Stirling, Mr Dale and Mr Bland, had been working zealously to popularize the colony's timbers in the Old Country, very little had come of the several attempts made to start a jarrah export industry. Sandalwood had been tested by an expert in England and pronounced equal to the East Indian wood, and settlers were advised that it should be possible to sell large quantities of it in England at "enormous prices".

It is no wonder then, that upon receiving the report, the Governor hastened to initiate enquiries into the possibility of exporting sandalwood to the Far East. At the same time he notified the settlers of the report and instructed them not to burn or use sandalwood for any other purpose, but when clearing to stack it aside and have it available for export when required.

Early in 1845 a group of settlers set about establishing a sandalwood trade themselves. As an experiment they shipped four tons to the Far East and were delighted to receive for it what was then the excellent price of \$20 per ton. So began Western Australia's sandalwood industry.

Financial Boom

By the end of 1846 another 32 tons had been exported and sold for \$640, and an additional 200 tons were cut and ready for export. In 1847 the 370 tons exported earned \$8888 at an average price of \$24 per ton.

By then the industry was booming - the young colony's first real financial boom - and all those who were able to do so, mainly Avon Valley settlers, became involved in sandalwood getting.

Consequently, in 1848 exports leapt to 1335 tons and earned \$26706 of the colony's total exports of \$59196. The other main items of export were: wool \$19332 and whale oil \$7142. Sandalwood, therefore, only three years after the initial experimental export shipment, had become the colony's primary industry.

In spite of the success being enjoyed in the industry and the prosperity it was bringing to the colony, it was not without its critics. It was claimed that settlers in the Avon Valley were neglecting their properties and flocks while they were away in the bush cutting sandalwood.

It was, indeed, a very time-consuming occupation and it

would often have been necessary for a settler to be away from home for a fortnight at a time, or even longer. For, after having cut and cleaned the wood, it had to be loaded into wagons or drays and hauled to the coast by bullock or horse teams. Several early accounts indicate that many settlers carted their own wood.

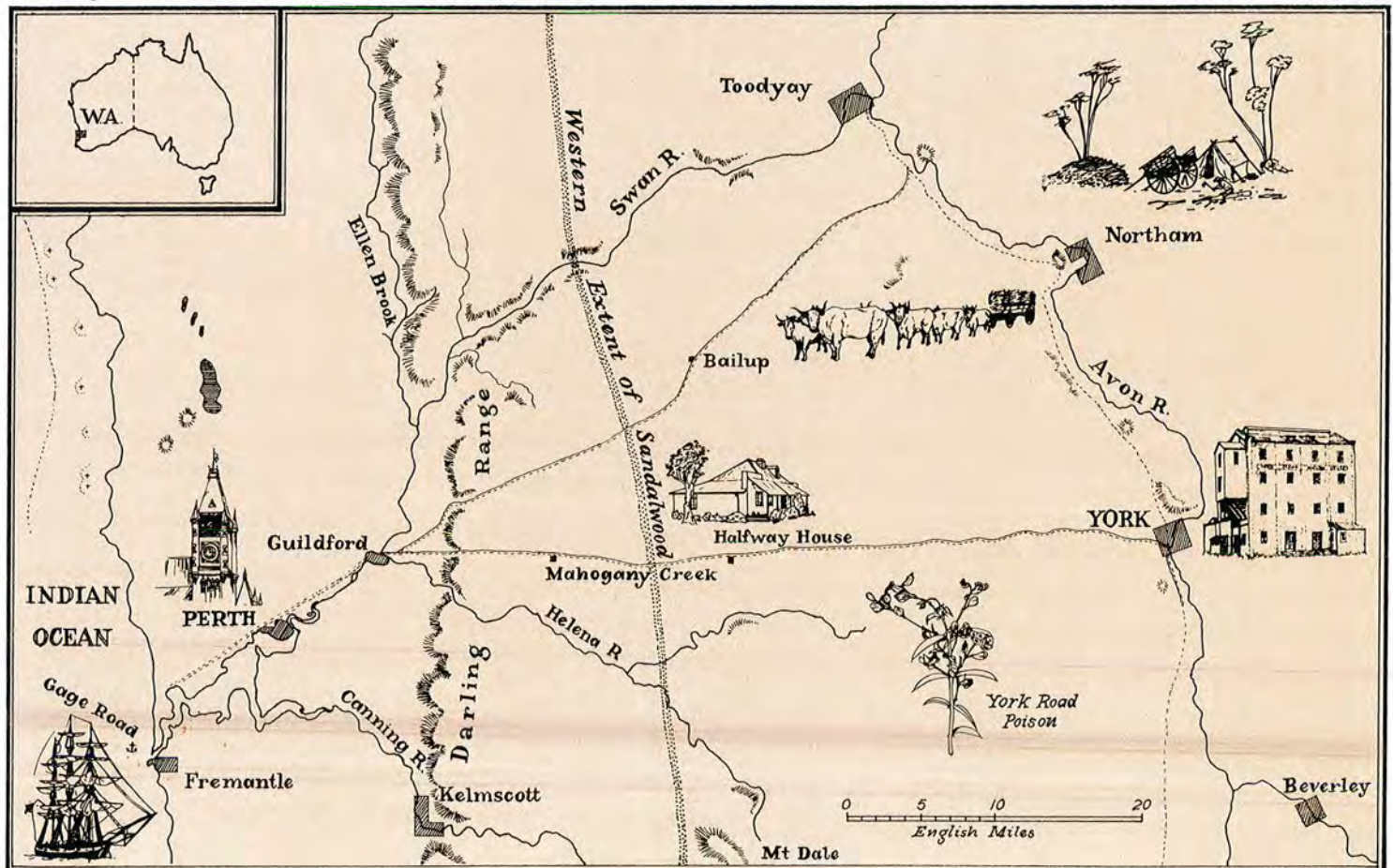
Hauling

From those early accounts too, it is apparent that bullock teams were used in preference to horse teams. Bullocks, although much slower than horses, were better suited to this type of work, especially in the very early days when roads were at best mere winding, narrow tracks. While horses needed a fairly straight line to work, and tended to become frightened and excited in soft ground, bullocks were easier to handle, could weave around obstacles better, work in awkward places, and would pull steadily

under any circumstances. They could live mainly off the rough bush plants whereas horses required good grass, or else bran and chaff had to be carted to feed them, thus taking up valuable freight space.²

Many accounts of journeys with bullock teams show that on the rough roads, 16 kilometres a day was about a normal day's journey. In the 1840s the roads from York and Toodyay to Fremantle were very rough indeed. In summer the deep, soft sand of the coastal plain, between the foot of the range and Fremantle, would have been as difficult to traverse as the boggy flats and creeks in the hills during spring and winter. Teamsters often travelled in groups so that they could help each other through the difficult stretches, sometimes having to hitch two teams together to pull the wagons through the worst patches.

FIG. 9 AREA FROM WHICH SANDALWOOD WAS FIRST CUT IN WESTERN AUSTRALIA





Courtesy of Charles Cable

Camels were introduced to the sandalwood industry early this century. As sandalwood became more difficult to find near towns, railway lines and waterholes the camels' capacity to survive without water or special feed proved invaluable to the trade.

There were other difficulties to be contended with. Bushfires, for instance, must often have caused concern by burning the scrub on which the bullocks could be grazed, and therefore making it necessary to locate new overnight stopping places where there was still feed for the team. Camp sites where there was sufficient water for the team were essential, and sometimes it would have been necessary to erect a temporary yard to stop the animals straying during the night. Perhaps the worst problem of all would have been the dreaded York Road Poison, a pretty pea-flowered plant that was fatal to stock and which still grows abundantly in the Darling Range.

In time, regular stopping places and roadside inns were established along the roads; but the pioneer sandalwooders of the 1840s would have had to fend for themselves. It is not to be wondered at then that, under such conditions, a return journey by bullock team to Perth or Fremantle took a fortnight or even longer. No doubt the critics were justified in claiming that sandalwood getters were neglecting their properties and flocks. Very likely though, the

money they made compensated for it. Certainly it helped the colony at a time when such help was sorely needed.

Taxes - and the Industry Declines

Governor Hutt had been succeeded by Governor Clarke in 1846 and the new Governor, desperately short of funds for public works, early in 1847 put an export tax of \$2 per ton on sandalwood. The money thus was to be spent on the upkeep of roads. This provoked such a public outcry that the tax was soon dropped, but in its place a system of sandalwood licences was instituted and then, only three weeks later, another Bill was passed imposing a toll of \$1 per ton on all sandalwood prepared for export. The penalty for failure to pay the toll was a fine of \$100.

Not long afterwards the Governor reintroduced, and had passed into law, his tax on sandalwood.

For the settlers this was the "last straw". Some even threatened to leave the colony over the harsh taxes. They claimed that after paying taxes, tolls and licences plus

freight, which was \$8.25 to China and \$4.50 to Singapore, and commission on sales, there was not much left for them. It was shown that expenses, without the Government's charges, amounted to \$17 per ton.

A meeting was held in July, 1848, between the Governor, the Chief Secretary, the Chairman of the Central Board of Works and representatives of the farmers and cutters. It was pointed out that the price had fallen slightly recently because of oversupply. The Governor was reminded that sandalwood had virtually saved the colony and that it was ridiculous to aggravate the people engaged in the trade.

The Governor agreed to drop the tax again but he retained the licences and the toll. It was also agreed at the meeting to meet the challenge from competitors by exporting a better class of log, and to put an end to the practice of bartering sandalwood for tea; a practice, it seems, that was more advantageous to the merchants in China than to local exporters.

Perhaps the Governor's harsh taxes helped to kill the industry, or perhaps it was entirely due to the competition from other sources, such as India and the Pacific Islands, but whatever the cause the sandalwood bubble had burst so far as Western Australia was concerned. After 1848 no more sandalwood was exported for eight years; except for 219 tons in 1851. The trade was resumed in 1857 when 280 tons were exported.

The Trade Resumes

In between the collapse of the trade in 1849 and its resumption in 1857, many significant changes had occurred in the colony. The most important change was that Western Australia had become a penal colony. By 1857 about 5000 convicts had arrived and in the same period a similar number of free immigrants came, thus trebling the 1848 white population of 4622. The wool industry had prospered and grown, more land had been opened up for farming, and flocks and herds had also

increased considerably. Gangs of convicts had been put to work on the main roads, such as the York, Toodyay and Albany roads, building small bridges and widening, straightening and realigning them. Overall, there was a general air of prosperity that had been lacking a decade earlier.

It is certain that by this time many of the original sandalwooders would have become prosperous farmers and graziers, or at least would have been well on the way to becoming such. This being so, it is doubtful that many of them would have been interested in returning to the sandalwood trade. One imagines that they would be fully occupied and happy enough at this stage, nurturing their flocks and improving their properties.

But, there were new settlers who would still have been struggling to develop their farms and who would, like so many of the original settlers, have welcomed the opportunity to make some quick money to help tide them over until their farms became viable. So, although there was now a new type of cutter entering the trade, the majority of sandalwooders would still have been settlers. At least for another decade or so. There were, surely by now, more full-time teamsters who could be hired to cart wood for them so that long absences from home would no longer be so necessary.

A Hard Life

But, as time went on, more and more full-time cutters joined the industry. There are on record descriptions of some of these men, that give us a few glimpses into their life style. They were mainly itinerants, living in tents or some similar temporary dwelling, who moved along the rivers at first, but later as the wood got scarcer went further and further out in their search for new sandalwood country³. Often, it seems, they were married men who took their families with them.

They lived a hard life. There was no schooling for their children, nor was there any doctor or nurse closer than a day or two's travel. They lived off the land as much as they could, depending mainly on

kangaroo for their meat. All cooking was done in camp ovens over an open fire.

Life must have been especially hard for the women. There is an account recorded of a cutter's wife who bore seven children, two of them in sandalwood drays on the way to seek a midwife.⁴

Often a woman would be left alone with her children while the husband carted the wood, perhaps all the way to Perth, but more often to the nearest town, where he sold it to the local storekeeper or agent in exchange for stores. Some women spent much of the time

they were alone at the backbreaking work of cleaning the sandalwood their husbands had already cut ready for the next trip. Heat and flies in summer, cold and damp in flimsy dwellings in winter, loneliness, sickness in themselves and among their children, and certainly sometimes even the death of a child through diphtheria or whooping cough, was their lot.

Sandalwood Cut Out By 1882

Sometime about the 1870s restrictions were placed on the export of sandalwood from India. The Mysore plantations had failed.





Copied from the Battye Library pictorial collection, No p 20165.

Waiting for the ship in the 1890s.

With competition from India thus reduced local exports increased dramatically, almost trebling between 1872 and 1882. In the latter year 9605 tons were exported and earned \$192000 (an increase from 3942 tons and \$63072 in 1872). This peak was not surpassed for almost forty years, until in 1919 8998 tons exported brought in \$234144 and the next year 13945 tons earned \$467162.

After 1882 exports dropped away and though this was sometimes due to market factors, such as a fall in demand following oversupply, or outside events like the Sino-Japanese War of 1884, the main cause was the increasing difficulty cutters were having in locating new stands of sandalwood; it having been almost cut out from accessible areas.

Cutters were going back over the same ground again and again, cutting smaller regrowth trees and pulling out stumps and roots left by the earlier cutters. In the early days only the log part of the tree was utilized, but later, limbs, butts and roots were utilized too, and then it became customary to pull the tree out by its roots.

The more determined cutters - or pullers - were pushing further out beyond the settled areas in their

search for virgin sandalwood country. Some wells had been sunk for their benefit, but as they continued to push further out they camped on water holes and gnamma holes (hollowed out caverns in rocks) that they found, or were led to by aborigines, or else dug and timbered their own wells. In this way, the sandalwooders pioneered the way into much of the country that was later to become the wheatbelt. The surveyors, who came later, were able to follow the tracks they had made and to set up their bases on the wells and water holes the cutters had established.

Meanwhile, things had changed down in the capital, too. By the 1860s there were many boats on the river plying between the bustling river ports of Guildford and Perth and the seaport at Fremantle, transporting cargo from overseas vessels up the river, and taking produce to them from the inland.

Guildford was the port for sandalwood. In one eight-month period in 1868, 3000 of the 3256 tons exported that year were shipped down the river from there. When sandalwood exports doubled over the next decade, it is reasonable to assume that Guildford retained its share of the trade.

Teams coming down from Toodyay, the Victoria Plains, York and Northam and beyond, and Beverley and the Dale would there transfer their wood on to the boats at the busy riverside wharf, thus saving themselves the long trek down to Fremantle. Whatever merchandise they required for back loading could be purchased too, from stores at Guildford. It goes without saying that the colourful, hard-drinking teamsters would have patronized the local inns during their stopover in town, and certainly ale, porter, wines and spirits would have featured prominently in their purchases for back loading. Even so, the journey back over the hills would not have been unnecessarily dry, for by that time there were roadside inns at Mahogany Creek, The Lakes and the Nineteen Mile on the York Road and at Bailup on the Toodyay Road.

The Coming of the Railway

However, this whole scene was to change again quite dramatically after the opening of the Guildford to Fremantle railway in 1881. Within a few years the lines had snaked up through the hills, first to Chidlow and then by 1888 on to York, Northam, Toodyay and Beverley. The transportation of inland freight by rail quickly led to the demise of the river traffic and the importance of the river ports. By the end of the century the railways had been extended eastwards beyond Kalgoorlie to Kanowna, south to Albany and Busselton, north to Northampton, to link up with the first Government line established there in 1879, and from Geraldton inland to the Murchison goldfields. Those railways were to play an important and lasting role in the expansion of the sandalwood industry.

The opening of the Eastern Goldfields Railway in 1896 gave access to vast areas of uncut sandalwood country hitherto inaccessible and the cutters were

quick to capitalize on this. The effect is clearly reflected in the export figures for the decade 1892-1901, which show how the trade had been declining in the early 90s, and then the sudden pick-up that came with the opening of the railways.

Year	Tons	Value in \$
1892	5716	85740
1893	3893	64320
1894	2784	46860
1895	3851	61726
1896	6848	131600
1897	5852	98960
1898	4349	63624
1899	4084	59438
1900	5095	78076
1901	8864	147862

Perhaps the temporary wane in the late nineties was due to cutters joining in the gold rushes while the easily won surface gold lasted.

Gold

The life of sandalwooders in the Goldfields and Great Southern districts before the Great War would not have been so very different from that of the cutters of the 1870s and 80s: except of course for the advantages brought by the railways. However, the wood close to the lines was soon cut out and the cutters had to move further and further out from the towns; so it was still a hard, lonely life. They still, of necessity, had to keep moving camp and to live in tents or makeshift homes. Furniture consisted largely of kerosene cases. Water, always a problem in the dry inland areas, had to be carted from the railway or else some other supply located. In the goldfields in particular there was much sickness: barcoo rot, dysentery and, in the towns at least, typhoid. Accidents and infection were not infrequent.

Poor diet, bad water and flies were the main causes of illness - not just for sandalwooders of course, but for the many thousands of men who had flocked to the area during the gold rushes. Damper and "tinned dog" comprised the staple diet, sometimes supplemented by boiled tomatoes or potatoes; but more often than not there were no vegetables available.

Of the many thousands of men who rushed to "the fields" in the nineties, only a handful succeeded in finding the Eldorado all had hoped for. Some of the less successful miners turned to sandalwood getting to earn a living, often combining it with prospecting, a practice that has continued to the present time. During the 1920s, when the price of gold fell, and again in the Depression years, the Forests Department reserved a percentage of the annual cut for genuine prospectors who were temporarily

The coming of the railway to the wheatbelt and goldfields opened up a vast area of the State to sandalwood gatherers.



Courtesy Australian Sandalwood Company.

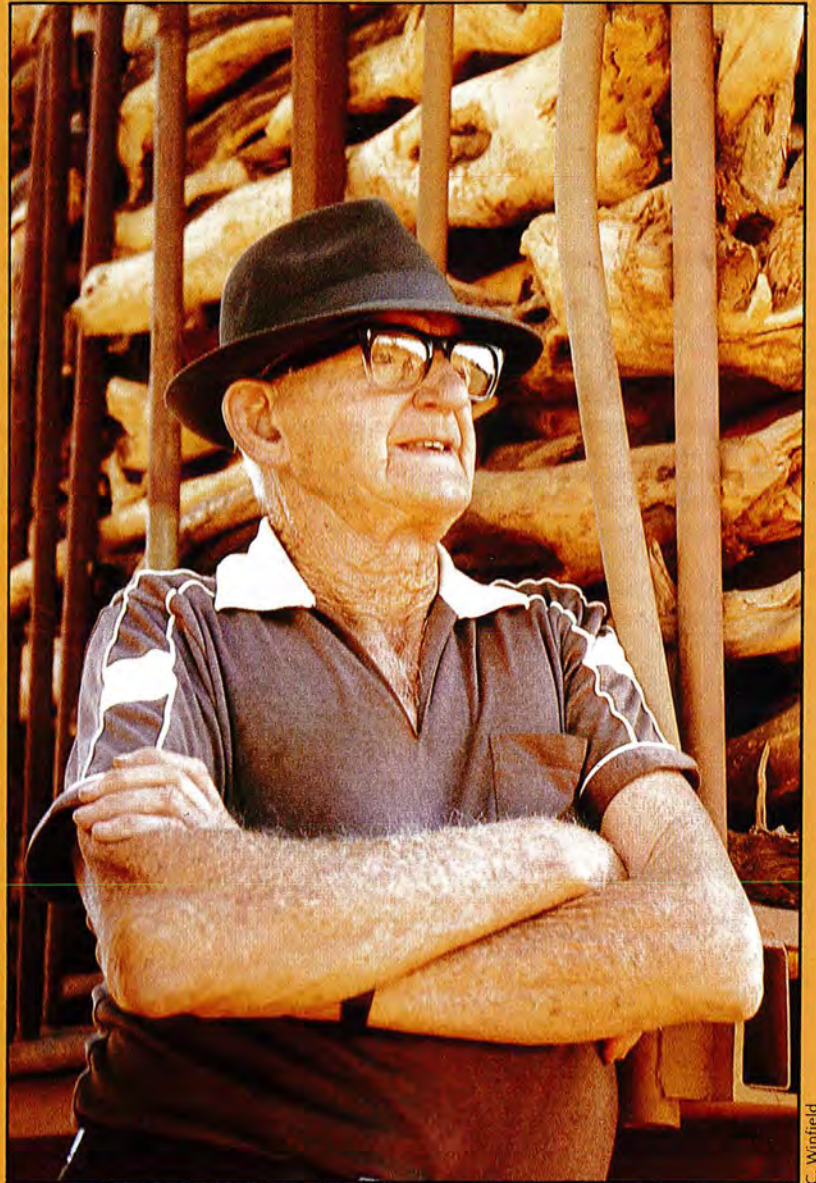
down on their luck. Licences for small quantities were issued to such men to enable them to earn enough to live on for a while, until they were again in a position to support themselves from prospecting and from working their “shows”.

Cutters Exploited

From time to time, cutters complained about the low price paid to them and of the big profits made by the exporting companies. In the early days settlers, with government assistance, made their own exporting arrangements, but by the 1880s cutters were finding it convenient to sell to local buyers or agents and so spare themselves all the hassles associated with such transactions. It wasn't long before the middlemen were exploiting the producers - or so it was claimed.

In 1909, James Mitchell, the Minister for Lands and Agriculture wrote to the Secretary of Woods and Forests, which was a section of the Department of Lands at that time, asking if he could suggest any means by which the industry could be improved, both for those engaged in it and for the State. The request was referred to the forestry officer in charge in the Eastern Goldfields, Forest Ranger Kelso, who was the Department's expert on sandalwood.

Kelso failed to see that there was any problem.⁵ According to him, 1908 had been a near record year, the best since 1882; the price was governed by the price received in “The East” and sandalwood was being brought down from Kookynie to Fremantle (808 kilometres) at a profit. About \$14 to \$16 a ton on rail at Fremantle was always considered a good price in the Eastern Goldfields and about \$2 less in the agricultural areas. At that time, he reported, the Goldfields cutters were being paid about \$15 and those in the agricultural areas about \$13. He pointed out that the price was to a large extent controlled by the demand and that the opening of the Great Southern, Eastern Goldfields and Norseman lines and the timber tramways was an important factor in the supply



C. Winfield

Wood and gold — hand in hand.

Charlie Cable comes from a line of gold prospectors and pioneers. His grandfather was on the Californian goldfields and in the Eastern States “rushes”, his father was identified with every goldfield in Western Australia from the Kimberley to Kurnalpi, and Charlie himself worked several mines, the chief one at Burtville near Laverton. But the search for gold gives results sporadically. Charlie's father had realized the potential of sandalwood early this century, and had begun business transporting the wood from Kanowna to Fremantle on the newly constructed rail line. Charlie began pulling sandalwood as a boy of 14, and supplemented his gold income with valuable sandalwood returns for the next 60 years. “It's different to the old days”, he says. “Now they've got 2-way radio and generators out at the camps, even television . . . And there's the Flying Doctor, that's important”.



Courtesy of Charles Cable

In 1930 Charlie Cable (left) with his brother Douglas, led an expedition out to the Warburton Ranges 800 kilometres north-east of Kalgoorlie, looking for gold and pastoral country. Their equipment consisted of a team of camels loaded with two tonnes of stores, and a small boring plant to bore for water in the Gibson Desert. They are pictured above at Giles' Tank, east of Warburton. On this rock is carved the names of the first European explorers in the region, John Forrest, Ernest Giles, Jimmy Tregertha.



Courtesy of Charles Cable

The 1930 expedition took the first wheels into the Warburton area, drawn by the camel team. On the way from Kalgoorlie, the Cables discovered an outlying patch of sandalwood, to which Charlie later returned. This patch is on an area known as Plumridge Lakes, located between the Nullarbor Plain and the Great Victoria Desert. Charlie's son, Bob Cable is now working in this area.

situation. He considered that the cutters had it in their power to control the supply by holding out for better prices. This had often been done, some men holding out for two or three years for a higher price.

Kelso added that years before, when he had recommended imposing a royalty on sandalwood, he had made careful enquiries into profits. Much ado had been made at the time by cutters about excessive profits big buyers were making on the China market. He had found that in the 1880s there were big profits - up to 36 shillings a pekul (about \$62 a ton) being obtained - but the price was nothing like that now. He understood that the real control of the trade was in the hands of very wealthy Chinese merchants, who were the distributing agents.

This belief that big profits were being made by a "Chinese Ring" seems to have been widely believed in the goldfields. It was to be the subject of an investigation after the Great War:

Controlling the Industry

But, if the cutters were being exploited, so too was the sandalwood resource. As early as 1876 legislation was passed aimed at preventing the unwise over-exploitation of this valuable wood. The new Act prohibited cutting of "miniature" sandalwood and provided for the establishment of large Sandalwood Reserves. In 1895 John Ednie-Brown, a professionally-trained forester, was appointed Conservator of the newly formed Department of Woods and Forests, which had been formed within the Department of Lands.

Unfortunately, Ednie-Brown died suddenly in 1899 and it was not until the Forests Department was founded in 1918, with Charles Lane-Poole as Conservator, that any serious steps were taken to properly control the industry, or that any worthwhile research was done.

Soon after the War Lane-Poole sent Geoffrey Drake-Brockman, a young engineer who joined the

Department soon after being discharged from the Army, to familiarize himself with every aspect of the sandalwood industry. Drake-Brockman read everything on the subject that he could get hold of. He journeyed to the wheatbelt and goldfields, familiarizing himself with the practical side of the trade, and inspecting the old sandalwood plantations established in Ednie-Browne's time.

It was while inspecting an old plantation at Meckering that he noticed that all of the sandalwood

trees that had survived, were growing close to raspberry-jam trees. He assumed the "jam" trees were host plants and the sandalwood trees parasites. Lane-Poole sent the Government Botanist C.A. Gardener to investigate this further. Gardener confirmed Drake-Brockman's theory and wrote a paper on the subject for the Royal Society.

These investigations led Lane-Poole to believe that sandalwood trees could be grown successfully in plantations if host species, of which it was soon discovered there

were several, were planted with them. To obtain seed with which to start the first plantations, an appeal was made to school children to supply them at sixpence per pound (about 12 cents per kilogramme). In his book "The Turning Wheel", Drake-Brockman said that the nuts rolled in like a brown avalanche until there were tons more than could possibly be used and the offer had to be cancelled.

After the war, there was a boom in sandalwood and many men joined the industry. The demand was always around 6000 tons per year, but in 1920 14355 tons were cut and in 1921, 10839 tons. Inevitably a slump followed. Large stocks built up at Fremantle and it was years before this stockpile was cleared. Claims about the Chinese Ring controlling the market re-emerged and Lane-Poole sent Drake-Brockman to China to try to unravel the situation there. This he soon succeeded in doing. He found that 80% of China's total annual requirements came from Western Australia and that while in WA it bought from \$16 to \$24 per ton, it was sold in China at \$100 to \$200. He reported that while the cutters in Western Australia, who roughed it in lonely camps in dry and isolated areas, received no more than a base wage rate, the State Government collected only a small royalty and the distributing firm in China earned only a small percentage on the selling price of the wood; it was obvious that the exporters from Western Australia made a huge profit.

An oversupply of sandalwood stockpiled at Fremantle in the 1920s.



Copied from the Battye Library pictorial collection, No p. 28586.



Copied from the Battye Library pictorial collection, No p. 28574.

So much for the mysterious Chinese Ring.

Drake-Brockman proposed that the cutters and the Western Australian Government should benefit more from the industry. He considered that even if the royalty was increased sharply, it should not

Preparing sandalwood for stacking at Fremantle in the 1920s. Note the marks on the wood made by the use of an adze to clean the bark and the sapwood from the stem. Now sandalwooders are obliged to remove the bark only.

affect the level of exports. He recommended that the State Government should control all sandalwood cut from Crown land and share the profits with the cutters on a sliding scale as the price varied. He estimated that the State Government's profit would amount to \$200 000 per annum and thus enable the Forests Department to afford to establish large plantations of sandalwood so that when the natural supplies cut out the plantations would supply the market requirements.

Lane-Poole accepted the recommendations without question but the Premier of the National Party Government, James Mitchell, rejected them. He said "It savours too much of a trading concern".

Eventually, 6000 tons were rationed to a panel of exporters with the Government receiving \$24 per ton. Thus its share would be \$144000 per annum instead of the few thousand dollars before Drake-Brockman's visit to China.

Later the exporting companies had to pay \$50 per ton royalty but \$32 were refunded upon proof that the cutters had been paid at least that amount. So the cutters too, benefited from the new arrangements.

It is not possible in an article of this length to deal with every aspect of the industry. The part the Forests Department has played in controlling the industry and in researching and protecting sandalwood, could alone provide sufficient material for an essay of this length. Neither has any attempt been made here to cover cutting in the North-west, the use of camels and donkeys in the industry in the North; the sandalwood oil industry, or the effects of grazing, insect pests and rabbits on young sandalwood plants, for instance. Instead this paper has been confined to giving a brief outline of the development of the industry and some insight into the life-style of the people who engaged in it.



The fruit of the Sandalwood tree (*Santalum spicatum*)



Mr Len Talbot is a forester at Mundaring. Recently, the Royal Western Australian Historical Society awarded Len the Lee Steere Award for a paper on the Sandalwood Industry from which this article is extracted.

References

1. Donald F. Lach, **Asia in the Making of Europe**, Vol. 1 p. 113.
Bernard H.M. Vlekke, **Nusantara**, A History of Indonesia, p. 104.
2. T.W. Doyle, **Bullock Teams and Their Drovers In The South-West**, Batty Library.
3. Arthur Clamp, **The Story of Sandalwood**, Batty Library, PR 8071.
4. Ibid.
5. Report by Forest Ranger Kelso in Forests Department file 1507/09, State Archives.

Other Sources

- | | |
|--|--|
| Crowley, F.K., | A Short History of Western Australia ,
McMillan & Co. Ltd., Melbourne 1964. |
| Donovan, R.J., | A History of the Sandalwood Industry of Western Australia , Batty Library, 10H71tr. |
| Drake-Brockman, Geoffrey, | The Turning Wheel , Batty Library, Perth,
Paterson-Brokensha, 1960. |
| Dunham, Albert Edmund, | Transcript of an interview by Michael Adams,
Batty Library, CH.2457 |
| Underwood, John, | Sandalwood Industry of Western Australia , Lee
Steere Essay, Batty Library, Perth, 1954. |
| Ware, Harry, | Sandalwood Industry of Western Australia.
Batty Library, Q.338. 174973. |
| Williams, A.E., | Western Australia, A Potted History ,
Williams Pioneer Publications, Perth, W.A. 1979. |
| Western Australia, Forests Department, Annual Reports - 1922 - 1953. | |



Front Cover

Karri reflections. In this issue we reflect on the age-old forestry principle of sustaining the yield (page 2).

Photo by Bill Bunbury

Right and Above

From the outback to the orient, sandalwood has travelled a unique journey through W.A.'s history (page 21).

Photo by Cliff Winfield

Photo by Courtesy Australian Sandalwood Company