

LIBRARY

Department of Biodiversity,
Conservation and Attractions

This PDF has been created for digital preservation. It may be used for research but is not suitable for other purposes. It may be superseded by a more current version or just be out-of-date and have no relevance to current situations.

USE AND ABUSE OF THE JARRAH FOREST



BATTE LIBRARY 816B/A 1569

Published by the Western Australian Forest Alliance
c/- Conservation Council of Western Australia (Inc.)
79 Stirling Street, Perth WA 6000

USE AND ABUSE OF THE JARRAH FOREST

Produced by the South-West Forests Defence Foundation Inc.
for the Western Australian Forest Alliance

November 1991

1. THE JARRAH FOREST - PAST, PRESENT AND FUTURE

1.1 Loss of forest

When Europeans first settled in Western Australia in 1829, Aborigines had been living here for at least 40,000 years. During this time, the jarrah forest evolved in a delicate balance of climate, water, soils, plants and animals, including human beings. The people who lived in the jarrah forest used the resources of importance to them, but managed the forest in such a way that it could have continued to flourish indefinitely.

The jarrah forest has always provided important wildlife habitat. For more than 40,000 years, it has also provided an attractive environment for the people of the south-west to live in and enjoy. However, since 1829 the jarrah forest region has been heavily exploited for the resources of importance to Europeans: cleared land, fresh water, minerals and hundreds of millions of cubic metres of wood.

Exploitation has resulted in the complete destruction of about half the jarrah forest for farms, towns and utilities (roads, power lines, dams) and minerals (bauxite, coal, tin, gold, heavy minerals, sand, gravel), and the serious disturbance (mainly by logging and burning) of almost all the rest. Today, the jarrah forest is greatly reduced in area. What remains is under enormous and increasing pressure.

1.2 Loss of forest values

Conservationists believe that the values once offered by the jarrah forest have been seriously diminished and that if demands are not reduced and management practices not changed, the jarrah forest ecosystem could collapse.

1.3 Concerns

Many of the demands on the forest are not compatible, so choices have to be made. These choices should be made by the people of Western Australia with the benefit of full and unbiased information. In the opinion of conservationists, this has never happened. The managing authority, the Department of Conservation and Land Management (CALM), has not engaged in genuine public consultation and does not readily provide full information to the public about its activities or the land it manages. CALM is also the Government's principal source of information and advice about forests and forest industries, so Government policy is heavily influenced by CALM.

Conservationists are concerned about almost every aspect of the jarrah forest and its use and management. Listed below are some of the reasons for our concern.

2. JARRAH FOREST FACTS

2.1 Half the jarrah forest has been cleared. At the time of European settlement, it is estimated there were up to 5.3 million ha of jarrah forest [1]. Today only about half that area remains and what is left is being further reduced, mainly by mining and agriculture.

2.2 Most of the remaining jarrah forest is on public land. Within CALM's three forest management divisions, the Northern, Central and Southern Forest Regions, there are about 2.1 million ha of jarrah forest, of which 1.7 million ha are on public land and 0.4 million ha are on private property [2].

2.3 CALM manages most of the public jarrah forest. Of the 1.7 million ha of public jarrah forest, 1.6 million ha are managed by CALM [3]. The other 100,000 ha are controlled by various Federal, State and local government agencies.

2.4 Most of the jarrah forest has been allocated to wood production. When the reclassifications proposed in CALM's forest management plans are complete, the jarrah forest managed by CALM will be allocated as follows:

State forest and timber reserves	1,266,000 ha
National park	88,000 ha
Nature reserve	70,000 ha
Conservation park	151,000 ha
Total	1,575,000 ha [4]

Thus 80% (1,266,000 ha) of the jarrah forest managed by CALM is in State forest and timber reserves where it is available for wood production.

2.5 Most of the jarrah forest has been heavily logged. Whereas the age attained by jarrah is estimated to be 800 to 1000 years [5], most of the remaining jarrah forest, including forest now in conservation reserves, has been logged in the last 100 years, much of it several times [6]. A relatively small but increasing area of jarrah has been clearfelled or virtually clearfelled in recent years [7].

2.6 There is very little 'virgin' jarrah forest left. CALM defines 'virgin' forest as forest for which there is no record of logging [8]. It says there are 322,000 ha of 'virgin' jarrah forest on land it manages [9], mostly in the southern jarrah forest (south of the Preston River). This amounts to only 20% of the jarrah forest managed by CALM. However, because not all logging has been recorded, the area of unlogged forest managed by CALM is actually much smaller. There is probably no unlogged forest on private property.

2.7 Most of the remaining 'virgin' jarrah forest is to be logged. Of the 322,000 ha of 'virgin' jarrah forest managed by CALM, 70% (225,400 ha) is in State forest and timber reserves [10], and, under current plans, will be logged by 2036 [11].

2.8 The jarrah forest is adapted to pre-European burning. Before the forest was logged, the forest canopy was much less open than it is today and the forest floor was not covered with logging debris. Before foxes, feral cats and European settlers decimated their numbers, abundant native mammals grazed on the forest canopy and understorey. Under those conditions, fires severe enough to damage jarrah trees occurred very rarely, centuries apart. The jarrah forest is adapted to such fires. The forest was also adapted to Aboriginal burning, which was not so intense as to damage the jarrah trees. A study by a former Conservator of Forests, T. N. Stoate, of the fire history of one area of jarrah forest showed that the jarrah trees had suffered no serious fire damage prior to the arrival of Europeans [12]. A study of grass-trees in the jarrah forest region showed that fire-response flowering had occurred only one to three times in the 150 years prior to 1829 [13].

2.9 The jarrah forest is subjected to fires to which it is not adapted. The jarrah forest is now frequently burnt by human-caused wildfires and regular prescribed burns. Most of these fires differ from pre-European fires in intensity, season, frequency, location and extent. They may have serious long-term adverse effects on soil nutrients, flora and fauna and the whole jarrah forest ecosystem, which is not adapted to such fires. For example, the fauna and flora in forest litter could be permanently simplified, with far-reaching effects on forest health [14]; species of flora that take longer to become fire tolerant or to produce seed than the length of the burning cycle could disappear [15]; and the birds of the south-west, 90% of which breed between July and December, could be seriously affected by spring burning, which may destroy their food supply for the following 12 months [16].

2.10 The 'Greenhouse Effect' is likely to have an adverse impact on the jarrah forest. The hotter drier climate predicted for the south-west of WA as a result of global warming (the 'Greenhouse Effect') will probably have an adverse impact on the jarrah forest. It could also result in increased insect attack and more fires. Already mature jarrah and marri trees have died from drought stress. Current use and management of the jarrah forest appear to take no account of the Greenhouse Effect [17].

2.11 Dieback affects a large area of jarrah forest. Dieback caused by the introduced soil-borne fungus *Phytophthora cinnamomi* is irreversibly changing many ecosystems, including the jarrah forest. Jarrah is the only eucalypt species of the jarrah forest ecosystem killed by dieback, but many understorey species are susceptible. Dieback is spread mainly by human activities such as logging, mining and making roads and firebreaks. In 1989 an estimated 211,000 ha of forest managed by CALM were affected by dieback [18].

2.12 Insect pests have attacked very large areas of jarrah forest. Two insect pests, jarrah leafminer and gumleaf skeletonizer, have reached epidemic proportions. In 1989 400,000 ha of forest from Collie to Albany were affected by jarrah leafminer and 120,000 ha from Bridgetown to Walpole by gumleaf skeletonizer [19]. The pests attack several eucalypt species but mainly jarrah. The interaction of various factors, including logging and burning, contributes to the infestations. For example, both thinning the forest canopy and spring burning stimulate the production of large quantities of young foliage. This attracts leafminer and can lead to severe outbreaks of the pest [20].

2.13 Jarrah forest is destroyed by mining. Between 1963 and 1989 Alcoa of Australia Limited mined 6,130 ha of jarrah forest to produce bauxite [21]. Bauxite mining by Alcoa and Worsley Alumina Pty Ltd now destroys 500 ha of jarrah forest a year [22], and mining for coal, tin, gold and mineral sands destroys additional areas. Even the most successful rehabilitation after mining cannot restore a jarrah forest ecosystem. In fact it is not known whether rehabilitation can produce any forest ecosystem that will survive in the long term. In addition to the forest destroyed by actual mining, further areas are removed for ancillary purposes such as roads and conveyor belts.

2.14 Privately-owned jarrah forest is cleared for agriculture. Native vegetation on private property has no effective protection from clearing. Privately-owned jarrah forest continues to be cleared, especially for plantations of pine and Tasmanian blue gum.

3. CONSERVATION

3.1 Only one-fifth of the jarrah forest managed by CALM is proposed for conservation reserves. Of the jarrah forest under CALM's management, only 20% (309,000 ha) will be protected in conservation reserves [23]. This amounts to less than 15% of the remaining jarrah forest and possibly as little as 6% of the original jarrah forest.

3.2 There is no evidence that CALM's proposed conservation reserve system is adequate. CALM has provided no evidence to substantiate its claim that the proposed conservation reserve system is 'representative' or 'adequate' to preserve all jarrah forest vegetation types even in the short term, let alone in perpetuity.

3.3 Most of the jarrah forest in existing and proposed conservation reserves was logged before being reserved. Of the 309,000 ha of jarrah forest that will be protected in conservation reserves, only 31% is 'virgin' forest; the other 69% has been logged [24]. This 'virgin' forest amounts to less than 6% of the jarrah forest under CALM's management and is the only jarrah forest that will be conserved in its 'virgin' state.

3.4 Regrowth lacks many of the values of unlogged forest. Regrowth lacks the beauty and majesty of unlogged forest. Most, if not all, the big old trees have gone and with them many of the birds and animals that need old trees. There is no evidence that the full range of flora and fauna of the pre-European jarrah forest is still present in intensively logged, frequently burnt forest.

3.5 There is no large national park in the Northern Jarrah Forest. The jarrah forest was at its most magnificent in the northern region, yet there is no large national park there. The 60,000 hectare Pinjarra Reserve, set aside in 1894 for the preservation of native flora and fauna, was transferred to wood production in 1911. Although relatively large, the Lane Poole Reserve is not a national park, and logging and mining are permitted in the recreation zone.

3.6 'Conservation parks' do not yet exist. 'Conservation parks' amount to 50% of the jarrah conservation reserves [25]. Although they are an important part of CALM's 1987 forest management plans, to late 1991 no conservation park has been declared.

3.7 CALM has re-allocated former conservation areas to wood production. In the Central Forest Region, CALM's predecessor, the Forests Department, allocated 42,000 ha of mainly jarrah forest to conservation or recreation [26]. CALM has re-allocated 68% (28,000 ha) of this to wood production [27]. Only the 'core' areas have been retained as conservation or recreation reserves. CALM says that the rest was just protective 'buffers' and it was always intended that these would be logged.

3.8 Commercial logging will be permitted in national parks. A 1991 amendment to the CALM Act will allow commercial logging of trees in national parks where roads or firebreaks are made or upgraded [28]. This is in conflict with national and international definitions of a national park and is open to abuse.

3.9 State forest adjacent to conservation reserves may not be managed sympathetically with conservation objectives. In the past, so-called sympathetic management has included clearfelling and burning up to the boundary of conservation reserves, so State forest does not always provide a protective buffer for reserves.

4. WOOD PRODUCTION

4.1 Most of the remaining jarrah is in State forest. There are 1,266,000 ha of jarrah forest in State forest and timber reserves, which are in theory managed for multiple uses (wood production, water production, conservation, recreation, tourism, honey production). This amounts to 80% of the jarrah forest managed by CALM.

4.2 State forest is managed primarily for wood production. The multiple uses of State forest other than wood production (conservation, recreation, tourism, honey production) are all adversely affected by the intensive logging and frequent burning now practised for wood production. These uses are rarely allowed to interfere with wood

production. Only water production is sometimes given higher priority than wood production, which may be curtailed to protect water quality or intensified to increase the quantity of water produced.

4.3 The jarrah forest cannot be used simultaneously for timber production and conservation or recreation. Logging as currently practised removes almost all the conservation and recreation values of forest, and those values will remain diminished until the regrowth again reaches maturity. Under current management plans, this will never happen. Furthermore, the regrowth is thinned several times before the main 'crop' is logged, and each time conservation and recreation values are again reduced.

4.4 Thinning of regrowth is a threat to the health of the jarrah forest.

Regrowth jarrah is thinned to increase wood production by reducing competition. However, thinning also increases the risk of fire (there is more dead wood in the forest), dieback (there are more entries into the forest) and wind damage (immature trees growing far apart are more easily blown over), and it further depletes soil nutrients. Over a long period, regrowth would probably thin itself naturally. In any event, the wood produced by fast-growing regrowth is inferior to that of the slow-growing, slowly matured trees of old growth forest [29].

4.5 Chemicals are used to kill millions of trees. CALM uses Tordon Timber Control to kill millions of trees in the jarrah forest. Tordon Timber Control is a combination of chemicals which moves right through plants, persists in the environment and should not be used in water catchments [30]. CALM claims that the trees it poisons are defective and compete for light, moisture and nutrients with 'crop' trees, and that poisoning is the cheapest way of getting rid of them. The effects on the jarrah forest ecosystem of this intensive treatment are unknown.

4.6 All the jarrah in State forest will be cut over within 63 years or less.

CALM claims that only about 1% of State forest is logged each year. If 1% of the forest is logged each year, the whole forest will be cut over in 100 years. In fact since 1985 the percentage of jarrah in State forest logged each year has varied from 1.6% to 3% [31], which is 60% to 200% more than CALM claims. At this rate all the jarrah in State forest will be cut over in 63 to 33 years.

4.7 Current sawlog production in the jarrah forest cannot be sustained. From 2021 the volume of jarrah sawlogs produced from State forest will be reduced to less than 50% of the 1991 volume [32]. This reduction cannot be attributed to enlarged conservation reserves, which are to remain the same, and thus proves the current rate of production is not sustainable.

4.8 Under current plans, high-grade mature jarrah will soon be unavailable.

The mature forest is almost all gone and soon most logs will come from regrowth. For most purposes, the wood from regrowth is inferior to that from mature trees. Unless jarrah trees are allowed to grow for at least 250 years (the minimum time it takes a jarrah tree to mature) [33], there will be no more mature jarrah.

4.9 Most remaining old trees in jarrah/marri forest are being killed to

increase wood production. Old trees in jarrah/marri forest that have escaped previous logging are now being felled or poisoned. A nominal 15 'habitat' trees per five hectares are retained. However, many 'habitat' trees do not have hollows, which are essential for many species of birds and animals. Two-thirds of the mammal species occurring in WA forests need hollows in standing trees or fallen logs, and one-fifth of forest bird species nest in tree hollows [34]. It is not known how long it takes for hollows to develop in jarrah or marri trees. The reasons for retaining only 15 trees per five hectares have not been published.

4.10 Logging takes place in dieback risk areas. In 1977 half the jarrah forest was placed in quarantine [35], but today, over 40% of jarrah forest logging occurs in the 'disease risk' (dieback quarantine) area [36] even though it is impossible to log without spreading dieback. Quarantine regulations such as closing gates to restrict the entry of vehicles are poorly enforced.

4.11 Logging and burning deplete soil nutrients. Most of the soils on which the jarrah forest grows have low nutrient contents. The cumulative nutrient losses from intensive logging and frequent burning may deplete nutrients to levels low enough to cause an observable decline in site quality [37].

4.12 Logging and burning harm native fauna. Quokkas, which used to be common in the jarrah forest, have almost disappeared [38], and in the past 20 years the number of western brush wallabies in the forest region has declined by almost 90% [39]. Logging and burning have been the major causes of extensive disturbance to the forest ecosystem, so it is reasonable to assume they have contributed to these declines.

4.13 After logging, jarrah forest is just left to regrow. 'Regrowing' jarrah forest consists of logging, burning (or now poisoning and burning), then leaving the forest to regrow if it can. The effects of many management practices on the ecosystem are not known. CALM makes little attempt to regrow anything but timber trees. It is not known how the understorey and the composition of the understorey affect the overall health of the forest.

4.14 The area of karri regrowth is being increased at the expense of jarrah. Where there are four or more karri trees per hectare growing in mixed jarrah/marri forest, regardless of the number of jarrah and marri the area is clearfelled and replanted with karri. This is probably because karri produces sawlogs much sooner than jarrah and, unlike jarrah, is used for woodchips.

4.15 Mixed jarrah/marri forest is logged to produce marri woodchips. Every year Bunnings' woodchipping subsidiary WACAP can log 4,000 ha of jarrah/marri forest to produce marri chiplogs [40]. It is the woodchip industry that drives this logging.

4.16 'Visual Resource Management' is of cosmetic value only. CALM tries to hide the ugliness of logging by 'Visual Resource Management'. This emphasis on the aesthetic effects of logging rather than the ecological effects is misplaced and a waste of resources. Rather than being screened from sight, logging should be visible to the public.

4.17 The annual production of jarrah sawlogs has remained fairly constant. About 550,000 m³ of jarrah sawlogs have been produced from State forest every year since 1985 [41]. The amount of sawn timber produced from these logs is less than 36% of the log volume. The remaining 64% is sawdust or sawmill residue. Some of the sawmill residue goes to the silicon smelter, some is sold as firewood and some is burnt as waste.

4.18 The area of jarrah forest logged annually has varied widely. In the past five years, the area of jarrah in State forest cut over each year has varied from 20,000 ha in the calendar year 1989 to 37,000 ha in the financial year 1984-1985 [42]. The average area was 27,000 ha. Since the volume of sawlogs extracted has remained fairly constant, some other factor such as the quality of the forest or the need to obtain other products (wood for the chipmill or the silicon smelter) must have been involved.

4.19 The annual production of firewood is increasing. In its Timber Strategy, CALM says that by 1992 the predicted annual demand for firewood will rise from 400,000 to 500,000 tonnes for local use with a further 200,000 m³ available for export [43]. Most of this firewood will be jarrah 'residue' from the forest or sawmills. With firewood for local use increasingly difficult to obtain, these demands may be difficult to meet.

4.20 Jarrah is used in a silicon smelter. Simcoa Operations Pty Ltd, formerly Barrack Silicon Pty Ltd, burns jarrah to make charcoal for its silicon smelter. Under the Silicon (Picton) Agreement Act 1987, CALM must supply 150,000 tonnes of forest residue to Simcoa every year for 15 years [44]. Simcoa wants this increased to 225,000 tonnes [45].

4.21 The major uses of jarrah seriously undervalue it. Although jarrah timber is a versatile product which is potentially beautiful and long-lasting, most of it is used in buildings where it is unseen and its values are largely unrecognised. For many uses, jarrah can be replaced by other materials such as pine. The use of jarrah for charcoal in a silicon smelter is a serious misuse of a scarce and valuable resource. There would be less jarrah waste for both silicon production and firewood if all sawmills were compelled to maximise their sawn timber recovery, by for example requiring much higher royalty payments on mature jarrah to take account of its age and increasing scarcity.

4.22 The Environmental Protection Authority's recommendations for better forest management by CALM have not been implemented. When it endorsed CALM's forest management plans in 1987, the EPA made six recommendations to try to ensure better management of the forest managed by CALM, including implementation of the proposed system of conservation reserves; detailed management plans for State forest that was formerly part of conservation or recreation reserves (3.7 above); and regular public reports by CALM on the environmental impacts of its forest management [46]. These recommendations have not been implemented.

5. THE TIMBER AND WOODCHIP INDUSTRIES

5.1 Current management of wood production is contrary to the social and economic benefit of the community. CALM's Timber Strategy has produced the following social and economic disbenefits to the community:

- 5.1.1 *Domination of WA's hardwood industry by a virtual monopoly further entrenched:*** The Bunnings group of companies has a virtual monopoly of the hardwood sawmilling and woodchip industries in WA. CALM's Timber Strategy has further entrenched Bunnings' domination. (WA's major hardwood woodchip company, the WA Chip and Pulp Co. Pty Ltd, is owned by Bunnings Ltd.)
- 5.1.2 *Misallocation of the sawlog resource:*** Large sawmills are allocated up to 80% of their sawlogs in 10- to 15-year contracts. Small sawmills are allocated no more than 50% of their resource in five-year contracts [47]. Any additional logs must be obtained by tender or auction. The State now has these legally binding commitments to supply sawlogs whether or not the resource is available in the years to come.
- 5.1.3 *Reduced employment:*** Large automated sawmills employ only about half the number of workers needed by small sawmills to produce the same volume of sawn timber. Despite big subsidies to the timber industry, timber workers in the south-west receive low pay and have little job security.
- 5.1.4 *Wasteful use of sawlogs:*** Large automated sawmills demand better logs and recover less timber out of old growth sawlogs than do small, labour-intensive sawmills. Under CALM's log allocation, big quantities of potential sawn timber become woodchips (karri and marri) or sawmill waste (jarrah) [48]. This is a serious misuse of valuable WA hardwoods.
- 5.1.5 *Unnecessary logging of native forest:*** Because the large automated sawmills get most of the logs from State forests but use them less efficiently than small sawmills, more forest than necessary is logged to produce the same volume of sawn timber [49].

- 5.1.6 *Loss of revenue to the State:*** Bunnings has been paying 25% less than other sawmillers for comparable sawlogs [50]. The present system, which is not open to public scrutiny, favours one big, powerful company, to the disadvantage of smaller companies. Most sawlogs should be sold in small parcels at public auction.
- 5.1.7 *Marri wasted as woodchips:*** Although marri produces excellent wood, its use as sawn timber has not been encouraged. Because of defects in many logs, it is much less profitable to mill than jarrah and karri. Its main use is for low-grade woodchips exported to Japan to produce paper. The Timber Strategy extended this wasteful use of marri until 1998.
- 5.1.8 *Destruction of old growth forest that other industries need:*** The timber and woodchip industries destroy old growth forest at the expense of the tourism and beekeeping industries, which also depend on old growth forest. The requirements of industries other than sawmilling and woodchipping were not properly addressed in the Timber Strategy.

6. THE JARRAH FOREST ECOSYSTEM IS AT RISK.

The combined effects of over-exploitation for wood; frequent burning; soil nutrient loss; dieback disease; insect and animal pests; and the Greenhouse Effect mean that the jarrah forest is under enormous and increasing pressure.

Conservationists believe the whole jarrah forest ecosystem is at risk.

WHAT YOU CAN DO:

If you are concerned about the jarrah forest, you can :

- Join a forest conservation group. There are a number of national, state and local groups actively involved in forest conservation. Contact the Conservation Council for information about them.
- Start a forest conservation group. There may be particular problems in your area. Join up with like-minded people and work together on solutions. Contact the Conservation Council for help with starting a group.
- Get the facts. Ask for information from the government bodies that are supposed to serve the public: CALM, the EPA, the WA Water Authority, local councils. Insist on written confirmation and documented evidence, especially maps. Contact the Conservation Council for the other side of the story.
- Go out into the jarrah forest and see for yourself what's happening. The jarrah forest does **not** belong to the Government or CALM or Bunnings or Alcoa. It's **your** forest and it needs your help.

Conservation Council of Western Australia (Inc.)
79 Stirling Street, Perth WA 6000
Telephone (09) 220 0652 Fax (09) 220 0653

South-West Forests Defence
Foundation Inc.
PO Box 203, Nedlands WA 6009
Telephone (09) 386 7159

DEFINITIONS

1. **State forest** is land vested in the Lands and Forest Commission, one of the 'controlling bodies' created by the Conservation and Land Management Act 1984. State forest cannot cease to be State forest except by Act or resolution of Parliament.

Under the CALM Act, in theory State forest is to be managed for a purpose, or combination of purposes, including conservation, recreation, timber production on a sustained yield basis, water catchment protection, or other prescribed purpose. In practice, State forest is managed to maximise wood production. Most other uses are adversely affected by the intensive logging and frequent burning practised in order to maximise wood production.

State forest is open to exploration for minerals and mining with the consent of the Minister responsible for the Mining Act and the concurrence of the Minister for the Environment.

When CALM's 1987 Forest Management Plans are implemented, there will be approximately 1,346,000 ha of native eucalypt forest in State forest in Western Australia.

2. **Timber reserves** are forested areas in a 'holding' condition pending a decision on allocation to another land-use category, or alienation from the Crown to a private or public landowner. They are generally managed as if they were State forest. They can be converted to other uses or sold at the discretion of the Government.

Many timber reserves are currently being transferred to selected private landowners, usually neighbouring farmers, in exchange for private land that CALM considers better located for its management purposes. This practice is not subject to public scrutiny and could be abused.

Timber reserves are open to exploration for minerals and mining with the consent of the Minister responsible for the Mining Act and the concurrence of the Minister for the Environment.

There are approximately 140,000 ha of timber reserves in Western Australia.

3. **National parks** are usually areas of high conservation value that have national or international significance and are vested in the National Parks and Nature Conservation Authority, one of the 'controlling bodies' created by the CALM Act 1984. A national park cannot have its vesting, purpose or boundaries changed except by Act of Parliament.

Under the CALM Act, in theory national parks are managed for the conservation of the natural environment and the protection of native flora and fauna, and for public recreation compatible with conservation. In practice, national parks in the forest region are often treated as buffers for State forest. In particular, national parks adjacent to wood production areas are subjected to frequent regular prescribed burns in order to protect a tree 'crop', regardless of the ecological consequences of such burns.

In the forest region, under the Lawrence government exploration for minerals and mining will not be permitted in national parks except in D'Entrecasteaux National Park. In practice, mining can be permitted with the consent of Parliament.

When CALM's 1987 Forest Management Plans are implemented, there will be 148,000 ha of native eucalypt forest in national parks in Western Australia.

4. **Conservation parks** are usually areas of regional significance vested in the National Parks and Nature Conservation Authority, one of the 'controlling bodies' created by the CALM Act 1984. A conservation park cannot have its vesting, purpose or boundaries changed except by Act of Parliament.

Under the CALM Act, in theory conservation parks, like national parks, are to be managed for the conservation of the natural environment and the protection of native flora and fauna, and for public recreation compatible with conservation. In practice, conservation parks in the forest region may be treated as buffers for State forest and burnt to protect an adjacent tree 'crop'.

Exploration for minerals can take place in conservation parks with the consent of the Minister responsible for the Mining Act and the concurrence of the Minister for the Environment. Mining can be permitted with the consent of Parliament.

When CALM's 1987 Forest Management Plans are implemented, there will be 197,000 ha of native eucalypt forest in conservation parks in Western Australia.

5. **Nature reserves** are usually vested in the National Parks and Nature Conservation Authority, one of the 'controlling bodies' created by the CALM Act 1984. An A class nature reserve cannot have its vesting, purpose or boundaries changed except by Act of Parliament. B and C class reserves can be disposed of at the discretion of the Government.

Under the CALM Act, nature reserves are managed for the conservation of the natural environment and the protection of native flora and fauna. Scientific study and limited recreation may also be permitted. However, inappropriate experiments and prescribed burns may take place in nature reserves.

In A class nature reserves exploration for minerals can take place with the consent of the Minister responsible for the Mining Act and the concurrence of the Minister for the Environment. Mining can be permitted with the consent of Parliament.

When CALM's 1987 Forest Management Plans are implemented, there will be 91,000 ha of native eucalypt forest in nature reserves in Western Australia.

6. **Conservation reserve** is an expression sometimes used to cover national parks, conservation parks and nature reserves. When CALM's 1987 Forest Management Plans are implemented, there will be 436,000 ha of native eucalypt forest in conservation reserves in Western Australia. The Government says it will take until 1998 to implement all the proposals for forest conservation reserves.

REFERENCES

1. Abbott, I. and Loneragan, O. (1986). Ecology of jarrah (*Eucalyptus marginata*) in the Northern Jarrah Forest of Western Australia. Bulletin No. 1, Department of Conservation and Land Management, Western Australia (CALM), p. 5.
2. CALM (1987). Regional Management Plan 1987-1997, Northern Forest Region, p. 17; Central Forest Region, p. 17; Southern Forest Region, p. 16.
3. Government of Western Australia (1990). Submission to Resource Assessment Commission inquiry into forest and timber resources, p. 10.
4. Same as reference 3.
5. Abbott, I. and Loneragan, O. (1986). Same as reference 1, p. 99, quoted from Jacobs, M.R. (1955). *Growth Habits of the Eucalypts*. Forestry and Timber Bureau, Canberra.

6. Same as reference 5, pp. 77-78.
7. CALM. Annual Report, 1986, p. 42; 1987, p. 35; 1988, p. 33; 1989, p. 36; 1990, p. 74.
8. Government of Western Australia (1990). Same as reference 3, p. 37.
9. Same as reference 8, p. 38.
10. Same as reference 9.
11. CALM (1987). Timber production in Western Australia: A strategy to take WA's south-west forests into the 21st century, pp. 44, 51.
12. Stoate, T.N. and Bednall, B.H. (no date). The jarrah and forestry practice (an historical record). Typescript, p. 6.
13. Lamont, B. B. and S. Downes (1979). 'The longevity, flowering and fire history of the grasstrees *Xanthorrhoea preissii* and *Kingia australis*.' *Journal of Applied Ecology*, 16, pp. 893-899.
14. Springett, J. A. (1976). 'The effect of prescribed burning on the soil fauna and on litter decomposition in Western Australian forests.' *Australian Journal of Ecology*, 1, pp. 77-82.
15. Muir, B.G. (1987). 'Time between germination and first flowering of some perennial plants.' *Kingia*, 1(1), pp. 75-83.
16. Davies, S.J.J.F. (1979). 'The breeding seasons of birds in south-western Australia.' *Journal of the Royal Society of Western Australia*, 62, Parts 1-4, pp. 53-64.
17. Dr Syd Shea, Executive Director, CALM, reported in *The South Western Times*, 30 August 1988, p. 5.
18. Parliament of Western Australia. Hansard, 6 December 1989, p. 6213.
19. Dr Ian Abbott, CALM, reported in *The West Australian*, 11 May, 1989, p. 49.
20. Mazanec, G. (1989). 'Jarrah leafminer, an insect pest of jarrah.' In *The jarrah forest* (ed. B. Dell and others), Kluwer Academic Publishers, Dordrecht, The Netherlands, p. 130.
21. Alcoa of Australia Ltd (1990). Submission to Resource Assessment Commission forest and timber resources inquiry, p. 6.
22. CALM, Annual Report, 1986, p. 42; 1987, p. 35; 1988, p. 33; 1989, p. 36; 1990, p. 74.
23. Government of Western Australia (1990). Same as reference 3.
24. Same as reference 23, pp. 10, 38.
25. Same as reference 23.
26. Forests Department of Western Australia (1982). General Working Plan for State Forests in Western Australia No. 87, Part 1, pp. 80, 83.
27. CALM (1987). Regional Management Plan 1987-1997, Central Forest Region, pp. 99, 100.
28. Conservation and Land Management Act 1984. Section 99A as added by Section 38 of the Conservation and Land Management Amendment Act 1990.

29. CALM (no date; 1990?). Out of the woods: Concluding report on the small eucalypt processing study, pp. 9-12.
30. The active ingredients of Tordon Timber Control are triclopyr (100 g/L) and picloram (50 g/L). On triclopyr see the Northwest Coalition for Alternatives to Pesticides, Eugene, Oregon, 5 June 1987. On picloram see the Northwest Coalition for Alternatives to Pesticides, Eugene, Oregon, 5 January 1987. In Sweden picloram was withdrawn from the market in 1984 because of its extreme persistence and its environmental impact.
31. CALM. Annual Report, 1986, p. 42; 1987, p. 35; 1988, p. 33; 1989, p. 36; 1990, p. 74.
32. CALM (1987). Timber Production in Western Australia, pp. 42, 49.
33. Forests Department of Western Australia (1984). Future timber supplies for Western Australia, p. 10.
34. Parliament of Western Australia. Hansard, 30 August 1988, p. 2348-9.
35. Forests Department of Western Australia. Annual Report, 1977, p. 19.
36. Parliament of Western Australia. Hansard, 26 June 1990, p. 2700.
37. Hingston, F.J., A.M. O'Connell and T.S. Grove (1989). 'Nutrient cycling in jarrah forest.' In *The jarrah forest* (ed. B. Dell and others), Kluwer Academic Publishers, Dordrecht, The Netherlands, p. 174.
38. Professor Don Bradshaw, Department of Zoology, University of Western Australia, reported in *The West Australian*, 14 March 1991, p. 43.
39. Reported in *The West Australian*, 29 October 1990, p. 30; *CALM News*, December 1990, p. 2.
40. Dames and Moore (1987). WACAP towards 2005: Environmental review and management programme, draft environmental impact statement, p. 209.
41. CALM. Annual Report, 1986, p. 42; 1989, p. 36; 1990, p. 74.
42. CALM. Annual Report, 1986, p. 54; 1987, p. 45; 1988, p. 45; 1989, p. 50; 1990, p. 80.
43. CALM (1987). Timber Production in Western Australia, pp. 11-12.
44. Silicon (Picton) Agreement Act 1987, Section 12.
45. Government of Western Australia (1990). Same as reference 3, p. 12.
46. Environmental Protection Authority (1987). Northern, central and southern forest region management plans: report and recommendations of the Environmental Protection Authority, Bulletin 303, pp. iv-v.
47. CALM (1987). Timber Production in Western Australia, p. xiii.
48. Reported in *The West Australian*, 11 May 1990, p. 14.
49. Coalition for Denmark's Environment (1990). Towards a forest accord in Western Australia.
50. Reported in *The West Australian*, 10 August 1990, p. 6.