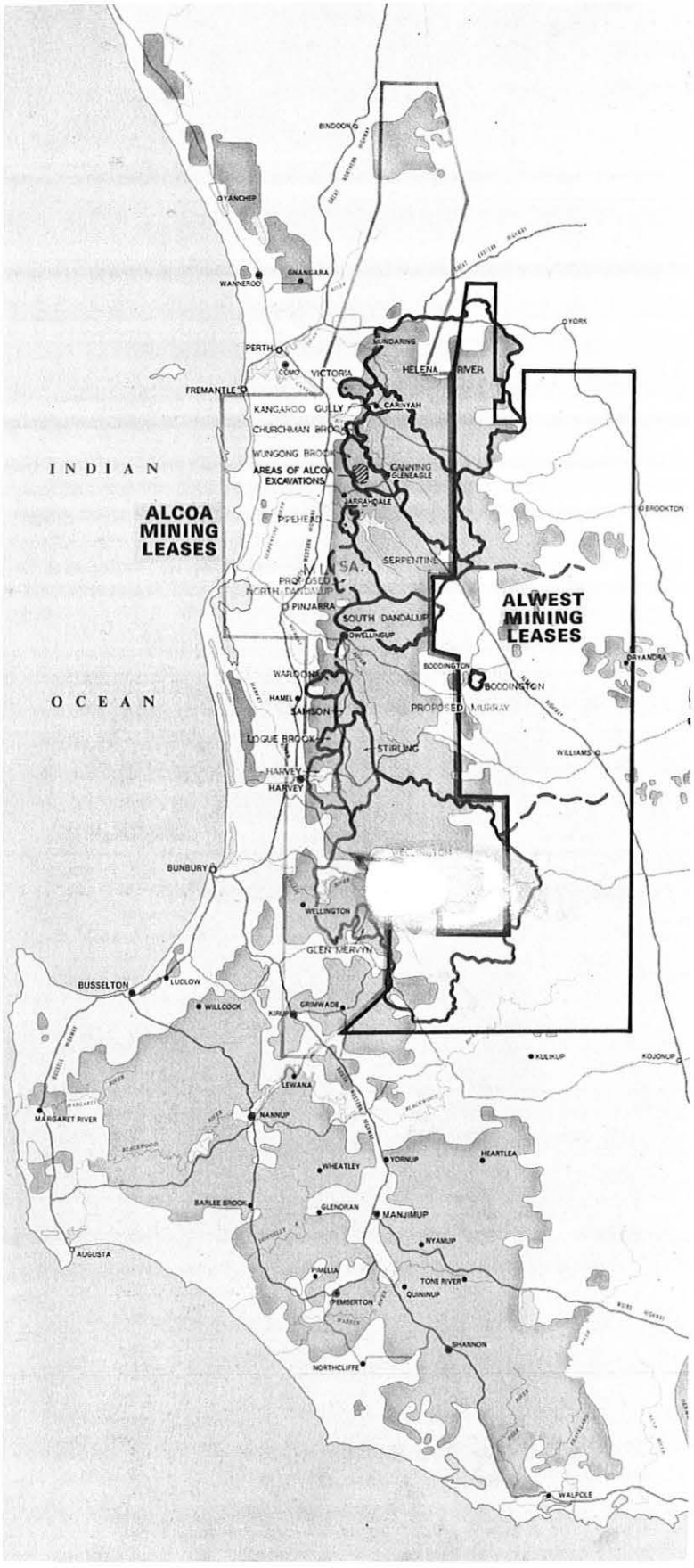
4
Ap 71

FORREST FOCUS

LOSS OF PRODUCTIVE FOREST



WESTERN AUSTRALIA

FOREST AREAS OF THE SOUTH WEST

SCALE: 10 MILES TO AN INCH

LEGEND

STATE FOREST & TIMBER RESERVES			
NATIONAL PARKS			
PINE PLANTATIONS			
KARRI			
WATER CATCHMENT - BOUNDARY			
DIVISIONAL OFFICES	◉	MAJOR TOWNS	◎
DISTRICT OFFICES	●	OTHER TOWNS	○

This map indicates how bauxite mining leases cover present major water catchments. It can be seen that virtually all water catchments are within State forests.

The proposed North Dandalup and Murray catchments are marked.

The Forests Department has always supported the multiple use concept with relation to forest land and apart from normal forest produce aspects, has given attention to the needs of the water supply authorities, naturalists, tourists and public recreation requirements.

Western Australia, and Australia as a whole, is under-forested on world standards. This is shown by the table below:

Brief Comparison of Commercial Forest Areas

Country	*Total Area*	*Area of Commercial Forests*	*Forests as Percentage of Total*
	millions of acres	*millions of acres*	%
United States	1,904	485	24·3
Canada	2,218	529	23·3
Japan	91	62	68
Australia	1,900	87	4·6
West. Australia (State Forests)	625	4·5	0·72

FOREST FOCUS

Number 4, April 1971

Published for Mr. W. R. Wallace, Conservator of Forests, Forests Department of Western Australia, 54 Barrack Street, Perth.

Printed in Western Australia.

Text (10 on 12 pt. Times) by Monofoto Typesetters. Offset plates by Art Photo Engravers Pty. Ltd. Printed by Alpha Print Pty. Ltd.

Compiled by Dale Watkins

Front Cover

On this spot, a jarrah forest once stood. Milling of "Swan River mahogany" commenced in this area over one hundred years ago. All that remains now is a patchwork of mined areas; abandoned tablelands which were cleared for mining; and the remnants of regenerated jarrah forest. The foreground trees are five years old. Note the lack of ground cover over the whole area.

". . . the State will require all its present forests, parks, reserves, beaches and adjacent waters, at least in the south-western part of the State, and probably more, in order to provide sufficiently for the recreational and aesthetic needs of the people."

". . . it appears to us that the forests have so many other advantages to the State and the people that commercial production is not the only reason why they should be preserved."

". . . the forests should be safeguarded not only for these reasons but because they are a scenic and tourist attraction and provide a natural habitat for the indigenous plant and animal life which occur naturally in a forest of indigenous trees."

The above quotes are from the Report of the Committee of Inquiry into the Mining Act, January, 1971.

Focus on Loss of Productive Forest

An average area of 1,387 acres of forest cover, much of it prime forest, has been lost from State forests every year for the past 20 years.

This attrition of dedicated forest is due to the extension of necessary public utilities as well as some commercial activities such as mining in State forests.

The total loss of 27,741 acres in 20 years is significant when it is realised that of the 625 million acres of Western Australia, less than four and a half million acres (0·72 per cent) are dedicated forest (see comparative forest areas, page 2).

On world standards, Western Australia is not only under-forested, but is also the driest third of the driest continent. Of the southern part of the State, where population is concentrated, only 10 million acres enjoy over 30 in. rainfall a year.

Population concentrations are situated close to the forest area, which provides various products to the community. The most vital of these is the State's most precious "mineral" —water—supplied and delivered to the front door at a cost of 5·6 *cents a ton!*

For 25 cents a thousand gallons, it is supplied to an estimated population of 612,730 through the metropolitan water supply scheme. The 1969/70 consumption figure was 142,052,800 tons. (See water catchments map, page 2.) Additional to this is the water piped by the country water supply schemes to inland mining centres, towns and farms.

No forests—no fresh water

While Western Australia is extremely rich in minerals, it can be fairly claimed that the most valuable —from the human angle—is good quality fresh water.

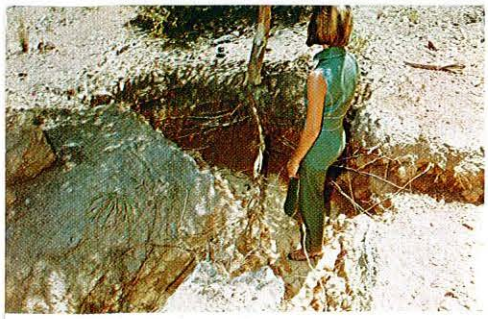
Having no extensive chains of mountains to provide water from melting snow, most West Australians rely solely on forest catchments for domestic and industrial fresh water needs.

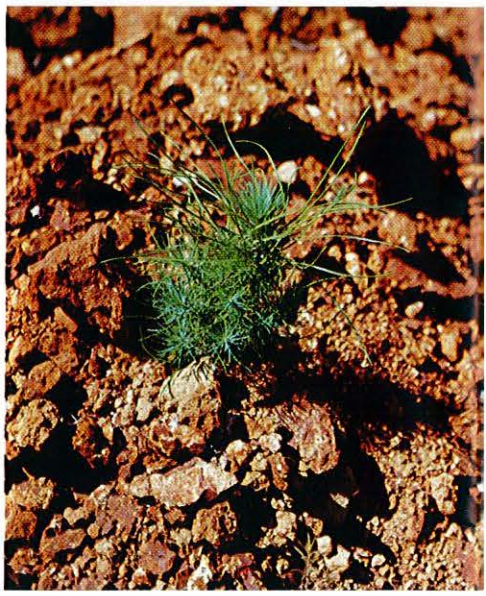
Local and world-wide experience with water catchments has proven that when forest cover is cleared, salinity, siltation and turbidity problems arise. A branch of the Collie River feeding Wellington Dam has

INTRODUCING . . .

the new Minister for Forests, Mr. T. D. Evans, who also carries the portfolios of Treasurer and Minister for Tourism.

One of the Minister's first activities with the Forests Department was to visit his home town of Kalgoorlie to attend a function held for a senior officer, Mr. R. Donovan, who was retiring after 40 years of service (30 of which were spent at Kalgoorlie).

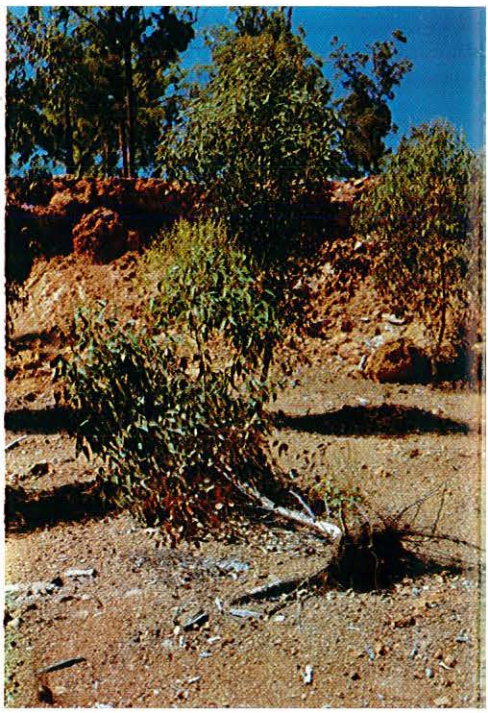




Above, left: The lack of normal taproot development does not augur well for the future.

Above, right: Pines, too, suffer windthrow. Here a pinaster pine (Pinus pinaster) *has struggled to gain a firm footing—and lost.*

Right: The harsh conditions with which some seedlings have to contend.

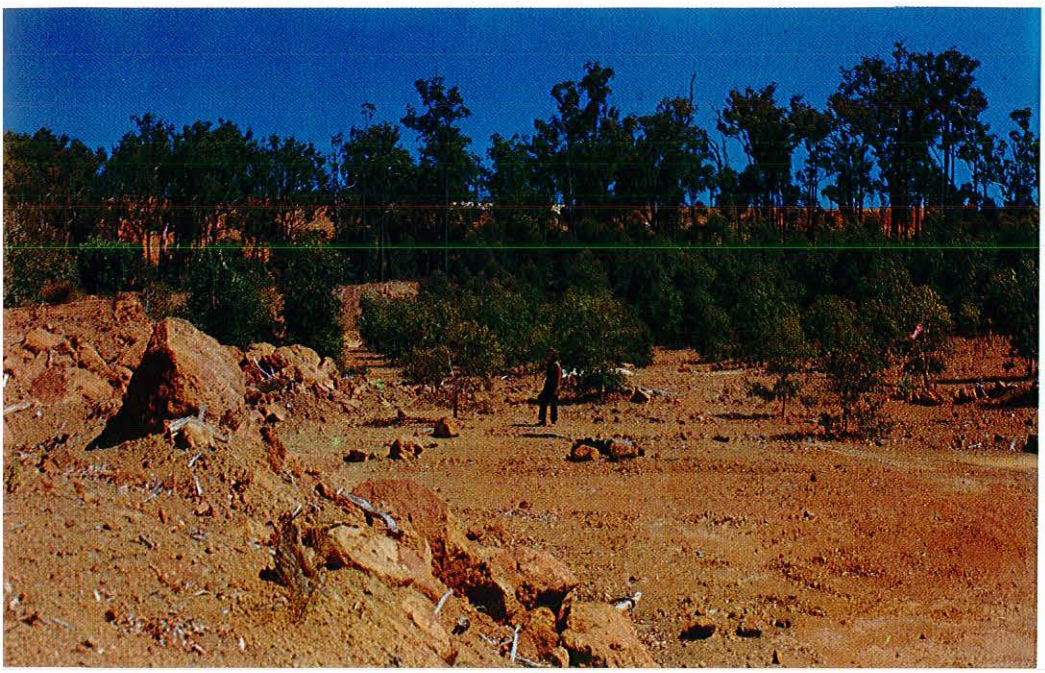


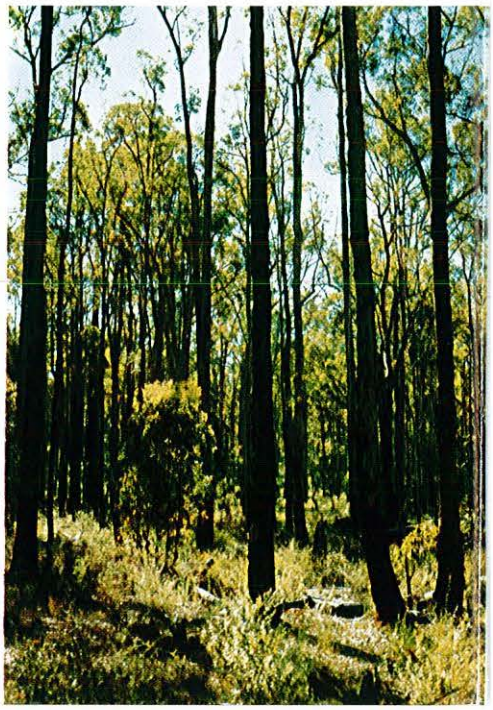
Above: A sample of erosion in an area planted with pines in 1969. The good patch of tallowwood (E. microcorys) *in the background is on a cleared and abandoned area.*

Below: Five-year-old plantings ranging from completely disappeared (foreground), to poor, and good in the far background where soil is deeper and fertilising brought a good response.

Right, centre: Windthrow in the oldest (five years) planting. Where the surface soil is shallow, the tree roots have failed to penetrate the underlying "hard pan" to gain the required anchorage.

Right, bottom: This is what it used to look like (see back cover and page 15). This photograph was taken in the Jarrahdale area.





A patch-work of cleared but abandoned, and mined areas. Foreground is also cleared and abandoned. All have been planted with various exotic species with varying results. The superior response in the valley is on an abandoned area where top-soil was not removed.

10 per cent of its catchment cleared, but the salinity is about three times as great as that in two other feeder rivers which drain from forested land.

The only streams which are reasonably free of salt and suitable for domestic and industrial water rise in the forested areas.

The importance to the community of retaining a normal, healthy forested water catchment can readily be seen. However, there are occasions where it is necessary, in the community's interests, to clear part of forest areas and catchments to provide public services such as roads, railways, power transmission lines, water storage reservoirs and pipelines.

Areas of State forest lost to these services in the last 20-year period are: water supply reservoirs 14,845 acres; power transmission lines 8,296 acres; new and re-aligned public roads 1,589 acres.

To this should be added the rapidly increasing problem of open cut or strip mining in State forests, 1,541 acres.

Mining spells destruction

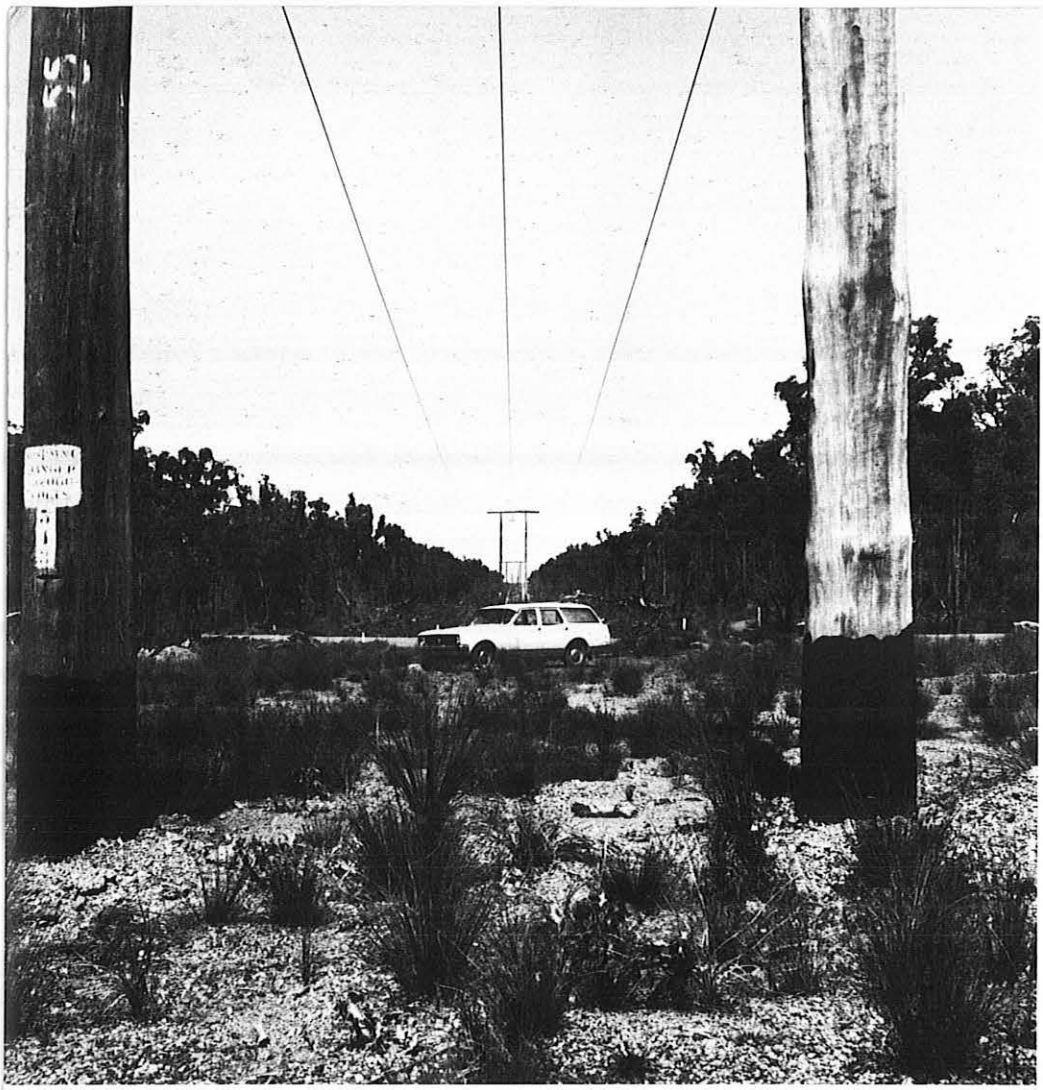
When the Forests Act of 1918 came into force it was recognised as advanced legislation in that it gave the Conservator of Forests wide powers to conserve and manage a small but increasing forest estate which had already been put under stress by early uncontrolled logging operations.

The malformed taproot of this wind-thrown pine (held erect for the photograph) illustrates the problems involved when the too shallow overburden is on top of a hardpan which is impenetrable for most species.

It was then recognised that our forest resources were limited. The Attorney-General and Minister for Woods and Forests, the Hon. R. T. Robinson, in introducing the second reading debate of the Forests Bill on 17 September, 1918, said:

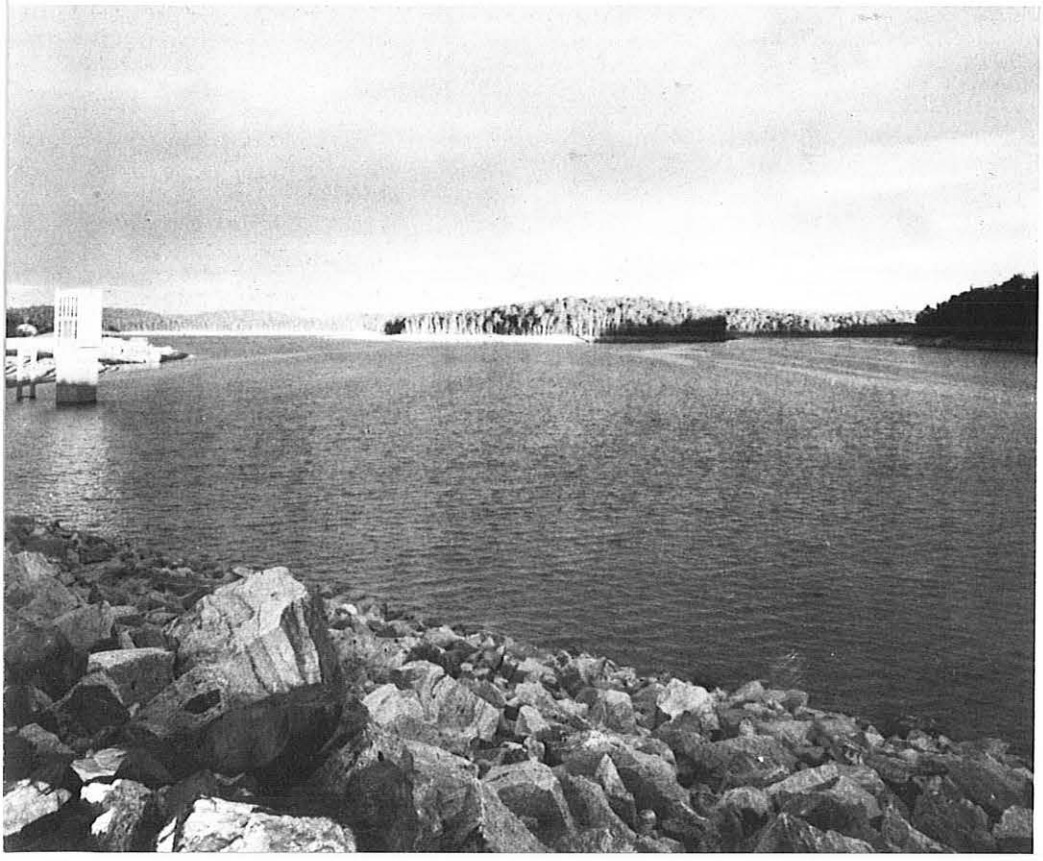
"*Forests are not mines and any attempt to treat them as such spells their destruction. The course of a gold-mine is clear. There is so much gold in a mine we say, 'Let us get it out as fast as we can and make as much profit as we can upon it.'*

"*When gold is exhausted the mine is finished. With forests the position is different. Here we have a mine of wealth, but unlike a gold mine it is inexhaustible so long as it is worked properly. It is not so much a question of how much timber there is in a forest and how quickly we can get it out and turn it into money. This, unhappily, has been the point of view of early govern-*



Above: Power transmission lines have caused the loss of about 8,296 acres of forest in the last 20 years.

Below: Serpentine Dam. In the last 20 years water storages have inundated about 14,845 acres of the forests which feed them. The higher the population, the more forest catchment area required to supply water requirements.



ments; but it is a question of how much we can take out without impairing the continuity of the supply."

Two forms of mining were already established in the main forest areas in 1918—coal mining at Collie and tin mining at Greenbushes. The area covered by these activities has been of minor concern in relation to the whole.

Some 20 years ago mineral sands mining was commenced and claims were lodged for small areas of forest. In view of the limited areas involved, agreements were entered into with the companies concerned, making provision for compensation and restoration of the areas to be mined. The areas sought were generally not high quality forest.

Over the last 10 to 15 years there has been a revival of tin mining activity in the Greenbushes forest area.

Major threat

The first major threat to the forest from open cut mining appeared a little over 10 years ago with the interest in bauxite alumina projects. Concern was expressed by foresters and others because of the likely loss of forest area and because the high grade bauxite was located under prime forest stands.

When objections were raised, the fears expressed were allayed by an assurance that the area which would be involved would be in the order of 20 to 25 acres a year—with a *maximum of* 35 *acres*. The fact that such an operation would embrace only 2,000, or at the most 3,500 acres in 100 years resulted in the objections not being pressed.

The first such agreement was ratified in 1961 with operations commencing at Jarrahdale in 1963. The company is required to pay compensation on an acreage basis for loss of forest and to undertake replacement of the sandy gravel overburden on the quarry pits. In practice, this replaced overburden provides a top-soil depth of only

4 to 12 in. and its shallowness is now the cause of serious concern. As young trees planted in the mined areas grow taller they become more subject to wind. Wind-throw of some young trees has already become evident and it is feared this will increase as the trees grow above the protection afforded by the steep quarry walls in the earlier planted areas. This, of course, is provided there is sufficient nutrients and summer moisture in the shallow overburden to allow tall tree growth.

A feature of the mining agreements has been that *no maximum* area of operation is specified and the only figure stipulated is the *minimum* tonnages which will be processed.

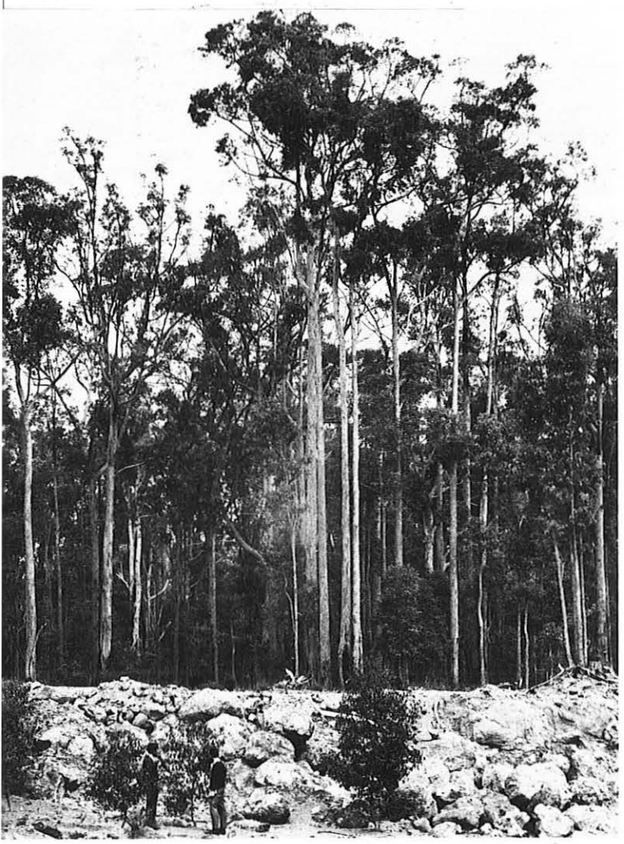
Already the annual clearing has increased tenfold to some 240 acres. At this rate in a hundred years something like 24,000 acres instead of the stated 2,000 or 3,500 acres would be mined. In addition, much larger annual areas are proposed for mining in prime forests east of Pinjarra.

Nearly 50 per cent of State forest area (2,100,000 acres) is currently taken up by mining lease agreements for bauxite.

In addition to the allocation of large areas of the northern forest, there has been a rush to peg the southern forest for mining tenements in the past 18 months. These claims cover a wide range of minerals with the glamour ore, nickel, being frequently mentioned around Manjimup. In February, 1971, over 800 claims, each comprising 300 acres, had been identified and objections lodged to them being granted. Pegging has been carried out by major companies, and many other parties who may be best described as "land agents". Reputable mining companies normally are most co-operative in the case of forest hygiene requirements, however, unknown operators of any size pose a direct threat to the control of the jarrah root rot fungus *Phytophthora cinnamomi* (see page 10).

Above: The State will require all of its present forests, parks, reserves, beaches and adjacent waters, at least in the southern part of the State—and probably more—in order to sufficiently provide for the recreational and aesthetic needs of the people.

Below: Bauxite mining in State forest, Jarrahdale. Between 1965 and early 1970, 1,200 acres of jarrah forest had been cleared, but only about 300 acres actually mined to date. This photograph shows some of the cleared and abandoned areas with forest in the background.



Above, left: Mined and planted area of four-year-old sugar gums (E. cladocalyx) *showing the quality of natural jarrah forest in the background.*

Above, right: This area borders the railway clearing to Jarrahdale No. 2 ore crusher plant, and is likely to be cleared for future mining. This is regrowth jarrah resulting from logging operations about 80 to 100 years ago. What is not mature enough for milling will be destroyed.

Below, left: Windthrown sugar gum, which subsequently died. Note the lack of root penetration. Planted areas have been experimentally treated with fowl manure and chemical fertilisers. Trees in left background have shown a good response.

Below, centre: Erosion of planted areas.

Below, right: Erosion in an isolated pocket of deeper overburden. This patch of four-year-old sugar gums (E. cladocalyx) *and tallowwood seedlings* (E. microcorys) *is showing good initial growth on the deeper pocket of soil and fertiliser treatments, with fewer deaths and windthrows.*

Loss ratio 3 to 1

The problem which has been experienced at Jarrahdale is that in addition to the area mined, a similar area is cleared and not mined, and there is an additional area approaching the same size again used for roads, crusher sites and so on.

A second plant is under construction at Pinjarra and it has been suggested that this unit could ultimately have an intake of $2\frac{1}{2}$ times the Kwinana plant. To this must be added the proposed operations at Bunbury and Upper Swan, and based on the growth which has occurred at Kwinana over 10 years, it is difficult to estimate the requirements for these or any other plants.

Experimental plantings

While some people associated with mining have predicted that the forest destroyed will be replaced with a more vigorous tree crop, foresters claim that these plantings must be regarded as experimental at this stage. It will take a number of years to find out if a satisfactory *protection* forest can be established on these quarry floors. There are definite reservations about the ability of the rehabilitated area to support a high value *production* forest crop.

Any predictions as to the success or otherwise of these experiments should not be made until the trees are *at least* 15 *or* 20 *years old* and are placing a strong demand on the site.

Soils of the jarrah forest have very low fertility and the sandy gravel under which the best bauxite is found provides a particularly harsh site for forest growth. The high quality jarrah forests which have developed on these areas amaze visiting foresters.

The bauxite before removal is a medium for plant growth to depths of 8 to 14 ft. and generally overlies a heavy impervious clay. The overburden resulting from mining only produces from 4 to 12 in. of sandy gravel to be replaced over the clay.

During the last winter, some windthrow of the more advanced plantings of exotic species at Jarrahdale has highlighted the problems of poor root penetration. Experiments are under way for deeper ripping into the clay before planting in an attempt to facilitate root penetration.

While every effort is being made to achieve success, with the fullest co-operation of the mining company ultimate satisfactory results are far from assured.

Some plantings undertaken to date have shown encouraging growth. These areas have received

(*Continued on page* 12)

Miss Lexie Nicholls with a penguin rescued during the recent oil spill emergency at Penguin Island.
Photo courtesy of W.A. Newspapers

OIL POLLUTION

The problem of oil spills may be solved by spreading dry pine bark on the affected waters, according to California-based *Forest Industries*.

Dry shredded bark from southern yellow pines can absorb three times its own weight in crude oil in seconds but repels water for several hours.

Tests at the Texas Forest Products Laboratory proved the utility of the bark for this purpose. Floating oil-soaked bark could be mechanically collected and much oil recovered.

Southern yellow pine is a collective term for several species growing in south-eastern U.S.A. from Virginia to Texas. Some members of the group are included in Forests Department trial plots in W.A.

Jarrah Root Rot

by Frank Batini

From the time that timber was exported from Western Australia in the early 1800s, it ranked among the leading primary industries of this State. Its widely decentralised nature has greatly assisted the development of the south-west.

Apart from timber values alone, the 4,500,000 acres of dedicated State forest assist the conservation of water, wildlife and wildflower resources and are an important recreational asset.

Jarrah (*Eucalyptus marginata*) is the most important timber species in this State, yielding a cut with an annual value of approximately $23,000,000. This forest is threatened by a disease caused by a microscopic soil-borne fungus, *Phytophthora cinnamomi*.

The fungus attacks the fine feeding roots, depriving its host of access to soil moisture and nutrients, with the result that most under-storey species and finally the jarrah trees themselves, succumb to protracted starvation.

P. cinnamomi does not attack the stem or branches of the tree and has no effect upon the strength or durability of the timber.

A free booklet describing in simple terms, the disease, the organism responsible and the known methods of control, is currently being published. This knowledge is essential to all forest users, sawmillers, tourists and the general public, if control measures are to be fully effective.

The booklet gives information, including colour photographs, on recognition of the disease.

Symptoms in jarrah are thinning of the crown and dying back of the tree's branches. The condition becomes progressively more severe until the tree succumbs. Death of the branches is merely an indication of the damaged root system and does not indicate the development of any disease in the above ground parts of the tree.

Diseased areas usually spread outwards slowly, however, the rate of movement can be quite variable depending on the forest type, site and the season.

The fungus

Fungi are lower forms of plant life which obtain their food either by parasitising living organisms or by decomposing dead organic matter. They may range in size from the relatively large mushroom to microscopic organisms undetectable to the naked eye.

Phytophthora cinnamomi causes serious disease in many plant crops and is widely distributed throughout the world, including the eastern and southern states of Australia. More than 400 plant species have been listed as being affected, including azaleas, camellias, peaches, plums, avocado, pineapple, oak, cypress, eucalypts and pines.

Available evidence strongly indicates that the fungus was introduced into Western Australia in the early years of this century, probably in infected soil on imported ball-stock.

Control

Photo mapping indicates that less than 5 per cent of the total forest area

Dieback area near Dwellingup. Scattered blackboys may survive on some sites.

A range of Eastern States eucalypts growing on a former dieback area.

is affected and that most of the infections occur on the poorer jarrah sites.

Control by fungicides or by mechanical means is theoretically possible but costs would be prohibitive for all but the most valuable agricultural crops. The best method of control in the forest is therefore to prevent the spread of the fungus into the 95 per cent of the forest area which has not yet been affected.

Spread of the fungus by natural means within the soil is very slow in comparison to its distribution by the transport of soil containing infected root material. Man, with his ability to transport large quantities of soil over great distances in a very short time, is the most efficient carrier of this disease into healthy areas.

Large volumes of soil are constantly being moved within the forest area on bulldozing, logging and road-building equipment and it is these units which constitute the greatest source of danger.

Prevention of this artificial spread is the greatest single step which can be taken to reduce the serious threat to our forests.

An intensive education programme of all forest users (sawmillers, S.E.C., P.M.G., M.R.D., shires and forestry personnel) is well under way. With the full co-operation of the sawmilling industry, logging prescriptions aimed at minimising the artificial spread of the fungus on infected machinery have been drawn up and are being implemented in all major sawmilling permits.

In localised and high value crops (nurseries, orchards, etc.) control may be achieved by soil sterilisation, fumigation or the use of fungicides. Due to the high cost of treatment, this approach is impractical on a forest scale and could only be used in very limited areas. However, physical barriers such as ditching and poison-band killing, draining of susceptible sites and replanting with resistant species have been used to control the natural spread of the disease within the forest area.

Rehabilitation of affected areas is essential if total timber production is to be maintained from State forests. Over 50 tree species with known commercial potential have been tested for resistance to *Phytophthora* so far and among these, three species of pine and at least five eucalypts have shown both a significant degree of resistance and the ability to become readily established on areas affected by dieback.

Field trials are continuing, but in the meantime over 600 acres are being rehabilitated each year using resistant species.

The oldest plantings of pinaster pine in a dieback area were established in 1950 and this species has grown in the diseased areas for 20 years without any ill effects.

Research

Research into various aspects of jarrah dieback is being carried out at Forests Department research centres at Como, Dwellingup and Manjimup. The Department has also sponsored two research scholarships at Australian universities. The Commonwealth Forest Research Institute is maintaining a research station at Kelmscott and has already sponsored two eminent forest pathologists to visit Western Australia and advise on avenues for research and possible control measures.

In November, 1969, the Forests Department organised a seminar on *Phytophthora cinnamomi* at the Como Institute of Forest Research and Protection. Twenty-seven research scientists from throughout Australia attended the proceedings.

Research into various aspects of *P. cinnamomi* is currently being undertaken in the Eastern States, where damage from this fungus is considered to be of economic importance to both forestry and agriculture.

Resistance of other W.A. forest types

Work to date indicates that karri (*E. diversicolor*), marri (*E. calophylla*), wandoo (*E. wandoo*), and blackbutt (*E. patens*), the other important timber species in this State, are resistant to the disease. The local plantations of *Pinus pinaster* and *P. radiata* also appear to be safe.

Three-year-old planting of Pinus pinaster *in a dieback area.*

(*Continued from page* 9)

applications of both chemical fertiliser and fowl manure.

Fourteen different eucalypt species and seven conifers have been planted, with the hope of proving some as suitable for growing on these rather harsh sites. Factors considered in the choice of species are that they be resistant to *Phytophthora cinnamomi* and that they have a commercial value.

Jarrah is not being replanted at present on the mined areas. The reasons for this are that jarrah is very susceptible to attack by *Phytophthora*, and it has, by comparison with many other eucalypts, a slow growth rate. Jarrah seedlings commonly remain in a dormant condition for up to 15 years before making any significant height growth.

Long term benefits

Two of the first thoughts which come to mind in comparing the advantages of forestry to those of mining on a particular area are those of short-term economic and social values. What is more important and considerably more difficult is evaluation of the long-term worth to future generations—which is possibly the greatest criterion where a regenerative natural resource is concerned.

Should the attempts to reforest mined areas not be successful, the long term effects of bauxite mining on State forest areas could outweigh any of the short term financial gains being made at present.

Apart from their timber production role, the jarrah forests in which mining is taking place include virtually all of the catchment areas for reservoirs supplying domestic water for the Perth metropolitan area. Being close to the main population centre, these forests also receive a large amount of recreational use, and are also a haven for indigenous fauna and flora.

The beneficial effects of forests in the fields of temperature, wind and salinity control; air purification and oxygenation; and soil and water conservation are of major importance to community welfare.

The wisdom of mining prime forest in proximity to our heavy population areas is questionable when there are large proven reserves of bauxite in the north where these other values of forestry do not exist.

Recommendations

In 1970 the Forests Department made submissions to the Committee of Inquiry in the Mining Act. The following are extracts from the Committee's report:

Recommendation 9 commenced: "We recommend that no marking off, prospecting or mining should be allowed on a State forest, timber reserve, water reserve or catchment area unless a permit is first obtained from the Minister responsible for the administration of the department concerned. The Minister should have power to grant or refuse to grant a permit or to grant permit subject to such conditions as he thinks fit to impose and there should not be any appeal from his decision."

Recommendation 24 commenced: "In view of our recommendations we think that it would be most undesirable to allow the existing or any future applications for prospecting or mining tenements on reserves, etc., to proceed except on the new basis which we have recommended. We therefore recommend that all applications both existing and future for mineral claims, prospecting areas, mineral leases or other mining tenement over any reserve or national park . . . or over any State forest, timber reserve, water reserve or water catchment area or over any private land should not proceed after the date of this report except on the basis that they conform to the relevant recommendations contained in this report and where necessary are accompanied by the necessary consents or permits."

Trees for Country Areas *by Frank Batini*

Although most of the Forests Department's activity has centred around the State forests in the higher rainfall region of the State, the department has, for many years, taken active steps to stimulate and maintain interest in the planting and conservation of trees throughout the farming areas.

This involvement commenced when the Hamel nursery was established in 1896 to supply trees for farmers and other residents of country areas. The interest and enthusiasm of Mr. G. E. E. Brockway, then officer-in-charge of the Kalgoorlie Forest Division, in raising seedlings of the hardy but fast-growing inland trees, led to the establishment of an additional tree nursery in Kalgoorlie in 1946. From this nursery came the plants which have made Kalgoorlie and Boulder so well known for its street planting programme.

Before the nursery was transferred to Dryandra in 1955, and finally to Narrogin in 1967, an arboretum was established in Kalgoorlie and this has become a focal point for tree-lovers throughout Australia and overseas.

By 1916 the annual distribution of seedlings had already exceeded the 90,000 mark, and during 1969 a peak of over 274,000 were sold. Previously free, the trees were sold at cost from 1917 onwards. (Current cost 35 cents each or $25 a hundred.)

Over 200 species are grown at the two forest nurseries; the most popular eucalypts being: river gum (*E. camaldulensis*), tuart (*E. gomphocephala*), dwarf sugar gum (*E. cladocalyx* var. *nana*), bald island marlock (*E. lehmanii*), salt river gum (*E. sargentii*), coral flowered gum (*E.*

(*Continued on page* 14)

Selected Flowering Eucalypts of Western Australia (being published)

The photograph of *Eucalyptus erythrocorys* (Illyarrie) below is taken from the front cover of a 48-page book titled *Selected Flowering Eucalypts of Western Australia*, which is being published shortly by the Forests Department of Western Australia.

The 29 species and five varieties selected for publication will be represented by 65 full-colour reproductions. In addition, the buds and fruits of each species will be illustrated in black line drawings. A colour map showing isohyets and place names is also included.

The genus *Eucalyptus* includes in its 600-odd species and varieties, not only trees of high commercial value for their timber, tanning materials and oil producing foliage, but also many trees and shrubs of considerable aesthetic value.

Any healthy tree may be considered to possess aesthetic value, but this publication is concerned mainly with those members of the genus which show outstanding beauty in blossoms, fruits or unique foliage or bark. Some 30 such trees and mallees occur in the southern portion of Western Australia, a section of the State which enjoys a mild climate and receives a predominantly winter rainfall. The outstanding trees of the northern part of the State have not been included.

The general statement has been made that "the smaller the eucalypt the bigger its blossom". The converse is nearer the truth as many small eucalypts have very small blossoms, nevertheless, most large eucalypt flowers are produced by species of small size.

Most of the small eucalypts assume the "mallee" form with a large woody rootstock or lignotuber from which several distinct stems arise. If the stems are destroyed or removed, fresh shoots will arise from the lignotuber and it is this characteristic which enables mallee plants to rejuvenate vigorously without the necessity for actual replacement by replanting.

A table of distribution shows that more than half of the species listed occur in the 11 to 20 in. rainfall belt, the area where the greater part of the State's agricultural development has taken place. This means that their occurrence throughout their natural range is becoming increasingly fragmentary and many are now extremely rare.

The remnants must be rigorously conserved otherwise most of them will, within the not-too-distant future, cease to exist in the wild state, and posterity could well be forced to rely on cultivated specimens to ensure the perpetuation of the species.

The book will be available from the department's head office, or on order from its other offices, for $1 (post free within Australia).

Illyarrie (Eucalyptus erythrocorys)

Above: Trays of young seedlings raised at Hamel Forest Nursery, soon to be despatched to buyers in country districts.

(*Continued from page* 12)

torquata), sugar gum (*E. cladocalyx*), Tasmanian blue gum (*E. globulus*).

In order to test the suitability of various species for the arid and semi-arid regions of the State, and to demonstrate the real value of tree planting in these areas, the Forests Department has, since 1949, maintained a programme of arboreta establishment throughout the farming areas.

Over 60 arboreta have been established and these comprise some 9,000 trees of different species. These arboreta cover a wide area ranging from Yuna in the north to Kalgoorlie in the east and Esperance and Boxwood Hills in the south. This work has enabled assessment of the most suitable species for different localities, and investigation of the most suitable spacing and establishment techniques.

The arboreta have proved to be an invaluable aid to the department's advisory service.

The severe drought to which the trees were subjected during 1969/70 provided a real test of their drought resistance. Results of a recent assessment have been very encouraging in that, almost without exception, well established trees have survived.

The performance of various species in these arboreta has influenced the revision of the list of trees recommended for planting in the agricultural areas of Western Australia.

In recent months, at the request of the Wheat and Sheep Division of the Department of Agriculture, officers of the Forests Department have attended agricultural field days at the Badgingarra and Wongan Hills Research Stations. On each occasion the advantages of tree planting were discussed, the arboretum was inspected and questions were answered. On these field days, a great deal of interest was shown by the attending farmers.

Few would question the desirability of establishing trees within the agricultural zone, particularly on the largely treeless heaths which have figured so prominently in recent agricultural development schemes.

A recent publication *Catalogue of trees for growing under Western Australian conditions* lists the trees recommended for specific areas and needs, and a brief description of each tree is given. Advice on tree planting techniques and the care of trees in general is also provided. Copies are available free of charge from the Forests Department, Perth, or either of the two nurseries.

Below: Farmers inspected this arboretum near Badgingarra during an agricultural field day earlier in the year.

A Masterpiece of Engineering

With the advent of tall buildings in Perth, people who are interested cannot fail to be impressed with some of the engineering aspects involved.

However, as the photograph below illustrates, not one of the buildings so far erected can match the ancient karri tree in engineering design, height and aesthetic appeal. The tallest karri tree measured so far is 286 ft. high, with a girth at breast height of 24 ft. Girths up to 38 ft. 6 in. have been measured on shorter trees.

The tallest karri is 20 ft. 6 in. above Perth's tallest building, Hamersley House, which the builder says is 265 ft. 6 in. above the Terrace.

The tree illustrated reaches up to the 286 ft. mark, dwarfing most of Perth's buildings . . . yet this is supported on a bole of only 7 ft. 8 in. in diameter at breast height, or half the length of the latest Holden. On the subject of summer shade, the tree crown width of 117 ft. is $19\frac{1}{2}$ times the width of this vehicle.

Each tree is a highly complicated and well balanced solar powered food factory (the cleanest factory in Western Australia) supplying energy to countless living cells which in turn help man in so many ways.

In addition, the tree pumps water from below ground level to the topmost leaf (a feat in itself) to carry nourishment—and in the process releases oxygen for human, animal and motor vehicle consumption.

The comparative heights of the tallest karri tree and Perth's buildings is indicated below.

Back Cover

FOREST SCAPES

Morning sun filters through these 53-year-old jarrah trees east of Dwellingup. The height of the dominant trees is 80 ft.

Western Australians have recently become more aware of their environment and the values of forests. In this they are in line with international thinking.

As Dr. Frederick E. Smith, of Harvard University said, as keynote speaker at the 70th Annual Meeting of the Society of American Foresters: "Forests contain the largest single agent of biospheric regulation. Forests contain more biological activity than all of the oceans, and over half of the live or recently formed organic matter on the planet is in forests. Their value as a global resource seems beyond calculation."