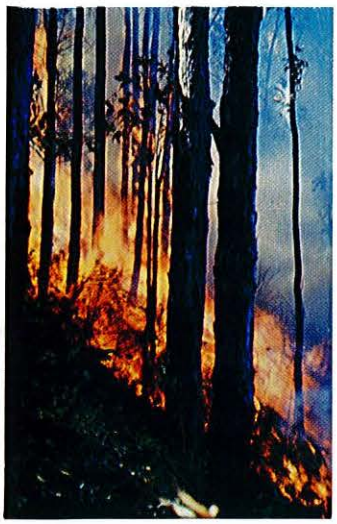
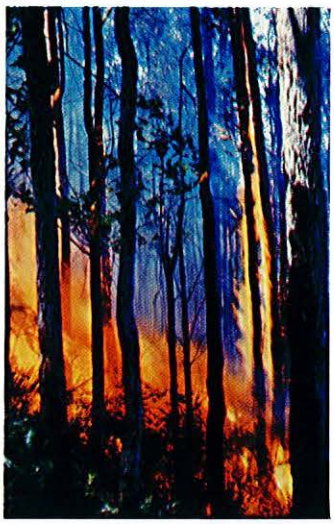
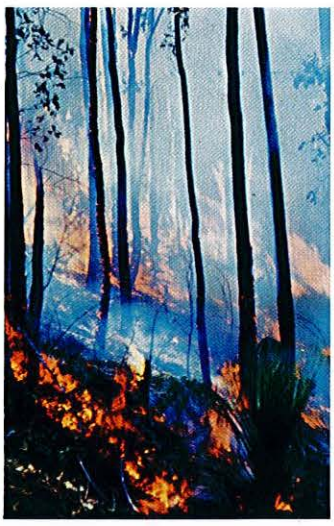
3.

FOREST FOCUS

CONTROLLED BURNING

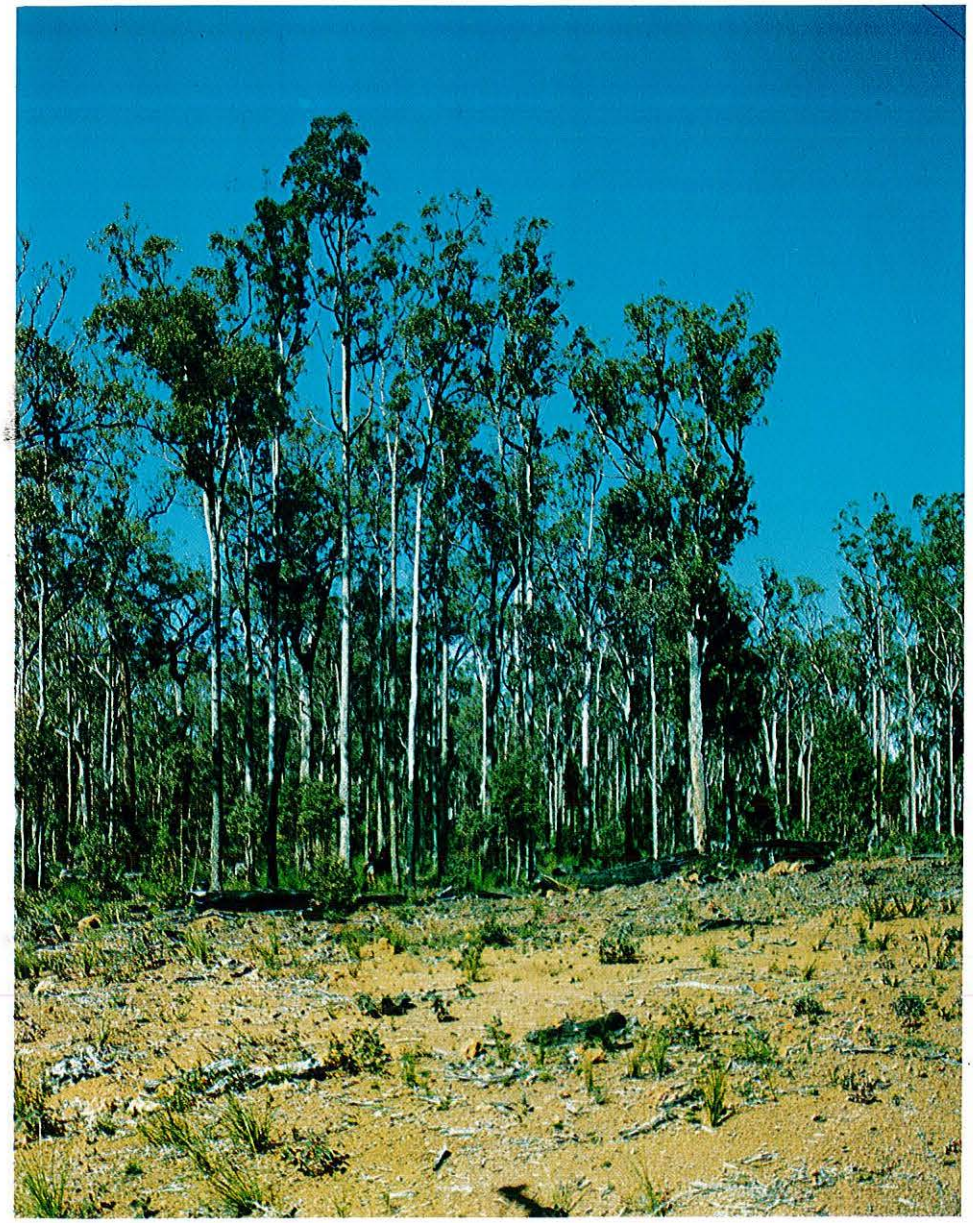






The devastating intensity of wildfires (left) can readily be compared to the dramatically cooler, less destructive prescribed burn (below).

The vigorous young jarrah pole stand (below left) has been controlled burnt for the past 40 years. This stand, not yet sufficiently mature for felling, is situated in the Jarrahdale bauxite mining area, just east of No. 1 crusher.



FOREST FOCUS

Number 3, December, 1970

Published by the Forests Department of Western Australia under the direction of the Conservator, Mr. W. R. Wallace.

Compiled by Dale Watkins

Cover

Diamond tree, between Pemberton and Manjimup, with its 20 ft. tower perched 180 ft. above the ground in the branches of this karri tree is one of the 40 fire lookout towers in the Forests Department's Fire Protection Branch.

Although less well known than Gloucester tree near Pemberton, Diamond tree is interesting in that a tower is built on to the tree to support a cabin instead of the cabin being built directly on top of the branches,

Apart from pre-suppression policy and organisation, three of the essentials of fire control are: a detection system which permits the early positioning of fire outbreaks; an efficient and reliable radio and telephone communications network; and a suppression force capable of tackling the sometimes formidable and always urgent problem of forest fires and which can mobilise the whole range of equipment specifically designed to meet the demands of forest protection.

These "demands" vary greatly between forest types and between hardwoods and softwoods.

Back Cover

A wandoo *(Eucalyptus wandoo)* surrounded by regenaration in the Mundaring Forest Division, see page 9.

Focus on Controlled Burning for Forest Conservation

More than one million acres of State Forest in Western Australia were treated by the Forests Department in its rotational controlled burning programme in 1969. At the time of going to press, it was planned to cover a similar area in 1970.

Over half of this was covered by the now routine technique of aerial controlled burning. This has proved to be a major breakthrough in prescribed burning of heavy fuel areas as well as providing an efficient tool for the undertaking of large area burns under ideal conditions.

This example of how wartime developments can benefit man was first demonstrated early in December, 1965, by the W.A. Forests Department and the Bush Fire Research section of the C.S.I.R.O. in the first large scale trials of aerial ignition of forest areas with incendiary capsule techniques.

The successful use of aircraft in routine controlled burning was a notable achievement—a world first for Western Australia.

The State's well known jarrah forest was the testing ground for this operation, which was envisaged almost 12 years previously.

Information obtained from fire behaviour studies permitted the development of the aerial burning technique which fits ideally into the Department's rotational controlled burning programme. This programme is aimed at covering the whole of the forest area of four and a half million acres, once every five years—thereby reducing forest litter fuel quantities so that wildfires may be more readily controlled even during severe fire weather.

Each burn is applied to a predetermined area surrounded by tracks and at a predetermined intensity consistent with the silvicultural condition of the particular forest type.

The scheme involves detailed planning and a thorough understanding of fire and weather behaviour.

For the jarrah forest, fire danger ratings and a controlled burning guide have been prepared and tested in practice. They have proved valuable aids to the planning and execution of rotational controlled burning both by hand and aircraft.

Investigations along similar lines are being carried out in the karri forest.

From pre-1930 days controlled burning was practised in virgin forests and firebreak belts for protection of areas regenerated after trade cutting.

With ever-increasing areas of young growth it was found impracticable to continue with total fire exclusion and a policy of hazard reduction was commenced in 1954 over long-protected stands.

Although a job for specialists only, the aerial controlled burning technique can be briefly summed up as a calculated grid pattern of ignition points, related to forest fuel, scorch height, rate of fire spread, age and type of forest and general weather conditions. The fires burn slowly and at low intensity until they

Aerial incendiary operation—with the priming and timing device in the foreground. On the flight deck are the pilot and a Forests Department officer who does the plotting and navigating.

Controlled burning by aerial ignition, Shannon River. Each area burnt is surrounded by tracks. To ensure control, boundaries are edge-burnt well before the major area is lit—this is illustrated by the lack of fire adjacent to the track. The lighting pattern is parallel strips of spot fires lit across the wind. Weather conditions are chosen to produce low intensity fire—indicated by the white, thin smoke.

connect and burn out by late afternoon or run into barriers of moisture and go out. An area is never burnt out completely.

The benefits of aerial controlled burning are greatest in areas where road and track networks are few, or where access by ground parties is difficult and dangerous due to thick scrub.

Previously, several problems had been associated with extensive controlled burning:

1. Large areas had to be covered on the very limited number of days available for satisfactory burning, as weather conditions are strictly limiting for any given quantity of fuel per acre.
2. During three months of the summer and on any Sunday of spring and autumn, burning is prohibited by law.
3. Burning had to be carried out by men walking the area lighting carefully spaced lines of spot fires. This is a relatively slow process and the limitations had been intensified in recent years due to labour shortages.

4. Inadequate access and heavy undergrowth further limited the area burnt, particularly in the southern regions.

The distinct advantages of the aerial incendiary lighting technique can be readily recognised.

To comply with D.C.A. safety regulations, each incendiary device is inert and safe until primed just prior to dropping. It ignites 28 to 30 seconds after priming. Dropping intervals are controlled by an electric timer.

Flying about 600 to 700 ft. above the ground, the aircraft is in constant touch with a field control centre near the prescribed area, where a small suppression force is located.

Throughout the operation radio contact is maintained with all units involved.

The ground dropping pattern is aligned by the use of A.D.F. (automatic direction finder) radio homing beacons.

The remains of a jarrah forest devastated by fire from the massive accumulation of debris following early logging.

Fire control—an early problem

In Western Australia, with its long, hot and dry summer, fire was the first obvious problem to receive the attention of early foresters. It was apparent that until effective fire control could be practised, the expenditure on regeneration of young crops and planting of exotics could easily be wasted, and the work nullified by uncontrolled wildfires.

This explains the emphasis in the earlier years on fire control work and organisation before other injurious agencies received so much attention. The Forests Department of Western Australia has led in the innovation of new fire techniques.

The climate of the forest belt of the south-west of Australia is such that it is susceptible to fire for at least six months each year.

Colonisation, development and exploitation in the forest areas brought changes which resulted in the massive accumulation of litter and the forest fires which eventually burnt these areas were often of holocaust proportions, causing widespread forest damage.

As forest utilisation and the clearing of adjoining farming land increased in tempo, so also did the size, number and severity of fires.

The first fire truck was equipped in 1934. Methods of controlled burning and fire fighting were developed and in 1936 a fairly comprehensive set of notes on these techniques was issued within the Department.

One of the most important developments in this field was the initiation of a fire weather research station with the objects of devising some simple measure of fire hazard; and exploring the possibility of forecasting fire weather.

Three years of detailed research enabled the present Conservator of Forests to establish in 1936 the first

fire weather forecasting service for jarrah forest areas. In another two years the same system was accomplished for the karri areas.

This system identified fire hazard by relating it to moisture content of forest fuel and is currently in use throughout Western Australia. Officers from other State forest services were trained in the procedure.

Detailed studies of fire behaviour were commenced in 1960 and have been actively pursued since that time. As a result, the preparation of controlled burning guides have enabled accurate predictions in fire behaviour to be made.

The development of the aerial burning technique was made possible by information gained from these studies, which were carried out in conjunction with the Bush Fire Research section of the C.S.I.R.O. W.A. fire research is continuing in a number of fields both in native hardwood forests and in softwood plantations.

The value of hazard reduction burns on a large scale was highlighted after the Dwellingup fire in 1961. This fire was the most serious ever in the jarrah forest within memory.

As a result of lightning, 22 known fires were started under extreme weather conditions. Many were suppressed, but others combined and grew to an overall size of 361,000 acres in six days.

Extreme heat conditions made suppression almost impossible.

By the end of the second day, 72,000 acres of forest land had been burnt. On the third and fourth days the fire was gradually being brought under control. On the fifth day, however, a cyclonic windstorm whipped the fire through the townships of Dwellingup, Holyoake and Nanga Brook, causing great destruction estimated at $1 million.

Damage to the forest was estimated at $2 million at that stage.

On the sixth day cooler conditions developed and rain falling in the afternoon allowed the running fire to be stopped.

The fire showed very clearly the effect of fuel quantity on fire intensity. Areas which were still carrying heavy fuel suffered severe damage. Approximately ten per cent of the Dwellingup Division had been controlled burnt each year between 1953 and 1961, and areas with less than three years litter showed relatively little damage.

Controlled burning in softwood forest. Forest officers check relative humidity and wind force.

Fire, forests, flora, fauna

In October, 1969, Forests Department research officers made a study of the effects of aerial controlled burning on kangaroos and wallabies in the jarrah forest. (Previously, other animal, bird and wildflower observations have been carried out over wide areas of State Forest in respect to prescribed burning.)

Approximately two thirds of the kangaroo population left the area of the burn for cover in adjacent forest outside the unit, while only five per cent of the wallabies left the area. No evidence of injury or mortality was found.

In the study, a 60 per cent burn was achieved. Even under the best conditions there are always pockets of forest unburnt due to insufficient and moist forest litter. These moist areas and swamps in the forest give

shelter to numerous small animals and birds. In autumn burning a more even and more intense burn will result, with consequent danger to forest wildlife.

A very detailed study of fauna carried out by the W.A. University on the Popanyinning reserve near Beverley pointed out the danger of complete absence of fire. The Forests Department was asked how it might be burnt under controlled conditions so that the habitat could be rejuvenated.

Without this rejuvenation burn the animals would have been unable to continue to find food and the type of shelter they needed.

The native flora of the south-west forest belt, having evolved in a fire environment, has inbuilt mechanisms to ensure its survival of occasional fires—in fact many depend on fire for continued existence. Examples of these mechanisms can be seen in the lignotuber of eucalypt trees and the variable seed coat hardness of the Proteaceae family (e.g. grevillea, hakea, banksia) which results in only a portion of each seed crop germinating each year for several years.

As early as the 17th century the logs of such navigators as Pelsart, Vlaming, Jonk and Volkerfen made reference to smoke and fires on the mainland of this country. From these reports it must be assumed that the aborigines of this State, in common with those of eastern Australia, were well acquainted with fire.

Evidence points to the use of fire by Aborigines as a hunting aid. Summer lightning is responsible for a number of uncontrolled fires each year and it must be accepted that this source of fire was also present.

In 1930-31, a fire which started in early December moved steadily through virgin forest covering a distance of some 15 miles in three months. There was virtually no damage to the forest crop from this quietly moving low intensity "natural conditions" fire. This is a direct contrast to the Dwellingup fire in 1961 which covered 15 miles in 15 hours, causing complete defoliation and serious material loss.

The rotational controlled burning programme undertaken by the Forests Department is largely done in spring—on a four to six year cycle. This decision is influenced by a number of factors.

Research has shown that satisfactory weather conditions occur most frequently and most reliably in spring, starting during October in the northern forest areas and progressing through to December in the southern karri forest.

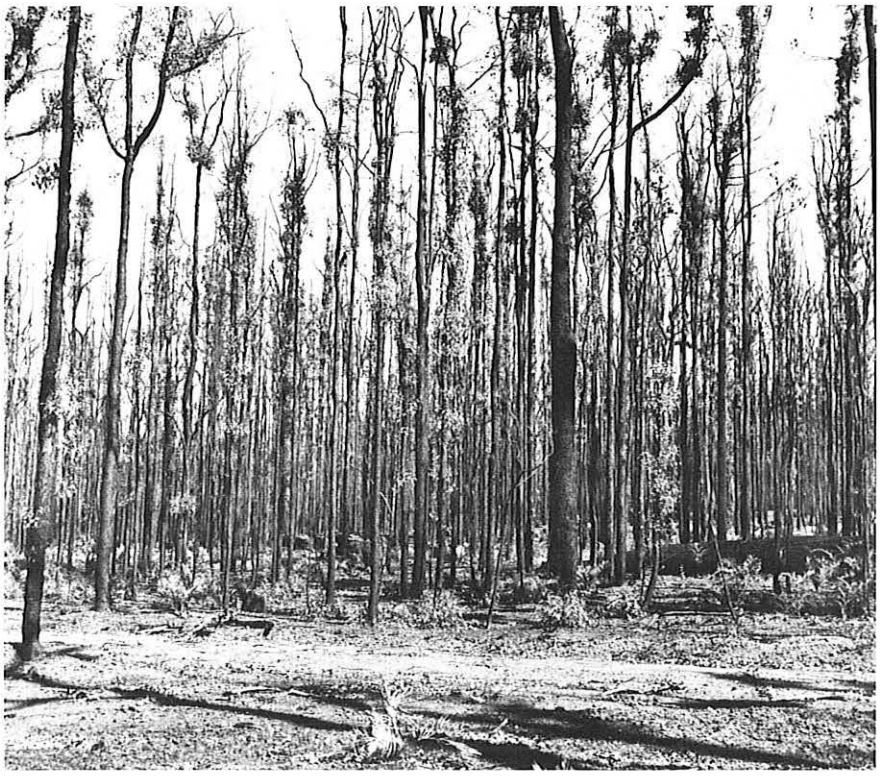
To achieve a similar fire intensity and safety from "breakaways" in autumn burning, the summer drought effects must first be alleviated. This generally requires three or more inches of rain to return tree bark, scrub foliage and heavy fuels such as ground logs (which when wet provide safe refuge for many small animals and insects) to the low inflammability levels of late spring.

Occasionally such rain falls in early April and extended suitable burning weather may follow. However, this is unreliable, as further rain may preclude further burning. Pre-planning is essential for extensive controlled burning, to prevent disasters of the type which occurred recently in Tasmania and New South Wales, at Dwellingup and Karridale in 1961, and Victoria in 1939.

For these reasons, reduced scenic values are justified once every five or six years when rotational burning is being carried out on an area. Even then, the conditions conducive to good controlled burning occur after the main flush of spring flowering so that burning begins as the wildflower display wanes.

There is still much to be learnt about the effect of fire intensity, frequency and seasonal timing on natural flora in the south-west.

The intensity of a wildfire can be seen by these defoliated karri crowns 230 ft. above the ground, after a fire east of Pemberton in 1959. This photograph shows epicormic growth after ten months as the trees struggle to recover. Apart from its effects on flora and fauna, the fire caused considerable damage to the standing crop of trees and retarded their growth rate.



Good jarrah regrowth on Duncans Road, about 14 miles east of Dwellingup. Top photograph taken six months after the 1961 fire shows already well developed epicormic shoots.
The bottom photograph (two years later) illustrates jarrah's fire resistant ability, although the fire concerned here was quite severe, resulting in both setback of growth and bole length, as well as physical damage to the tree crop and the forest ecosystem as a whole.

Despite the fact that each problem area should be treated on its own merits, a policy of autumn burning is not generally justified.

Rotational controlled burning every four to six years whether in spring or autumn, allows seed-set and seedling establishment in the intervening years. This type of burning may change only the proportion of each species but not the number of species.

Different fire frequencies favour different species and where only native flora exists without introduced annual weeds and grasses, the rate of ground litter build-up is slow enough to prevent annual burning.

Where annual burning is practised in the presence of grass and weed seeds, season is of little significance since that part of the native flora dependent on seedlings will eventually be killed out and annuals will take over. Once this occurs the annual grass fuel frequently results in sufficiently high fire intensity to cause damage and ultimate death to trees.

Factors other than fire are of equal or greater significance in the case of roadside flora where only a thin strip remains after the natural forest cover has been cleared in an adjoining paddock. The dramatic reduction of width to this strip of native vegetation causes major changes in the environmental conditions to which it is subjected. Increased sun lighting, more intense heat and access to wind are three of many changes in factors to which plants are sensitive, and these changes strongly favour invasion by, and establishment of, annual weeds and grasses.

It is obvious that where annuals are now established, autumn burning would fail to achieve the purpose of hazard removal served by spring burning. It is therefore more logical to turn to other means of hazard reduction than to autumn burning.

WANDOO BOTANICAL NOTES

Wandoo *(E. Wandoo)* is an attractive, smooth-barked tree which may grow to a height of 100 ft. with a bole length of 30 to 40 ft. and a breast height diameter of 4 ft.

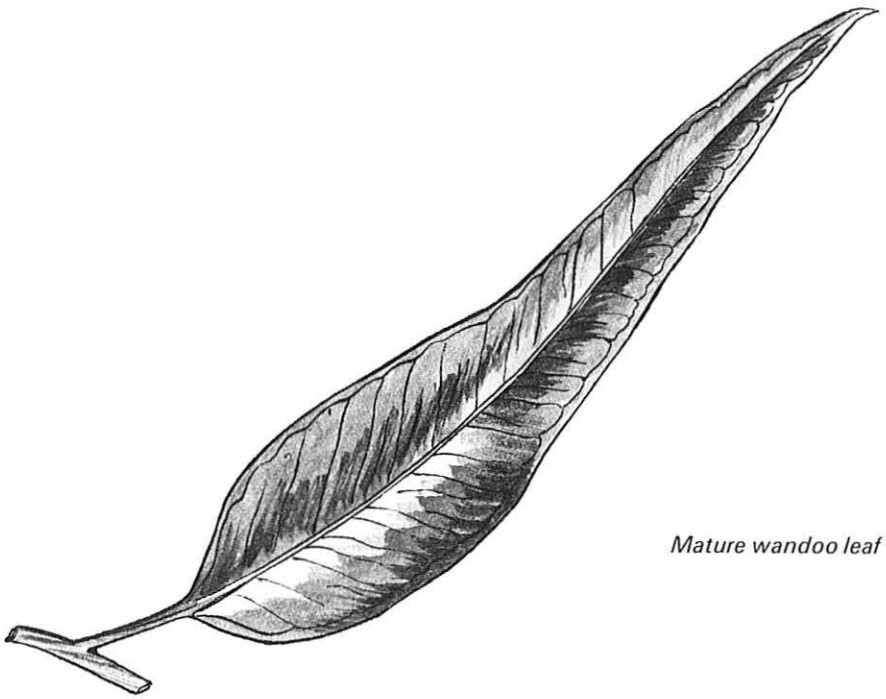
Under forest conditions, however, the height is generally between 70 and 80 ft. with a 20 to 25 ft. bole and a breast height diameter of two to three feet.

The bark is yellow-ish white in colour with purple-grey patches of more persistent bark. On a mature tree the bark is about one inch in thickness and decorticates in patches.

The tree closely resembles *E. accedens* (powder bark wandoo) both in appearance and silvicultural characteristics, and often the two species are found growing in mixture. A point of distinction is that the bark of mature trees of *E. accedens* bears a fine, white powder which may be rubbed off with the hands. Also the bud cap of the wandoo is long and tapering, while that of the powder bark wandoo is blunt. In the young stages the two species may be readily separated by the differences in juvenile leaves.

Unlike the jarrah, karri and tuart formations, the wandoo forest does not present a uniform woodland, but a series of associations in which the tree takes a leading part. It does not grow in close formation, but in open savannah woodland type forests. Wandoo occurs both as pure forest and in mixture with poor class jarrah, stunted marri and powder bark wandoo. Usually it is found growing on lower lying country than these species, but on the middle and upper slopes of gently undulating country wandoo occurs in mixture with them.

Throughout the range of wandoo, york gum *(E. loxophleba)* is found in association, but not as a mixture—the separation of site being determined mainly by soil factors. In the centre and to the east of its range, wandoo associates with the mallets *(E. astringens, E. gardnerii, E. falcata)*. Yate *(E. cornuta)* and swamp yate *(E. occidentalis)* occur in association with wandoo towards the limits of its range where its quality is poor. Flooded gum *(E. rudis)* is also found with wandoo along some gullies.



Mature wandoo leaf

Distribution

A native to the south-west of Western Australia, wandoo is generally found between the 15 and 30 in. rainfall limits. It extends as far north as Moora, but reaches its maximum development in the vicinity of Toodyay where it occupies two areas, one on either side of the Darling Range.

Wandoo on the west side of the range is not extensive and exists mainly as odd clumps of trees along the foothills of the Darling Scarp, as indicated by the diagrammatic map.

On the east of the Darling Range it encroaches well into the jarrah forest along the gullies,

The prime wandoo forests occur from Boddington to Toodyay, either in broad gullies or on low ridges. Extending south from Boddington, the quality of the forest falls off until it reaches the southern limit of its distribution in the Stirling Ranges.

Soils of the Wandoo forest

The surface layers of typical wandoo soil are dark brown loamy sands or sandy loams containing some gravel. Occasionally in the bottom of a valley the texture of the surface soil becomes a clayey loam. Usually clay occurs at a shallow depth in wandoo soils, varying from six inches to almost four feet, depending on the slope of the land. Surface drainage is fair only, and down the profile the drainage can be poor.

Timber

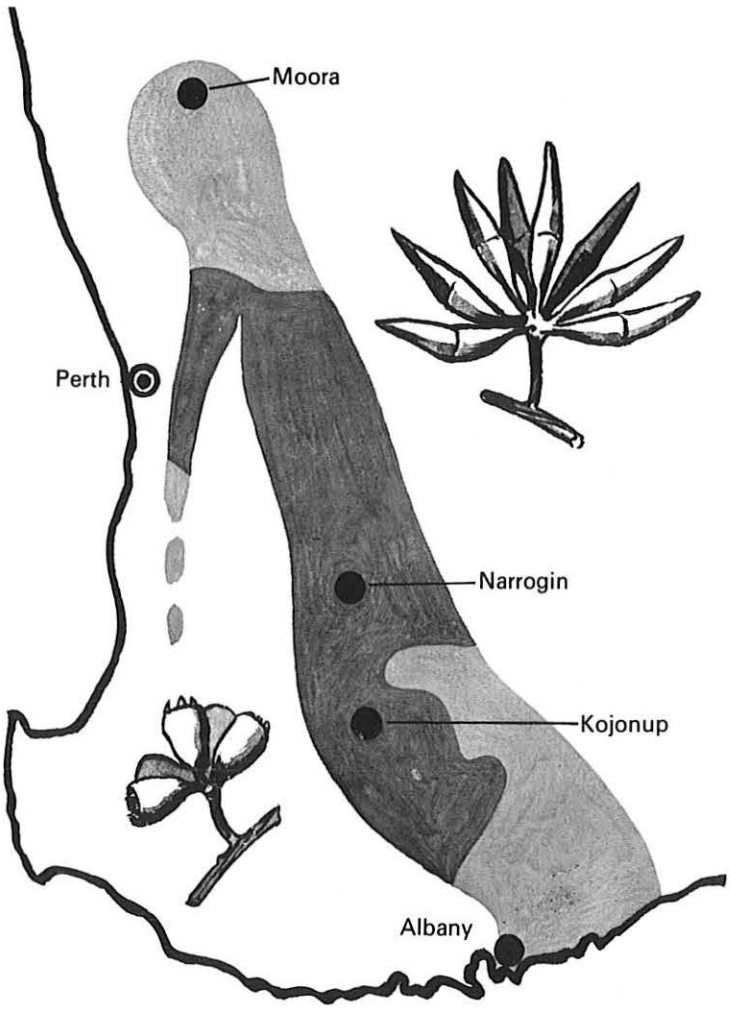
Wandoo timber is light brown to light yellowish brown in colour. It is fairly close-textured with a wavy or interlocked grain, with which some figure may be associated. It is one of the heaviest eucalypts and one of the most durable of Australian hardwoods.

A first class structural timber, wandoo is best suited for purposes where strength and durability are of importance. It is used in considerable quantities for sleepers (one of Australia's best) and is in great demand for poles.

It is particularly suitable for flooring subject to heavy wear and in building construction where durability, strength and hard wearing qualities are desired. Clear-finished wandoo floors and panelled walls are very attractive.

A remarkable quality of this timber is that, when used in conjunction with steel, there is no chemical action between the wood and the metal. Bolts have been taken from under-frames of trucks after 20 years' use and found to be quite as clean as when put there, while the auger marks were still visible in the holes.

Wandoo is unusual in that it contains a high percentage of tannin, which is extracted by cooking the chipped wood in large vats and evaporating the liquors to a heavy black viscous extract.



A wandoo *(Eucalyptus wandoo)* surrounded by regeneration in the Mundaring Forest Division, see back cover.

Natural Regeneration

The formation of the bud, fruit and seed of wandoo follows a similar pattern to jarrah.

For an average season, new leaf growth begins in January and reaches a maximum during February. In conjunction with leaf formation, new flower buds form in the axils of the leaves. Many of these buds do not mature further.

Twelve months later during February when the buds have fully developed, flowering occurs. These flowers set and require a further twelve months after flowering for the seed to ripen. The fruit capsules do not remain on the tree for long after ripening.

From the first formation of the bud it requires two years to obtain the ripe seed which is generally shed while the fruit is still held on the crown. After a ground fire a heavy fall of seed will result.

Generally seed years occur about once in every three years. Flowering throughout the forest does occur every year, but to a limited extent.

Present observations indicate that under natural conditions wandoo seed will only germinate satisfactorily on an ash bed.

As with jarrah, the aerial shoot from the germinating seed of wandoo does not grow immediately to form one erect stem. Several shoots develop to assume a low bushy habit and the plant enters into a resting period during which the ligno-tuber increases in diameter. Approximately ten years after germination the ligno-tuber, which has grown to about three inches in diameter, puts forth one single vigorous shoot from the bushy advance growth to assume dominance and develop into a sapling.

Due to the establishment of the vigorous ligno-tuber below ground level following germination, a light fire does little damage to regeneration. Intensive fires, however, may cause lack of advance growth under virgin wandoo forest. In areas where there have been severe fires, a marked effect on the soundness of the timber in mature tree is apparent. Wandoo burnt at the butt, or with a dry side, is usually not suitable for milling.

FACTS AND FIGURES—1970

Forest Area

PERMANENT FORESTS

Total Area of Western Australia	624,589,000 acres
Area of State Forests	4,460,584 acres (0·7 per cent of area of W.A.)
Area of Timber Reserves (Forests Act)	1,862,884 acres (0·3 per cent of area of W.A.)
Total Area of Permanently Dedicated Forests	6,323,468 acres (1·0 per cent of area of W.A.)

FOREST TYPES

Forest Type	*State Forest*	*Timber Reserves (Forests Act)*	*Total Permanent Forests*
	(acres)	*(acres)*	*(acres)*
Jarrah	3,198,597	96,476	3,295,073
Karri	172,797	—	172,797
Jarrah-Karri (mixed)	656,082	465	656,547
Jarrah-Wandoo (mixed)	163,785	71,682	235,467
Tuart	6,435	—	6,435
Karri-Tingle (mixed)	24,582	—	24,582
Mallet	54,928	475	55,403
Sandalwood	1,930	23,100	25,030
Pine Planting*	181,296	4,584	185,880
Miscellaneous	152	1,666,102†	1,666,254
Total	4,460,584	1,862,884	6,323,468

* Set aside for pine planting.
† Nearly all mining timber and firewood reserves for the Eastern and North-Eastern Goldfields.

PINE PLANTATIONS

Plantation areas only—excludes experimental areas

In Year	P. radiata	P. pinaster	*Other Species*	*Total*
	(acres)	*(acres)*	*(acres)*	*(acres)*
1925	63	542	N.R.S.	605
1935	1,367	4,287	N.R.S.	5,654
1945	2,772	7,111	N.R.S.	9,883
1955	3,737	13,944	N.R.S.	17,681
1965	17,104	23,127	402	40,633
1970	26,114	38,581	520	65,215*

* A further 1,833 acres have been planted for experimental purposes.
N.R.S.—Not recorded separately.

Timber Production

LOGWOOD

Removals by Species (% of Vol.)

	1950	*1955*	*1960*	*1965*	*1966*	*1967*	*1968*	*1969*	*1970*
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per Cent*
Jarrah	78·5	75·0	74·5	72·1	75·7	76·7	75·2	71·7	69·4
Karri	15·5	17·4	16·6	17·3	15·0	13·6	14·4	17·1	18·9
Wandoo	2·8	1·8	5·0	4·9	4·2	4·1	3·7	2·5	2·9
Other Hardwoods	1·9	4·0	1·1	1·2	1·5	1·6	2·0	2·5	2·4
Pine	1·3	1·8	2·8	4·5	3·6	4·0	4·7	6·2	6·4

HAULING
Past and Present

The past half century has witnessed many and far-reaching changes in methods and equipment in the forest industries, with increased mechanisation and decreased use of man and animal power. In the early 1920s, logs slung under whims were hauled to bush landings by bullock teams (note miniature whim to left of dog) and horse teams. A major change, especially in the karri forest, was the introduction of giant stationary log

haulers pulling in logs with a steam winch and long steel cable. The heavy cable was pulled out again by a small team of horses or bullocks, or by an "out haul" drum, using light steel cable.

During the 1930s, diesel crawler tractors were first used for direct log hauling with whims in jarrah forest and to pull out steel ropes and shoes for the big karri logs. As heavier and more powerful tractors were developed during and after World War II, they gradually displaced all other hauling methods, using various aids such as "sulkies", jinkers and logging arches. Today, rubber tyred articulated tractors, sometimes fitted with their own loading forks, are tending to replace heavy crawler tractors in jarrah forest. Crawler tractors and bulldozers fitted with forks, are still required for the heavier karri logs.

Removals by Land Tenure (Vol.)

Year	Source		Total	Per cent from Private Property
	Crown Land	Private Property		
	'000s of cu. ft.	'000s of cu. ft.	'000s of cu. ft.	
1926	48,824	25,037	73,861	33·9
1927	46,888	31,356	78,244	40·1
1932	11,743	4,116	15,859	25·9
1933	13,166	2,456	15,622	15·7
1938	31,737	15,929	47,666	33·4
1945	21,970	4,310	26,280	16·4
1956	39,811	13,773	53,584	25·7
1959	40,534	13,756	54,290	25·3
1960	38,882	12,018	50,900	23·6
1965	41,431	9,816	51,247	19·1
1966	42,225	10,106	52,331	19·3
1967	40,941	9,968	50,909	19·6
1968	43,486	8,061	51,547	15·6
1969	40,385	5,677	46,062	12·3
1970	39,597	6,204	45,801	13·5

Includes pine logs, mainly from pine plantations.

NOTE: The total recorded volume of logs removed from the forests of W.A. since the foundation of the Colony in 1829 is 2,922,566,034 cubic feet.

Pine Log Categories

	P. radiata	P. pinaster	Total	Per cent
	'000s of cu. ft.	'000s of cu. ft.	'000s of cu. ft.	
Chipwood	199·5	1,099·5	1,299·0	45·3
Sawlogs	942·5	314·8	1,257·3	43·8
Peeler Logs	215·2	5·3	220·5	7·7
Posts and Rails etc.	54·1	10·0	64·1	2·2
Woodwool Logs	0·7	13·1	13·8	0·5
Miscellaneous	5·2	10·3	15·5	0·5
Total	1,417·2	1,453·0	2,870·2	

SAWNWOOD

Year	Total Production	Exports		Imports Vol.
		Volume	Per Cent	
	'000s of cu. ft.	'000s of cu. ft.		'000s of cu. ft.
1926	20,801	12.001	58	520
1927	21,377	12,580	59	636
1932	4,551	3,063	67	267
1933	4,817	2,236	46	508
1938	14,294	7,546	53	617
1945	8,761	2,851	32	84
1956	19,219	4,568	24	787
1959	17,759	6,462	36	836
1960	16,625	6,133	37	1,030
1965	17,052	4,716	28	1,619
1966	17,378	2,431	14	1,329
1967	16,888	4,898	29	1,500
1968	17,173	2,986	17	2,174
1969	15,300	3,053	20	2,164
1970	15,614	3,400	22	2,357

Note the effect of the "World Depression" and World War II on production, exports and imports.

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

Value of Timber

Year	Exports*	Imports*
	$	$
1926	3,045,916	214,288
1932	723,400	82,168
1938	1,964,840	209,886
1945	1,140,056	52,214
1960	8,320,708	1,203,990
1965	7,091,254	2,612,654
1966	4,361,278	2,300,438
1967	7,467,696	2,949,808
1968	4,947,595	4,567,367
1969	4,984,098	4,047,028
1970	5,661,547	5,395,058

* Covers logs, rough sawn, dressed and moulded timber, plywood, veneer and reconstituted wood (particle board etc.)
It does not cover wood manufactures—e.g. furniture—or paper and paper products.

NOTE: (*a*) For 1968-69 the value of imports into W.A. from all sources of "paper, paperboard and manufactures thereof" was $15,222,000—$11,605,000 worth from other States of the Commonwealth.

(*b*) The estimated value of W.A.'s timber production for 1970 was:

	$
Sawn Timber (on mill skids)	25,143,600
Other Forest Products*	5,852,770
Total	$30,996,370

* Poles, piles, fence posts etc.

Boronia megastigma

BORONIA RESOURCE SURVEY

Within recent years public concern has intimated that land cleared for agriculture, increased exploitation by pickers and perhaps fires, may be over using and threatening Western Australia's resources of brown boronia *(Boronia megastigma)*—one of the most popular indigenous wildflowers.

Since the beginning of the century this delightfully perfumed species, which occurred naturally in the wetter areas of the extreme south-west of the State, has been picked to supply a demand for decorative sprays, seeds and concentrates (attar) for the perfume industry.

It ranges sparsely over an area of about 10,000 square miles.

In 1969 the Forests Department arranged for a survey to assess the present boronia resource situation, which led to the following conclusions:

Picking does not threaten survival, but without burning, boronia has a life span of only seven to ten years before it is suppressed and finally disappears beneath longer lived and more vigorous scrub. Rotational burning seems essential for the continued reproduction of the species.

Burning appears to be advantageous to both seed germination and establishment even in the absence of competition.

Two hundred and fifty known areas on State Forest totalling about 1,000 acres ensure that while many hundreds of acres have been lost through clearing of land alienated for agriculture, very considerable areas are permanently protected as long as the land remains State Forest.