KARRI FOREST CONSERVATION

REPORT AND RECOMMENDATIONS BY THE ENVIRONMENTAL PROTECTION AUTHORITY

OCTOBER 1982

DEPARTMENT OF
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KARRI FOREST CONSERVATION

Report and Recommendations by the Environmental Protection Authority

Department of Conservation and Environment
Western Australia

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ENVIRONMENTAL PROTECTION AUTHORITY
BP HOUSE,
1 MOUNT STREET, PERTH, WESTERN AUSTRALIA 6000
Telephone 322 2477

HON MINISTER FOR CONSERVATION
AND THE ENVIRONMENT

Your Ref.
Our Ref. 55/82, 191/73

My Dear Minister

The Environmental Protection Authority has concluded its reassessment of Karri forest conservation based on the Forests Department's report 'Conservation of the Karri Forest', over five hundred public submissions received on that report, and on the conclusions reached by Dr Peter Attiwill, consultant to the EPA.

Please find attached the Authority's report and recommendations. Your concurrence is sought for the EPA to publish the report and recommendations.

Yours sincerely

A R MAIN
CHAIRMAN

7 OCTOBER, 1982.

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SUMMARY AND RECOMMENDATIONS

In its 1976 report to Government on Conservation Reserves in Systems 1, 2, 3 and 5, the Environmental Protection Authority made recommendations for conservation of the karri forest in both State Forest and the proposed South Coast National Park. These recommendations were endorsed by Cabinet but have yet to be fully implemented.

This reassessment of karri forest conservation has confirmed that the 1976 recommendations provided a sound basis for a system of reservation of a range of karri forest ecotypes for conservation and recreation.

In its reassessment, the EPA was assisted by the Forests Department through the publication of its future strategy for karri forest management in the report "Conservation of the Karri Forest", by over five hundred public submissions received by the Authority on that report, and by the report of Dr Peter Attiwill, consultant to the EPA.

The Authority has accepted in principle, Dr Attiwill's conclusions and recommendations (Appendix A) and in his report will be found the rationale for the EPA's own recommendations.

The EPA recommends:

1. *that the EPA (1976) recommendations for reservations within the main karri belt for both State Forest and National Parks be fully implemented.*

   In reiterating these recommendations, the EPA confirms its view that there should be established in the State Forest, an adequate and representative system of areas for conservation of flora, fauna, and landscape, and for recreation, and that these be identified in approved Working Plans.

2. *Security of Purpose of MPAs*

2.1 *that so as to ensure that security of purpose of conservation and recreation Management Priority Areas (MPAs) in State Forests be given comparable status to "A" Class Reserves created under Section 31 of the Land Act 1933 (as amended), the Forests Act be amended to provide that the provisions of an approved Working Plan so far as it relates to MPAs for conservation and recreation shall be deemed and take effect as if it were a regulation and so be unalterable except in the manner required in the Interpretation Act for the amendment of regulations made under an Act of Parliament. In the event that the foregoing proves impracticable, some other method be sought to achieve the same security of purpose.*

   Any proposal to utilize such a MPA in a manner which affects its value for its primary purpose should only be considered after there has been a thorough and rigorous study.

   This recommendation is similar to that made by the EPA in 1976 for "Forest Parks". Again it should be noted that the Interpretation Act by Sections 36 and 37 requires that regulations shall be laid on the table of each House of Parliament within six sitting days of such House and may be disallowed by a resolution of either House. The security of MPAs for conservation and recreation will therefore lie in the requirement of the law that no change can be made in the status or purpose of MPAs for conservation and recreation without scrutiny by Parliament.

2.2 *that it be a clearly stated and an implemented objective of management of State Forests to protect the conservation and recreation values of MPAs defined for the purpose in approved Working Plans;*

2.3 *that security of purpose for all MPAs for Conservation of Flora, Fauna, and Landscape within the main karri belt be identified by designation of these within a new priority, to be established, of <u>Forest Sanctuary</u> or similar name;*

2.4 *that security of purpose for all MPAs for Recreation within the main karri belt be identified by designation of these MPAs within a new priority, to be established, of <u>Forest Park</u> or similar name.*

3. *Management of Forest Sanctuaries and Forest Parks*

3.1 *that management plans for Forest Sanctuaries and Forest Parks be prepared and made public as soon as possible. One of the management objectives should be that logging these areas will have no priority.*

The EPA considers that it should be made absolutely clear that Forest Sanctuaries and Forest Parks will always be secure from any logging for commercial wood production. However, the Authority recognises that in order to attain management objectives for these areas, some logging may be necessary in the future. Such logging should be justified in management plans.

3.2 *that the areas surrounding Forest Sanctuaries, Forest Parks and National Parks be managed so that diversity is maintained by a broad series of age classes of forest;*

3.3 *that the core and buffer concept within existing MPAs for Conservation of Flora, Fauna, and Landscape and for Recreation in the main karri belt not be adopted, and that the whole area of these MPAs (to become Forest Sanctuaries and Forest Parks) be managed for their primary objective. By this recommendation it will be necessary to manage the area surrounding the MPA in sympathy with the primary objectives of management for the MPA;*

3.4 *that greater effort be made to identify those recreational and other values which people seek from the forest, and to organize management so that these values may be readily obtained;*

3.5 *that the Forests Department employs more professionals in disciplines appropriate to this wider view of management.*

4. *Management of the Karri Forest*

4.1 *that research and quantification continue, particularly in relation to the effects of clear-felling and of prescribed burning on productivity, diversity and water quality, and that management continues to be developed on the basis of this research and quantification;*

4.2 *that the Forests Department be supported in enforcing the strictest safeguards and controls so that the forests in MPAs for Wood Production are logged and regenerated with minimum damage to the environment;*

4.3 *that experiments with the planting of exotics in the karri forest be restricted to arboreta, and that existing plantations of exotics which have failed and serve no further purpose should be destroyed and the areas regenerated to native vegetation.*

5. *Beavis, Giblett and Strickland MPAs*

5.1 *that Beavis and Giblett Management Priority Areas be reclassified immediately as MPAs for Conservation of Flora, Fauna, and Landscape;*

5.2 *that Beavis, Giblett and Strickland MPAs be managed by the Forests Department to complement the Beedelup National Park;*

5.3 *that, at some future time, Beavis, Giblett, and Strickland MPAs be reviewed in the light of the use of the Beedelup National Park.*

In making these recommendations the EPA is aware that they differ from its 1976 recommendations in that previously, the Authority agreed that Beavis and Giblett MPAs should be cut over and regenerated before being added to the Forest Park System. However it has now accepted Dr Attiwill's conclusions and, particularly in the knowledge that this change will not markedly affect the karri cut, believes Beavis and Giblett should be added immediately to the reserved areas.

6. *Shannon River Drainage Basin*

6.1 *that the areas within the Shannon River Drainage Basin recommended for reservation by EPA in 1976 and now listed as MPAs for Conservation of Fauna, Flora, and Landscape should become Forest Sanctuaries;*

6.2 *that rehabilitation of those parts of the central Shannon in need of restoration, particularly the fire-damaged forest, should proceed by appropriate harvesting procedures and regeneration techniques based on those applicable to MPAs for Wood Production;*

6.3 *that the central Shannon having been rehabilitated, its suitability for reservation should be reviewed at some time (perhaps one or two decades) in the future.*

This recommendation is essentially the same as that made in 1976 and is made for exactly the same reasons; namely the Authority still considers that the central Shannon basin is fire damaged to the extent that it is not in a condition which warrants reservation in its present form. It is significant to note that Dr Attiwill, as an independent authority, confirms this view. However the Authority remains convinced that rehabilitation of the central Shannon basin does not preclude the possibility that it be reserved sometime in the future.

7. *South Coast National Park*

7.1 *that the recommendations made by the EPA in 1976 regarding the South Coast National Park should be fully implemented.*

The EPA strongly emphasises that the areas selected in 1976 for inclusion in the South Coast National Park, and in particular the areas of the lower Shannon Basin, are essential components of the karri forest conservation system and if they are not reserved, then the Authority believes that a further reassessment of the whole system is required.

1. INTRODUCTION

The Environmental Protection Authority has had a long involvement with karri forest conservation. One of the first actions taken by the EPA when it was created was to establish the Conservation Through Reserves Committee (CTRC) in February, 1972 to make recommendations on parks and reserves in the State.

As part of its 1974 report, the CTRC recommendations for the conservation of karri forest were in summary:

- clearfelling should not be carried out in the Shannon River Drainage Basin during the first licence period of the Wood Chipping Agreement
- after that time when the effects of clear felling could be more readily assessed, a substantial area of wet sclerophyll forest in the Basin be conserved in perpetuity as natural forest
- this area be managed by the Conservator of Forests like a national park
- during the first licence period a detailed study of the environment of the Drainage Basin and Broke Inlet be carried out.

In response to considerable public interest in the CTRC proposals and to gain further perspective on Systems 1 (South-West) and 2 (South Coast) a Special Review Committee was established by the EPA in September 1975 and asked to review the CTRC recommendations, the public submissions received on relevant parts of the CTRC report, and to make any additional recommendations deemed necessary.

For the karri forest, the Review Committee proposed an alternative conservation plan based on conserving representative examples of a more diverse range of karri and karri-marri ecosystems than CTRC. It recommended that the Forests Department select appropriate reserves to be managed as "Forest Parks" and that these be incorporated in the next revision of the Forests Department's General Working Plan.

In particular, the Review Committee argued against the setting aside of the whole Shannon Basin as a conservation reserve.

Before the EPA received the Special Review Committee's report in March, 1976, the Authority addressed the conflict over the Shannon River Drainage Basin in its Second Interim Report on the Woodchip (Manjimup) Project in September, 1975. In this report, the EPA announced that it had reached agreement with the Conservator of Forests that in the first five years of the woodchip licence period, not more than 9% of the Shannon Basin would be logged. The figure of 9% was derived from data quoted by the Forests Department relating to areas in the Shannon Basin requiring immediate regeneration.

The EPA also reached agreement with the Conservator that there would be no further use of the Shannon Basin after the first five years without the approval of the EPA.

In July 1976, the Cabinet endorsed EPA's Recommendations for Conservation Reserves in Systems 1, 2, 3 and 5. Included in these were the Authority's specific recommendations for the karri forest and Shannon Basin which were in summary:

- the upper portion of the basin (part of Curtin forestry block north of S W Highway), and the lower portion (south of Dog Pool to the boundary of the South Coast National Park) be conserved as "Forest Parks"
- the central section of the Shannon Basin which badly needed rehabilitation, be regenerated with a view to reservation of the rehabilitated forest at some time in the future
- not more than 9% of the basin be cut over during the first five years of the woodchip licence without EPA's approval as per the earlier agreement
- other areas of selected karri forest were also recommended for conservation as "Forest Parks". A "Forest Park" was defined in the Preamble to the EPA's Recommendations as an

area of forest which is kept unavailable for the commercial production of timber except in the ordinary course of forest management and to such limited extent as would enable the Conservator for the betterment of the park to cut and remove timber for the purpose of tree regeneration in any areas containing trees which have been damaged or which have deteriorated through age, fire or disease.

Although endorsed by the Government in 1976, the EPA's Recommendations for karri forest conservation have not been fully implemented. In particular the concept of "Forest Parks", aimed at giving greater security of purpose and which required changes to be made in the Forests Act for implementation, has not eventuated. The reasons include:

(a) The Forests Department saw the need to further refine the concept, particularly with regard to appropriate naming to indicate the priority purposes, whether conservation, recreation, or both;

(b) The need to further consider, in the light of the fullest possible information, the alternative competing uses for the Management Priority Areas (MPAs) (particularly mining and timber production), before establishing them with the full security proposed;

(c) The recognition that the published General Working Plans for State Forest with EPA Recommendations have now created a public awareness of the existence and value of the MPAs, which in itself gives them a degree of security; and

(d) The fact that security of purpose of conserved areas of State Forest was being considered in depth as part of the System 6 Study.

The areas selected by the EPA in 1976 for "Forest Parks" were however listed as Management Priority Areas in the Forests Department's General Working Plans No 86 of 1977 and No 87 of 1982. Eleven of the areas have a flora, fauna and landscape Management Priority (plus one additional area not recommended by the EPA), three have a recreation Management Priority (plus one additional area not recommended by the EPA) and two have a scientific study Management Priority. In addition Road and Stream Reserves are listed as being managed as MPAs for conservation and recreation.

As well as conservation of karri in State Forest, the EPA also recommended the establishment of a South Coast National park. Within the proposed boundaries of the Park are some fine examples of karri forest which form an important part of overall karri forest conservation. Again for a number of reasons, the South Coast National Park recommendation is yet to be fully implemented.

This re-examination of karri forest conservation is a result of the expiry of the agreement reached between the EPA and the Conservator of Forests concerning the Shannon Basin.

The Conservator of Forests requested an extension of the agreement from the original expiry date in May 1981 until 31 December 1981. The EPA agreed, and this enabled resource data being compiled for the Forests Department's General Working Plan No 87 to be used as a basis for strategy. It was noted that only about 5.5% of the Shannon Basin would have been cut over by then.

In November 1981, the EPA received the report "Conservation of the Karri Forest" from the Conservator of Forests which outlined a Strategy for future karri forest management.

The EPA released the report for a public review period of three months ending 2 April 1982. Over five hundred submissions were received.

In May 1982, the EPA let a short term consultancy to Dr Peter Attiwill, Reader in Botany, University of Melbourne to examine and report on some aspects of karri forest conservation. Dr Attiwill's report was received in September, and with the Forests Department's *Conservation of the Karri Forest* and public submissions, forms the basis of this, the EPA's report to Government on future karri forest conservation.

2. FORESTS DEPARTMENT'S REPORT *CONSERVATION OF THE KARRI FOREST*

Conservation of the Karri Forest was examined in detail by Dr Attiwill as well as being reviewed by the EPA. In it, the Forests Department explains its proposed management strategy for the karri forest, how this relates to conservation of the karri forest and in particular to the future use of the Shannon River Drainage Basin.

The Forests Department has adopted two key objectives for wood production from the karri forest:

(a) to achieve a minimum rotation length of 100 years; and

(b) to ensure a continuous supply of large size karri sawlogs at a minimum level of 50,000 m^3 per year during the period of conversion to sustainable yield. The maximum volume of karri able to meet these objectives is 100,000 m^3 per year from clear fellings and thinnings.

In the Shannon Basin, about 40% of the land is already excluded from cutting as National Park or MPAs. In the report, the Forests Department looked at the remaining 60% in three ways by examining:

(a) whether this area is a better alternative to the existing MPA system;

(b) if not, whether is it a necessary addition to the MPA system; and

(c) the consequences on the remainder of the karri forest of withdrawing the wood production area in that part of the Shannon.

The Shannon as an *alternative* reserve to the MPA system was rejected by the Forests Department because it would not represent the range of karri forest types nor would it include many of the existing recreational features outside the Shannon Basin. The Shannon as a wilderness area would make management extremely difficult.

The Shannon as an *additional* reserve was also rejected by the Forests Department because it would not add to the representation of karri forest; wilderness values were better represented in the D'Entrecasteaux National Park and satisfactory hydrological benchmark areas have been established elsewhere.

The implications for wood production of reserving the Shannon were said by the Forests Department to have a serious effect on timber yield, long term production planning, regional fire protection and communities in the region. The present wood production strategy for karri is based on using the resources of the Shannon Basin. The only acceptable alternative if the Shannon were reserved from the Forests Department's point of view would be to immediately reduce the hardwood cut by the equivalent of the timber yield from the Shannon. While this would retain the planned 100 year rotation, it would obviously be at a reduced level of yield — below 100,000 m^3 per annum. It would cause socio-economic disruption in the region and lower wood supply to the State. The Forests Department rejected this alternative as well.

Finally it should be noted that *Conservation of the Karri Forest* was not an Environmental Review and Management Programme (ERMP) under the EPA's environmental assessment procedures.

3. PUBLIC COMMENTS RECEIVED ON *CONSERVATION OF THE KARRI FOREST*

By the end of a three month public review period concluding on 2 April 1982, 505 public comments were received. Of them, the report *Karri at the Crossroads* and supplement *Redirection of the Karri Forest Economy* compiled by the Conservation Council of WA and others was the most comprehensive, and as such was considered in depth by Dr Attiwill and the EPA.

It is a reflection of the growing maturity of the conservation groups that this submission went to some trouble to outline alternatives to the effect of reserving the Shannon Basin. The arguments put forward were two-fold: firstly, the submission questioned the security of existing karri forest conservation reserves and secondly it proposed a large increase in area of reserved karri forest.

The main criticisms concerning the security of existing karri reserves were argued on the premise that the Forests Department's Management Priority Areas for conservation and recreation do not offer security of purpose. In addition, they differ from the EPA's Cabinet endorsed Recommendations that such areas become "Forest Parks" and the Forests Act amended accordingly. A further criticism was concerned with the lack of definite management plans for conservation and recreation MPAs.

The proposal in *Karri at the Crossroads* for a large increase in area of reserved karri forest is based on the argument that the area of existing reservation is inadequate and that losses to the timber industry would be offset by increased revenue from tourism and recreation.

A summary of all public submissions is at Appendix B.

4. DR ATTIWILL'S REPORT

As a result of the complex issues involved and the strong differences of opinions which existed in the community, the EPA decided to seek independent expert advice on certain aspects of karri forest conservation and accordingly, in May 1982, let a short term consultancy to Dr Peter Attiwill, Reader in Botany at the University of Melbourne.

Dr Attiwill's terms of reference were:

1. Review and give a technical opinion on the adequacy of existing and proposed reservation of karri forest in Western Australia in terms of, but not constrained by, the following:

   1.1 alternative views of the forest resource and of its use;

   1.2 areas and diversity of forest types conserved;

   1.3 security of purpose; and

   1.4 compatibility of management objectives.

2. Examine the issues associated with the Shannon River Drainage Basin, especially those contained in the documents *Conservation of the Karri Forest* by the Forests Department and *Karri at the Crossroads* by conservationists.

3. Report and make recommendations to the Environmental Protection Authority (in a form suitable for possible public release) accordingly.

Dr Attiwill's report was received in September, 1982, and the Authority pays tribute to his impressive achievement in coming to terms with the issues, and reporting and making substantiable recommendations within the timescale set. His clear, concise and logical conclusions made the EPA's task of reporting to Government considerably easier.

Dr Attiwill's full report is at Appendix A.

The EPA agrees in principle with both the text and the recommendations in his report and has used it as the basis for its own recommendations.

Appendix A

CONSERVATION AND MANAGEMENT
OF THE KARRI FOREST

A Report on a Consultancy to the Environmental Protection Authority, Western Australia

P.M. ATTIWILL

Reader in Botany
University of Melbourne

September, 1982

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TERMS OF REFERENCE

A short-term consultancy was let to me in May 1982 by the Environmental Protection Authority (EPA). The terms of reference for this consultancy are:

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INTRODUCTION

The Karri Forest

The karri *(Eucalyptus diversicolor)* forests of Western Australia are recognized internationally as among the tallest and most beautiful forests of the world. A variety of aesthetic and recreational values of these forests is immediately apparent, and the conservation of a sufficiently large area of karri is generally accepted as a national and international responsibility. On the other hand, the karri and jarrah forests of south-western Western Australia are important sources of timber and timber products. The use of this resource is of economic importance to the region, the State, and the nation. Here, in a nut-shell, is the problem which this consultancy addresses.

Karri occurs in both pure and mixed stands in a restricted area of high rainfall in the south-west of Western Australia. In mixture, it is found most commonly with marri *(Eucalyptus calophylla)*, sometimes with jarrah *(Eucalyptus marginata)*, and in small areas with red tingle *(Eucalyptus jacksonii)*, yellow tingle *(Eucalyptus guilfoylei)*, and Rates tingle *(Eucalyptus brevistylus)*. The karri forest is described as *temperate wet sclerophyll forest*[1] or *tall open-forest*[2]. Mature karri trees grow to 75 m in height and 2.5 m in diameter at breast height. The great size of the karri leads to more vivid descriptions. "With their associated understorey, the giant karris of south Western Australia constitute a unique and ancient forest; one of the great botanical associations of the world".[3]

The *main karri belt* covers an area of about 610,000 ha, and is some 160 km long in a south-easterly direction from Nannup to Point Irwin, and up to 50 km wide in a north-easterly direction inland from the coast. Within the main karri belt (Table 1), pure karri occurs over 61,500 ha (10% of the area) and karri in mixture with other eucalypts occurs over 111,500 ha (18% of the area). About 35,500 ha of karri forest has been cleared, mostly for agriculture.

TABLE 1

Vegetation types in the main karri belt
(from Bradshaw and Lush[4])

VEGETATION TYPE	CROWN LAND Hectares	PRIVATE PROPERTY Hectares
Pure karri	59,000	2,500
Karri mixed with other species	104,000	7,500
Cleared land (previously karri)	2,500	33,000
Cleared land (previously other type)	2,000	26,000
Other forest	200,000	14,000
Other native vegetation	135,500	15,500
Mobile dunes	10,500	150
TOTAL	513,500	98,650

The climate of the karri forest is generally mild. Mean annual rainfall exceeds 1000 mm and may exceed 1500 mm. The southern extremity of the Darling Plateau within the main karri belt forms a gently sloping, lateritic peneplain over a basement of gneiss rocks. Remnants of the lateritic duricrust have been preserved to the north, but become less frequent to the south where the peneplain has been more completely dissected[5]. The karri occurs particularly on the red earths and on the deeper, loamy, yellow podzolic soils[5] formed where the underlying gneiss has been exposed by erosion of the lateritic plateau. Jarrah occurs on the lateritic duricrust and extensive heaths occupy the swampy depositional soils of the flats. In between the laterite and the karri soils and between depositional sands and the karri soils, various associations such as karri-marri are found. The junctions between these various associations are sudden and abrupt.

The forests within the main karri belt are therefore characterized by great diversity. McArthur and Clifton[5] surveyed an area extending from Pemberton through Manjimup and Northcliffe to the coast. They concluded that while "the distribution of both species and vegetational formations is controlled by a combination of rainfall, soil, land form and aspect. . . the single most significant factor controlling vegetation is soil". Since there is a great diversity in the distribution of soils, there are "continuous variations in the vegetation"[5].

In the north-west of the main karri belt (e.g. in the valley of the Donnelly River, west of Manjimup) karri occurs on the flood plains of the streams and, in pure stands, on the red earths of the lower slopes. The best development of karri is found on the south-facing slopes of deeper valleys. Further up the slopes, the soils become podzolized and the forest changes to mixed karri-marri and then to jarrah on the lateritic duricrust at the top of the slope. In this north-western zone, the dominant species in the understorey of the karri forest is the karri netic, *Bossiaea laidlawiana*.

To the south-east, dissection of the lateritic duricrust becomes more complete, and the landscape becomes one of rounded hills of pre-Cambrian rocks protruding from the sandy plains where the soils are depositional. The hills are islands of vegetation, rising from the extensive swampy plains of heath. On the more elevated islands, red earths and yellow podzolic soils have developed. Karri is found on the south side of these islands — not so magnificent in size and, clearly, not so extensive in area, as the karri in the forests of the dissected valleys to the north. The understorey of the karri also changes from *Bossiaea* in the north, through *Acacia pentadenia*, to *Lepidosperma* and *Macrozamia* in the south.

The Forests Department of Western Australia manages 145,500 ha (89%) of the 163,000 ha (Table 1) of the karri forest on Crown Land in the main karri belt. 91,000 ha of karri forest is still virgin* — an extraordinary fact which emphasizes the short history of development of the area: "prior to 1921, when group settlement schemes were implemented, there was only sporadic use of forest resources and very minor utilization of land for agriculture"[5].

On the value of a forest

The preceding description of the karri forest may be summarized: the karri is a tree of magnificent size and beauty which occurs in the restricted high-rainfall area of south-western Australia. It occurs in pure stands and, more extensively, in mixture with marri and other eucalypts. Its distribution within the high-rainfall area is determined primarily by the sequence of soil development in an eroding lateritic plateau; the karri forest occurs as patches within a general mosaic of other types of vegetation. Only 16% of the karri forest has been cleared for agriculture, and almost half is still virgin. How are we to value this forest?

The total value of a forest is the sum of all of its values. These values, as perceived by different people, are many and varied, perhaps without limit. For practical purposes, we can divide values into two groups according to the effects of realizing a given value on the forest environment. The first group includes the values of the forest as a water catchment, for recreation, as a landscape, in the conservation of fauna and flora, as an awe-inspiring contribution to man's emotional requirements — and countless other values which can be gained with little or no immediate effect on the forest environment. The second group includes the value of the forest for timber products, where harvesting has a major and immediate effect on the forest environment. The effects of realizing these two groups of forest values are inter-related (Fig. 1). Maximizing both groups is impossible; the total value of the forest resource to a community, however, is maximized at some level involving competition in the realization of all the values which the forest can provide.

*A *virgin forest* is one "in its untouched natural state"[6]. The definition implies that the forest has been untouched since the time of colonization; that is, it implies that the pre-colonist is part of the natural state and that the colonist is not. It is doubtful if any forest in Australia conforms to such a definition. Every forest has its share of introduced plants (sometimes of weed proportions) and animals (for example, the kookaburra in the south-western forests of Western Australia). Every forest has its share of roads and of fires since colonization. (A forest which has regenerated following a fire caused by a pre-colonist presumably retains its virgin state.) The meaning of *virgin forest* in this report is simply a forest which has never been logged.

This simple picture (Fig. 1) illustrates the present problem. At one extreme, we may manage the forest entirely for timber production and at the other, entirely for values other than timber production. In between these extremes, we have a variety of options — for example, we may manage all of the forest to gain some or all of the values, or we may define areas within the forest to be managed entirely for specific values at the exclusion of other values.

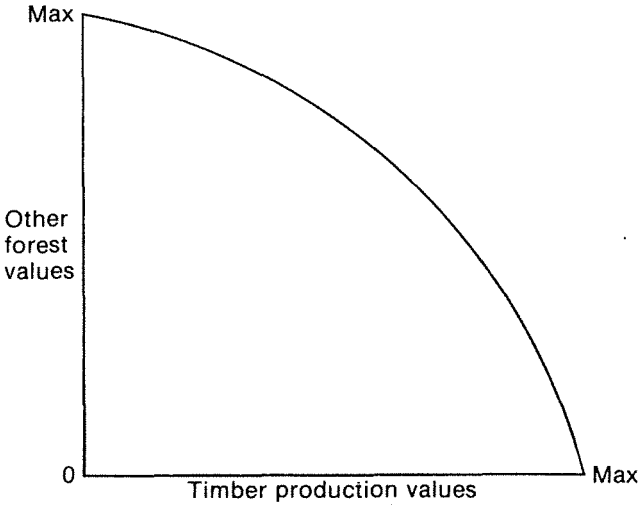

Fig. 1. The inter-relationship between the effects of harvesting for timber production and the realization of other forest values. Both sets of values cannot be maximised; maximization of total value involves a competition between alternative forest uses.

ADEQUACY OF EXISTING AND PROPOSED RESERVATION OF KARRI FOREST

Alternative views of the forest resource and of its use.

The two principal views of the karri forest are those contained in *Conservation of the Karri Forest*[4] and in *Karri at the Crossroads*[7] and an associated paper, *Redirection of the Karri Forest Economy*[8]. These two will be referred to as "CKF[4]" and "KATC[7]", abbreviations of the two principal documents.

Both views are introduced with quotes from *The World Conservation Strategy*[9]:

> "Conservation is the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations. Thus, conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment."

From this definition, divergent views are established. The KATC[7] view emphasizes *living resource conservation* which, according to *The World Conservation Strategy*[9] has three objectives:

> ". . . to maintain essential ecological processes and life-support systems;
>
> . . . to preserve genetic diversity;
>
> . . . to ensure the sustainable utilization of species and ecosystems".

KATC[7] leans toward the theme that human rights may have to be subordinate to those of the environment; it claims to establish "the true meaning of conservation" and asserts that "the multiple use management policy of the Forests Department promotes forest management for human use at the expense of living resource conservation."

CKF[4] leans heavily on the theme of multiple use, the theme of "greatest sustainable benefit" to which Fig. 1 is addressed. One of the principal recommendations of *The World Conservation Strategy*[9] is that every country should prepare its own National Conservation Strategy. The

Australian effort has produced *Towards a National Conservation Strategy — A Discussion Paper*[10] from which I quote:

> "Forests can serve a multiplicity of uses, including wood production, water catchment, recreation, sources of genetic material, wildlife habitat and wilderness, many of which are mutually compatible. The major task of integration is between the production of wood and wood products on the one hand and protection of the natural environment on the other." (Para 145).

and

> "Multiple use management should be the aim of all forestry authorities. Thus in some forest areas management could allow uses such as water catchment protection, wildlife preservation or recreation to occur concurrently with timber production. In other areas it may be necessary to exclude wood production to ensure the sustainability of other uses. Dedicating certain areas of forests solely to timber production may also be necessary, particularly in critical harvesting and regeneration phases. The management of forests, particularly with regard to rotation length, is fundamental to the ability of a forest to supply multiple benefits. Better definition of the use of forest areas is necessary to ensure a balance of uses and objective management. Like forestry other forest uses depend upon integrating development and conservation." (Para 154).

The divergent views having been established, both CKF and KATC in fact reach similar conclusions in relation to the principle of multiple use of the forest resource. The differences are in practice. CKF[4] follows the recommendations for reserves in the karri forest of the E.P.A., 1976[11], and asserts that the Forest Department should continue to manage the karri forests on a multiple use basis. KATC[7] recommends conservation of substantially larger areas than those recommended by the E.P.A.[11]. The substantially larger areas include the Shannon River Drainage Basin, and National Parks are increased from 8% of the area (under E.P.A.[11] 1976, recommendations) to 34%. Hence wood production is reduced in the KATC[7] plan from 59% of the area (under CKF[4] plan) to 41%.

Both views acknowledge that a decrease in the level of permissible cut (300,000 m^3 sawlog yield) is essential. If that permissible cut were sustained the karri forest would be exhausted within twenty years. The CKF[4] proposals involve a decrease in karri sawlog yield from the 1976 high (slightly more than 300,000 m^3) to around 130,000 m^3 by 1990 and to about 100,000 m^3 by 2020. The cut will then increase after the first rotation age of 100 years is reached. The Forests Department has calculated that, if the Shannon River Drainage Basin becomes a National Park in addition to the reservations recommended by E.P.A.[11] in 1976, the permissible cut must decrease to 100,000 m^3 by 1988; if all the recommendations of KATC were to be implemented the permissible cut must be reduced to 67,000 m^3 by 1988.

Thus, in summary, the two views presented here differ in their basic appraisal of the forest but differ only in degree in their proposed utilization of the resources of the forest. There is no absolute right or wrong — both views are valid. On the one hand, CKF[4] ("the foresters") conserves a large area of forest (but not as much as KATC[7]) and it is provocative to label this view as wholly *exploitive*. On the other hand, KATC[7] ("the conservationists") leaves a large area of forest for timber production (but not as much as CKF[4]) and it is provocative to label this view as wholly *preservationist*.

In retrospect, it is unfortunate that processes of decision-making could not have involved the two sides from the beginning*. Both CKF[4] and KATC[7] are well-prepared documents. In particular, government should recognize the very considerable effort required of community groups in the production of a document as detailed as KATC[7]. In my view, the production of an official critique[12] of KATC[7] was insensitive to this recognition. Both the critique[12] and the reply[13] it provoked brought the debate on the future of the karri forest beyond provocation to the point of distrust.

*The forest services are the traditional managers of forested land in Australia, and they have become sensitive to the increasing demands of "the public" to participate in decision-making. The extent to which KATC[7] represents "the public", and the extent to which any one group should receive particular attention, are both debatable. The simple point I make here is that both CKF[4] and KATC[7] have the common interest of management so that the long-term future of the forest is protected.

Area of forest types conserved.
Karri forest occupies some 173,000 ha (Table 1), of which 145,500 ha is managed by the Forests Department, 13,000 ha is existing and proposed National Park, 4,500 ha is other Crown lands, and 10,000 ha is private property. Some 35,000 ha of karri forest has been cleared for agriculture.

The karri forest exist as patches — as a mosaic within an area of some 612,000 ha, 513,000 ha of which is Crown Land. Within this "main karri belt", pure karri forest covers only 11.5% of the area and mixed karri forest, 20.2%. Other forest types cover 38.9% of the main karri belt, and 26.3% is covered by vegetation other than forest. In other words, 68.3% of Crown Land in the main karri belt is not occupied by karri (Table 1). Of the 59,000 ha of pure karri forest on Crown Land (Table 1), about 45% is virgin forest, the remainder having been cut-over and regenerated since saw-milling became well-established in the 1910's. About 61% of the mixed karri forest (Table 1) is virgin forest.

A system of reservations in the main karri belt has been the subject of prolonged investigations under the umbrella of the Environmental Protection Authority of Western Australia (EPA). The report of a Special Review Committee[14], appointed to assess the Systems 1, 2, 3 and 5 recommendations of the *Conservation Through Reserves Committee*[3], was formulated by EPA into a series of recommendations *(Conservation Reserves for Western Australia,* 1976[11]). These recommendations included the creation of a number of *forest parks* within the main karri belt (Table 2); "the Conservator (of Forests) would continue to have the care and management of forest parks which should be kept for such uses as the preservation of flora and fauna and the preservation of the forest for its aesthetic and scenic values as well as for its capacity for silvicultural study and research" (p x). The EPA[11] recognized that the concept of forest parks "involves a significant departure from the role of the Forests Department as stated in the Forests Act, which will need to be amended to define and regulate the use and management of our concept of a forest park" (p iv).

By this stage (March, 1976) Cabinet had approved a new statement of forest policy in which multiple-use management was emphasized as a basis. Amendments to the Forests Act[15] in September, 1976 provided for this policy to be put into practice:

> "A working plan may specify the management priorities that are proposed to be applied to State forests".

The two most recent working plans[16], [17] have defined management priorities for individual units over the entire forest estate. These units are called management priority areas (MPAs) and they form the essential basis for future management of the forest.

MPAs within the main karri belt are shown in Table 2 against the areas of forest park proposed by EPA[11], 1976. There has been much debate over the relative areas of proposed[11] forest parks versus MPAs[17]. However, some 8,000 ha of the 17,054 ha recommended by EPA[11] for the Lower Shannon Forest Park (Table 2) is incorrectly included. This 8,000 ha (approx) — the Pingerup Plains — is to the east of the Lower Shannon and is correctly part of the EPA proposal for the South Coast National Park (compare Figs. 2.3 and 2.7, *Conservation Reserves for Western Australia,* 1976[11]). The correct area for Lower Shannon (Table 2) should therefore be about 9,000 ha, and the total area of forest parks recommended by EPA[15] in 1976 then becomes about 50,000 ha. In comparison, the area of MPAs for Conservation of Flora, Fauna and Landscape, and for Recreation is about 45,500 ha (Table 2). A further 18,000 ha is allocated as Scientific Study Priority Areas (see footnotes (d) and (e) to Table 2).

In addition to MPAs listed in Table 2, other priorities are listed for Protection of Forest Values, for Catchment Protection, for Road Reserves, and for River and Stream Reserves (Table 3). By this allocation of priorities, 32.9% of the total karri forest will be reserved (MPAs for Conservation of Flora, Fauna and Landscape, for Recreation, for Road, River and Stream Reserves, and in existing and proposed National Parks) and 57.5% of the karri forest will be managed for the priority of timber production (Table 4). 50.8% of the area of pure virgin karri and 38.3% of the area of mixed virgin karri will be reserved (in the categories outlined above, Table 5).

TABLE 2

Recommendations for Forest Parks[a], and Management Priority Areas[b] for Conservation of Fauna, Flora, and Landscape (FFL), for Recreation (REC), and for Scientific Study (SCI).

NAME OF BLOCK	FOREST PARKS	MANAGEMENT PRIORITY AREAS		
		FFL	REC	SCI
		Areas in hectares[c]		
DICKSON	261	280		
STRICKLAND	1,485	1,600		
HAWKE-TREEN	1,840	1,600		
DOMBAKUP	144	120		
BOORARA	587	560		
CURTIN	1,108	1,300		
LOWER SHANNON	17,054	8,500		
WATTLE	2,953	2,900		
JOHNSTON O'DONNELL	9,078	9,200		
MITCHELL CROSSING	10,990	10,300		
SOHO	5,668	6,100		
ONE TREE BRIDGE	429		730	
BROCKMAN	690		880	
MUIRILLUP	353		190	
MT FRANKLAND	—		1,200	
LEWIN	—			260
IFFLEY	341			370
LINDSAY	1,086			1,100
BEAVIS-GIBLETT[d]	4,604			3,585
SUTTON	—			790
TOTAL[e]	58,671	42,460	3,000	6,105

(a) Recommended by E.P.A., 1976, *Conservation Reserves for Western Australia*[11].

(b) Management Priority Areas listed in *General Working Plan for State Forests in Western Australia* No 87, 1982, B.J. Beggs, Conservator of Forests[17].

(c) There has been considerable, and mostly meaningless, debate on sizes of forest areas. It is evident that, as the status of forest inventory improves, boundaries may be drawn with greater reliability, and estimates of area may become more precise. To avoid further debate, I have sought the assistance of the Forests Department in the checking of these data and of those which follow. All of the tables are, I believe, now accurate; however, I accept responsibility for errors and omissions.

(d) Beavis and Giblett blocks were recommended by E.P.A. "to be added to the proposed Forest Park System following cutting and regeneration" (see *Conservation Reserves for Western Australia*[11], footnote to Table 2.4). These two blocks are not listed in General Working Plan No 87, 1982[17], but they have been given a preliminary Scientific Study Priority[19].

(e) Further areas not listed in General Working Plan No 87, 1982[17], but defined as having a preliminary Scientific Study Priority[19] are:

BIG BROOK	445 ha
KTC	232 ha
WALPOLE	8,129 ha
GIANTS	3,069 ha
TOTAL	11,875 ha

Is the proposed area of reservation of karri forest "sufficient"? In terms perceived by people who value (for a variety of reasons) the majesty of extensive areas of forests in more or less virgin condition ("the sombre magnificence of uncut timber"), the proposed area of conservation priorities and National Parks is probably not sufficient. Present Government policy is specifically directed towards multiple use, including sustained yield of timber at reduced levels. Alteration of this policy requires considerations of State and regional economies and employment, of changing attitudes to tourism and recreation, etc. — these considerations are beyond my terms of reference. Within my terms of reference, however, I conclude that the Government's policy of multiple use priorities is in accord with the conservation ethic of "greatest sustainable benefit". I also accept the EPA[11] (1976) recommendations for reservations within the main karri belt and I consider that, in terms of the biology of the species, the proposed area of reservation is adequate.

The area of karri forest in existing and proposed National Parks is 8% of the total karri area (Table 3). The area of virgin karri in existing and proposed National Parks is 14% of the total virgin karri area (Table 5). Nevertheless, the distribution of vegetation types in existing and proposed National Parks (Table 6) is disturbing — karri forests occupy only 10.8% of the area of National Parks within the main karri belt. In contrast, karri occurs over 31.7% of the total area of Crown Land in the main karri belt (Table 1); this contrast emphasizes the fact that the major area of National Park is located within the extensive flats and coastal dune systems to the south of the main karri belt where the occurrence of karri is relatively sparse*.

TABLE 3

Distribution by vegetation type of MPAs, proposed(a) and existing National Parks, and other Crown Lands in the main karri belt.
Areas in hectares.

CLASSIFICATION	VEGETATION TYPE			
	PURE KARRI	MIXED KARRI	OTHER FOREST	OTHER VEGETATION
MANAGEMENT PRIORITY AREAS				
Flora, Fauna, Landscape	4,316	6,445	16,300	11,204
Recreation	733	1,269	959	89
Road, River & Stream	10,318	17,561	24,930	5,644
Protection Forest Values	1,371	1,341	12,386	7,121
Catchment Protection	171	455	1,529	33
Scientific	1,345	8,395	4,930	2,230
Wood Production	33,707	60,087	117,550	24,516
NATIONAL PARK	2,344	4,320	7,150	30,248
PROPOSED NATIONAL PARK	3,749	2,685	8,738	61,432
OTHER CROWN LAND	857	1,762	4,497	8,665
TOTAL	58,911	104,320	198,969	151,182

(a) Proposed by EPA, 1976[11].

The proposed[11] South Coast National Park and the Lower Shannon Conservation MPA (Table 2) are large and contain excellent examples of island karri forest. However, the existing National Parks in the main karri belt (other than those on the coast, Table 7) are small and do not adequately represent the taller forests of the dissected valleys to the west and north-west of the belt.

* This is not to deny the very great values of the coastal land and dune systems within National Parks, nor to suggest that the conservation of these systems is unimportant. It is to emphasize the fact that almost 90% of the land in existing and proposed National Parks in the main karri belt does not support karri forest.

TABLE 4

Percentage distribution, *within major vegetation types*, of MPAs grouped for general similarity of purpose, of proposed[a] and existing National Parks, and of other Crown Lands in the main karri belt.

CLASSIFICATION	VEGETATION TYPE				
	PURE KARRI	MIXED KARRI	TOTAL KARRI	OTHER FOREST & VEGETATION	TOTAL VEGETATION
MANAGEMENT PRIORITY AREAS					
Flora, Fauna, Landscape, Recreation, Road, River & Stream Reserves	26.1	24.2	24.9	16.9	19.4
Forest Values, Catchment Protection, Scientific	4.9	9.8	8.0	8.1	8.0
Wood Production	57.2	57.6	57.5	40.6	45.9
PROPOSED AND EXISTING NATIONAL PARKS	10.3	6.7	8.0	30.7	23.5
OTHER CROWN LANDS	1.5	1.7	1.6	3.8	3.1
TOTAL %	100	100	100	100.1	99.9

(a) Proposed by EPA, 1976[11].

TABLE 5

Distribution of MPAs, grouped for general similarity of purpose, of proposed[a] and existing National Parks, and of other Crown Lands within virgin karri forest, both pure and mixed, within the main karri belt.

Areas in hectares.

CLASSIFICATION	PURE VIRGIN KARRI	MIXED VIRGIN KARRI	TOTAL VIRGIN KARRI
MANAGEMENT PRIORITY AREAS			
Flora, Fauna, Landscape, Recreation, Road, River, and Stream	7,600	17,700	25,300
Forest Values, Catchment Protection, Scientific	1,900	6,800	8,700
Wood Production	10,500	31,200	41,700
PROPOSED AND EXISTING NATIONAL PARKS	5,900	6,800	12,700
OTHER CROWN LANDS	700	1,500	2,200
TOTAL	26,600	64,000	90,600

(a) Proposed by EPA, 1976[11].

TABLE 6

Percentage distribution, *within MPAs grouped for general similarity of purpose, within existing and proposed*[a] *National Parks and within other Crown Lands,* of the major vegetation types.

CLASSIFICATION	PURE KARRI	MIXED KARRI	TOTAL KARRI	OTHER FOREST AND OTHER VEGETATION	TOTAL, COLUMNS 3 + 4
MANAGEMENT PRIORITY AREAS					
Flora, Fauna, Landscape, Recreation, Road, River, Stream	15.4	25.3	40.7	59.3	100
Forest Values, Catchment Protection, Scientific	7.0	24.7	31.7	68.3	100
Wood Production	14.3	25.5	39.8	60.2	100
PROPOSED AND EXISTING NATIONAL PARKS	5.0	5.8	10.8	89.2	100
OTHER CROWN LANDS	5.4	11.2	16.6	83.4	100

(a) Proposed by EPA, 1976[11].

TABLE 7

Areas of National Parks within the main karri belt.
(from Annual Report 1980/81, National Parks Authority[18])

NATIONAL PARK[a]	AREA (ha)
COASTAL	
D'Entrecasteaux	36,599
Walpole — Nornalup	18,116
INLAND	
Pemberton National Parks	
Warren	1,356
Beedelup	1,531
Brockman	48
Old Vasse Road	206
Pemberton	122
Sir James Mitchell	1,087[b]

(a) The coastal National Parks contain a variety of landforms and habitats. There is relatively little karri in D'Entrecasteaux National Park, but Walpole-Nornalup National Park contains some fine stands of karri and tingle.

(b) This National Park consists of 100 metres along each side of the South West highway for a length of 64 km.

The EPA[11] recommended that two blocks, Beavis and Giblett (Table 2), should "be added to the Forest Park System following cutting and regeneration". This recommendation has caused considerable controversy. In fact the Special Review Committee[14] appointed by EPA proposed that it was desirable to select for conservation areas of karri forest which covered the full range of the karri ecotype. To this end, it was considered desirable to include representative karri forest from the Lower Warren and Lower Donnelly valleys. A choice

between Strickland, Beavis, Giblett, and Hawke-Treen resulted in all four being chosen as Forest Parks with the compromise that Beavis and Giblett would be cut, and reserved after regeneration. However, the Conservator of Forests[12,19] has given the two blocks a preliminary Scientific Study Priority (Table 2), and the intention of the Forests Department is to manage blocks as demonstration forests on a 100-year rotation. This management will be very similar to that for Flora, Fauna and Landscape (category (b)) in the priority uses outlined in *General Working Plan* No 87, 1982, p. 16[17]:

> *"Flora, Fauna, and Landscape*
> . . . Three types are recognized:
> (a) Preservation areas in which the management objective is to retain the area in as natural a condition as possible . . .
>
> (b) Silvicultural areas in which specific aspects of stand dynamics may be maintained and demonstrated . . .
>
> (c) Management areas where a range of management systems is employed to improve or sustain nominated values (of flora and fauna conservation)"

Beavis and Giblett together contain 2,776 ha of karri forest, 73% of which is still virgin — that is, virgin stands of pure and mixed karri occur over 45% of the area (Table 8). Giblett abuts the northern edge of Beedelup National Park, and Beavis in turn abuts the northern edge of Giblett. Strickland Conservation MPA (Table 2) lies only a few kilometres to the west of Beavis and Giblett and contains 955 ha of virgin karri forest (58% of the area of the MPA)[19]. These four areas — Beavis, Giblett, Strickland, and Beedelup National Park — together amount to some 7,500 ha and include more than 4,000 ha of fine karri forest[7] typical of the western ecotype. Such an area of extensive and concentrated karri forest should be of high priority for conservation.

TABLE 8

Distribution by vegetation type of MPAs within Beavis-Giblett.

CLASSIFICATION	PURE KARRI		MIXED KARRI		OTHER(a)	TOTAL
	VIRGIN	CUTOVER	VIRGIN	CUTOVER		
Road Reserve	4		39	24	272	339
River & Stream Reserve	158	85	183	51	71	548
Scientific	520	144	1,109	459	1,353	3,585
TOTAL	682	229	1,331	534	1,696	4,472

(a) This includes other forest, and non-forested land. Jarrah forest covers all but 63 ha of the total land in this category.

The decision to manage a demonstration forest such as that proposed for Beavis and Giblett is appealing, and would provide a valuable assessment of management by clear-felling and regeneration on a rotation of 100 years. However, these aims can be achieved in other areas as well as they can at Beavis-Giblett — it should only be a matter of planning the distribution of coupes*. Furthermore, the exclusion of Beavis and Giblett from logging would mean a loss of only 35 ha per year (only 22 ha of which would be karri). I therefore recommend that Beavis and Giblett be reclassified and included under the present system of MPAs for the Conservation of Fauna, Flora, and Landscape; the management objectives and prescriptions

* A coupe is a defined area of the forest which is to be clear-felled and regenerated according to silvicultural and management prescriptions. A number of coupes together make up the total area which is to be logged each year.

for Strickland, Beavis and Giblett should be along the lines of those suitable for a national park. The proposal, put forward by KATC[7], that Beedelup National Park be extended by the inclusion of Strickland, Beavis and Giblett should be reviewed at some time in the future. A review "at some time in the future" acknowledges that at present, the Forests Department is better equipped than the National Parks Authority, in manpower and in expertise, to manage extensive areas of forest particularly where the risk of fire is high.

Security of purpose.
The problem here is well-recognised and of long-standing. The problem is summarized[12]:

> "In terms of security of tenure, there is no difference between National Parks and Management Priority Areas, as in both cases tenure can only be changed by resolution of both Houses of Parliament. The Forests Department has expressed a desire to ensure security of purpose of management by requiring changes to be approved by resolution of both houses of Parliament. The finalisation of this matter awaits the deliberations of the System 6 Committee and resolution of conflicts with Agreement Acts."

The System 6 Study Report[20] stressed the need to ensure that "the value of the Management Priority Area for its primary purpose of conservation or recreation is not diminished" and recommended (in part) that:

> "Any proposal to utilize a conservation and recreation Management Priority Area in a manner which affects the value for its primary purpose . . . should be considered by Government at the highest level and only then after there has been a thorough and rigorous study. . ." (p. 25).

The original recommendations of the EPA[11] for reserves within the karri forest were based largely on the concept of *forest parks*. Management objectives of the Forests Department[18] effectively reject this concept which, it is argued, "has different meanings in different parts of the world". *The System 6 Study Report*[20] in effect (p. 25) reaffirms the need for a term such as *forest park* to be applied to those areas (MPAs) where management has the priority of recreation and suggests the term *forest sanctuary* for those MPAs where management is directed toward conservation of flora, fauna, or landscape.

The case against the rigorous dedication of reserves might reasonably be based on the need to retain flexibility for practical purposes of management. Within the area under control of the Forests Department in the main karri belt, however, there is unlikely to be conflict between external interests such as mining and those interests of forestry which are covered by the concept of MPAs.

Furthermore, the selection of MPAs for Conservation of Flora, Fauna and Landscape, and for Recreation has been based on a number of detailed reports and on a number of years of careful planning. The argument favouring flexibility seems to have short-term and practical merits, but in my view has little application to Conservation and Recreation MPAs, the selection of which demands (and undoubtedly has received) long-term considerations.

Security of purpose for Conservation and Recreation MPAs within the karri forest area is, I believe, of major importance. A former Director of the Department of Conservation and Environment put the general case[21]:

> "It is . . . evident that the hardwood forests of the South-West form an important part of the State and national heritage. They are more than that, even, because, as the EPA's Conservation Through Resources Committee stated —
>
> 'With their associated understorey, the giant karris of south Western Australia constitute a unique and ancient forest; one of the great botanical associations of the world.'
>
> It is clear, therefore, that they require special care and attention."

Similarly, KATC[7] calls attention to the high level of priority for protection of the karri forests both in the World Conservation Strategy and by the Australian Heritage Commission.

Conservation of karri is clearly a responsibility which has been acknowledged at regional, state, national and international levels. I therefore recommend that, for the karri forest, security of purpose is ensured for Conservation MPAs by the creation of *Forest Sanctuaries* (or some other name which conveys a similar sense of priority) and for Recreation MPAs by the creation of *Forest Parks* (or some other name which conveys a similar sense of priority). I recommend further (and largely in the words of the System 6 Study Report[20]) that any proposal to utilize a Forest Sanctuary or a Forest Park in a manner which affects its value for its primary purpose should be considered at Cabinet level, and then only after there has been a thorough and rigorous study.

Compatibility of management objectives.
Compatibility of management objectives is, of course, basic to the Government's present forest policy of multiple use and to the setting of management priorities within *discrete* MPAs. Much is known of the management prescriptions for MPAs where the priority is wood production. Prescriptions to achieve stated objectives of management for MPAs other than those designated for wood production are still, however, at the stage of formulation.

The size of individual Conservation MPAs (see Table 2) is not large; the mean size is 3,860 ha, six of the eleven Conservation MPAs are less than 2,000 ha, and only four of the eleven are greater than 6,000 ha. Similarly, the mean size of Recreation MPAs (Table 2) is 750 ha and all four are less than 2,000 ha. However, size should not be the only consideration. If the forest area surrounding the MPA to be protected is managed with sympathy (i.e. compatibility with the management objectives for protection) then the effective sizes of MPAs for protection will be increased. For example, to have a conservation MPA standing as an island surrounded on all sides by coupes all clear-felled within a few years is totally unsympathetic. In contrast, a Conservation MPA surrounded by patches of forest covering a wide range of age classes is totally sympathetic; by such management, diversity of the forest and of its habitats is increased.

The original concept of Conservation MPAs included a "core and buffer" approach which has not yet been defined, either in terms of relative size or in terms of relative management. Suppose that MPAs are circular and that a buffer of 500 m is required. If core and buffer are 500 ha, the core is only 36% of the total area. For the average size of Conservation MPAs (3,860 ha, Table 2) the core becomes 73% of the area. It seems far more sensible, given the small size of some of the Conservation MPAs and all of the Recreation MPAs, to treat the surrounding forest sympathetically as a buffer and to retain the entire MPA for the primary (or "core") management objectives. Such an approach demands flexibility; the inflexibility reached by defining cores and buffers within MPAs is unnecessarily restrictive, and reduces the size of effective conservation which can be achieved by management of the forest surrounding the Conservation MPA with sympathy — that is, in a way which is compatible with aims of conservation which have been specified for the MPA.

Further to this point, I favour management of the greater part of the forest by a single management authority. In my view, the Forests Department has, or is developing, the experience and skills to achieve compatibility of a range of management objectives. I would wish to add that, in my view, the Forests Department is outstanding among the forest services of Australia in terms of its detailed development of working plans, of detail of resource inventory, and of long-term prescriptions for management. In particular, the concept of multiple use is brought to a practical and documented reality through the development (and publication) of the system of Management Priority areas. Nevertheless, I believe that, to fulfill management objectives with complete compatibility (that is, to provide a balance between the utilization of timber and the utilization of other resources of the forest), it will be necessary for the Forests Department to employ an increasing number of professionals other than those with forestry qualifications. In particular, I see the need for further developments in forest recreation and the development of tourism, in animal behaviour and ecology, and in hydrology. The need for greater diversity of expertise is not restricted to Western Australia; it is required generally to meet the changing demands of management on forest services throughout Australia[22].

Specialists should also be involved in strengthening the development of the forest estate for recreation. The KATC[7] recommendation that "the Forests Department should critically revise its approach to recreational planning" (P. 31) is, in my view, valid. This is not to deny the

considerable recreational facilities which now exist (the major ones, it could be argued, are roads, without which access would be difficult, and fire protection). Rather it acknowledges the rapidly-changing view which people have of the forest resource, a view which is based on an increasingly sophisticated knowledge. The revision which KATC[7] envisages "should be based on a valid and objective interpretation of the value of the resource." The revision should have two separate aims — first, to identify and then to promote those values which people seek in the forest and secondly, to provide the basis upon which people may base their own appreciation of the biological value of the forest and of management of the forest for its many values.

Brief reviews of some management practices

Some management practices have caused a great deal of discussion and debate between "the foresters" and "the conservationists"[4,7,12,13]. It is worthwhile to review some of the concepts and principles within these debates which have centred on:

- the nature of the virgin forest
- management of karri as an even-aged forest
- management of the forest based on karri as a single species
- achievement of sustained yield
- clear felling
- the effects of harvesting on sustained production
- prescribed burning
- harvesting for wood chips
- effects of management on water quality
- the size and management of conservation areas
- the planting of species not native to the karri forest

(a) The nature of the virgin forest

The "virgin forest" is most usually thought of in terms like huge, magnificent, sombre, primeval, and even eternal — the best of the karri forest that we see, say, at Warren National Park. These most magnificent virgin forests tend to be taken as the yardstick against which we assess our management of the forest[23].

The virgin karri forests are, in fact, a mixture; they are a legacy of environmental interactions and events of the past. The mixture will continue to change as the forests continue to age and in response to management (there seems general agreement that at least the forests will be protected from destruction by fire).

KATC leans toward the view that there is a "right of some of the remaining natural areas in Western Australia to continue to exist undisturbed"[7] and that "substantial, secure reserves of karri forest must be left in a natural and mature condition for us and our children's children's children"[12]. CKF[4], however, argues the case that "we cannot dictate the needs of future generations, but we can and should provide choices". Thus "the decisions made now . . . will affect the options that are available to (future generations)".

I have previously stated that both CKF[4] and KATC[7] advocate multiple-use of the karri forest — the difference is one of degree. For the point of argument, however, we may take both views of our responsibility for the natural forest to their limits. The ultimate KATC[7] view would provide timber products only for which there are no substitutes and would conserve the maximum area of forest in as natural a state as possible. The increment of harvestable timber in the

ageing forests would, however, be minimized, and the virgin forest would become increasingly difficult to harvest for timber production. The ultimate CKF[4] view would maximize the harvest of timber products and leave little forest in virgin condition. The increment of harvestable timber would be maximized, but if some future decision is to manage the forests from that time as virgin forests, a number of generations will pass before the aim is achieved. In short, neither view can present future generations with the full range of options.

I stress again that neither side advocates such limits and that both accept the necessity to conserve a sufficient area of virgin forest for a variety of reasons (genetic, aesthetic, scientific, moral, etc). Given that a sufficient area is conserved, then what is our responsibility? In my view, an emphasis on the virgin forest makes a definition difficult — the nature of the virgin forest will change. Rather I would emphasize the land; it is our responsibility to manage the land so that we pass on to future generations land in good condition.

(b) Management of karri as an even-aged forest

There has been argument as to whether the "natural" karri forest is even-aged (like mountain ash, *Eucalyptus regnans*) or uneven-aged. I would judge that much of the virgin karri forest is even-aged, and that substantial areas are uneven-aged (uneven-aged in that there may be four or five age-classes of trees occurring in groups — the forests are never mixtures of all ages). The Forests Department practised the selection system in karri forest for many years, and there is abundant evidence of satisfactory regeneration under this system. There is also no doubt that the Forests Department is successful in managing the karri forest under a clear-felling system which produces even-aged forest in coupes. I conclude there is no single, "natural" way to manage the karri forest, and that the Forests Department has the ability to manage the forest in a variety of ways according to the objectives of management which are set.

(c) Management of the forest based on karri as a single species

The karri forest is, like other high-rainfall eucalyptus, largely monospecific. However, unlike *E. regnans* (for example), karri occurs extensively in mixture with marri, and sometimes in mixture with other species such as jarrah or tingle. I can see no scientific sense, however, in relating European (mainly German) experience in the management of mixed forests of hardwoods (beech) and softwoods (fir) to suggest[7] that there is something inherently wrong or dangerous in managing the karri forest primarily for karri.

(d) The achievement of sustained yield

I accept that the determination by the Forests Department[4,12] of the level of sawlog yield from the karri forest is conservatively based on the best information available. There has been debate as to whether this yield can be sustained relative to the present increment. An extensive quotation from the Forests Department's "Critique"[12] gives, in my view, an accurate assessment:

> "The definition used by (KATC), namely, that in sustained yield, the volume of timber being extracted for wood production is equal to the volume being added to forests through growth is only applicable to a forest that has been subject to management for a considerable time. (KATC recognizes) that in mature virgin forest this is not possible as increment is negated by death and decay, and that annual growth increment will not match timber harvest until the regrowth trees become mature enough to be harvested. By definition, it is impossible to determine what the cut should be when utilization of virgin forest commences. It is, in fact, only as an increasing proportion of the forest is cut over, that the permissible cut can be estimated from the performance of regenerated stands. It is, therefore, not surprising that only in recent years has the Department been able to define the permissible cut with greater precision, and to use it in control of the timber industry".

In other words, increment of a mature, virgin forest is zero or even negative. The sustained yield of regrowth stands can be estimated only as these stands reach a harvestable age (the short history of utilization of karri forest must be remembered here). Furthermore, present estimates of sustained yield assume present markets — in particular, sawlog yields are based on present-day standards of what is termed "a general-purpose sawlog". For these reasons, the sustained sawlog yield cannot be fixed today, to hold for ever. Flexibility, to allow both for constantly improving assessment of the forest resource and for changing markets, is essential.

(e) Clear-felling

Karri, like other high-rainfall eucalypts[24,25], and indeed many other communities, is adapted to an environment of which fire is a part[26]. In particular, karri appears to depend on fire for natural regeneration. Where the land has not been repeatedly burned, the virgin forest remains even-aged. Seedlings may become established in gaps within the mature forest where occasional fires have created favourable seed-beds. Some of the virgin forest may therefore have four or five age classes of trees established in groups throughout the forest[27].

Silvicultural systems in the karri forest have always used fire to obtain regeneration. From 1925 to 1935[4,25], regeneration was obtained by a clear-felling system in which seed trees were left and the debris from logging was burned. From 1935 to 1967, a group selection system was used. Since 1967, clear-felling over coupes of maximum area 200 ha (average area approximately 85 ha*) has become standard. About 60% of the coupes has been regenerated by hand-planting of seedlings[25,28].

There is no doubt that both the group selection system and the clear-felling system have achieved wholly satisfactory regeneration; it seems that karri is a relatively easy species to handle. The advantages of both silvicultural systems have been clearly stated[25]. The poor seed-set and the irregularity of good seed years[29] is overcome in both systems by hand-planting open-rooted seedlings. There is some loss of timber production in the selection system where root-competition from the mature trees suppresses the growth of the young trees[30]. However, the most compelling biological reason for avoiding group selection is the amount of damage to the trees which remain. This damage is caused by felling and burning, and is compounded by die-back of the crowns where the canopy has been opened[4]. Apart from this reason, the most compelling arguments in favour of clear-felling are economic and operational; they follow from current logging practices and from current methods of fire control. In particular, the devastation by bushfire in 1980 of a large area of regeneration scattered over a large number of small coupes in south-eastern New South Wales has re-inforced the practice of clear-felling in larger coupes in the karri forest[31].

The group selection system has been shown to be effective in karri forest and, in my view, is more acceptable than clear felling from most environmental viewpoints; the regression of the mature trees which are left in a selection system is, however, a major problem. The clear-felling system has economies of scale both in logging of large trees in the virgin forest and in protection of the regenerating stands and is therefore likely to continue given the present technology and the present economic situation. The group selection system, however, should not be rejected; it will, I believe, be particularly appropriate in the future when cutting becomes concentrated in the younger stands.

(f) The effects of harvesting on sustained production

There are few quantitative data for any forests which may be used to assess the effects of harvesting on the ability of a site to sustain production. Generally the removal of nutrients in timber is small relative to agriculture, and this is true for karri[32]. Uptake of nutrients by forests reaches a maximum during the first 20 or 30 years, after which an increasing proportion of the

* This figure is calculated from the number of coupes within size classes presented by the Forests Department[27], and must be accepted as an approximation.

demand for nutrients is met by cycling processes[33]. Fears of a decline in production are therefore usually related to intensive harvesting of forests in very short rotations, but these fears can easily be allayed by the use of fertilizers, as in agriculture. Over 100-year rotations as for karri, the input of nutrients from natural sources may be significant[34,35] and must be considered.

Forestry in Australia is still young relative to the length of a rotation for native forests. There is, however, no evidence for a decline of production in cut-over forest. Assessment and research must continue so that the problem, if it arises, is recognized immediately. Appropriate changes to management prescriptions must then be made.

(g) Effects of burning

Fire is used after logging to reduce the amount of debris lying on the ground and to provide optimum conditions for the establishment and growth of seedlings; such a fire is called a regeneration burn. Fire is also used within defined areas on a 5-7 year cycle to reduce the amount of accumulated fuel so that bushfires may be more easily controlled; these fires are called prescribed burns.

The loss through volatilization of nitrogen and even of phosphorus in the hot regeneration burns following logging has received much attention in recent Australian literature[36]. In my view the opponents of regeneration burning: (a) have presented an exaggerated case, (b) have not balanced losses by burning against gains from natural sources, and (c) have therefore not presented the "demolishing" case which KATC[7] suggests they have.

It is often assumed that maturity and stability of ecosystems go hand-in-hand. For example:

> "At climax, an ecosystem is considered to be not only mature but also said to be more stable as an ecosystem because it is believed that at such a stage —
>
> a. the system will recover more readily from perturbation,
> and
> b. mature ecosystems lose less energy and nutrients than immature ecosystems"[11].

Much recent work[37,38], however, indicates that immature, aggrading systems develop cycles of nutrients which are more stable than those in a climax system[39]. Of course there are losses when a forest is logged and burned; despite these losses, there has been no indication following even the hottest and most devastating bushfires (for example, the 1939 fires in the high rainfall forests of Victoria) of a decline in productivity in the regenerating stands. Boerner[39] has put forward an interesting proposition:

> "In oligotrophic (low nutrient) ecosystems . . . the bulk of the organic matter and nutrients are above-ground, so losses (due to wildfires) to atmospheric pathways are higher, . . . The lack of soil nutrient reserves and exchange capacity make these ecosystems more subject to leaching losses as well. Species inhabiting oligotrophic ecosystems, therefore, have developed nutrient conservation mechanisms to minimize these leaching losses, including mycorrhizal associations, symbiotic nitrogen fixation, profuse uptake, and evergreenness".

The temperature of prescribed burns is of course less than that of regeneration burns. The main concern here has been on the effects of repeated fire on fauna and flora. Results so far indicate a rapid recovery, both of diversity and number, of plants, mammals, and birds[40,41,42]. The Forests Department rightly acknowledges the preliminary nature of these results and has stressed the need for continuing observation and measurement[42,43].

As forests mature, an increasing proportion of the annual net primary production is shed from the trees as litter[44]. This litter provides the energy source for soil microorganisms — in the high rainfall forests, some 5-10 tonnes ha^{-1} of litter is decomposed each year. It would be surprising if periodic fires did not change the composition of soil microorganisms markedly — just as Springett[45] has suggested for microfauna. Perhaps this change again should be considered as part of the natural system, as is often proposed[4]. However, we do not have good data on the periodicity of natural fires in the south-west[46]; indeed, it has been suggested[47] that the absence

of old fire scars in the stems of virgin jarrah indicates that fires were not as prevalent before white man as is often supposed.

In summary, present indications are that the karri forest ecosystem recovers from controlled fires with little obvious effect*. This is not to say that burning is excellent. Rather, we have to meet today's problem with today's knowledge. The "do-nothing-until-we-know-everything" plea achieves nothing. I would judge that research on the effects of fire generally, and on microbiological processes in the soil in particular, should be of high priority. Management must then be continually responsive to increases in knowledge.

(h) Harvesting wood-chips

There has been more rubbish written in the last decade about wood-chips than on any other topic in Australian forestry. The essence of utilizing the wood-chip industry for the benefit of Australia lies in proper control of the industry. Management must ensure that wood-chipping is wholly integrated with the cutting of saw-logs and thereby uses only the wood which would otherwise be wasted, and that all of the prescriptions for environmental protection are strictly adhered to. Without doubt one can find many examples where control has failed — the most often-quoted case of lack of control is on free-hold land in Tasmania[24] — but it would probably have failed equally if the logging was for sawlogs only rather than sawlogs *plus* wood-chips. In short, the responsibility for gaining benefit from the wood-chip industry lies fairly and squarely with management.

The production of high-quality sawn timber inevitably utilizes a relatively small proportion of the total wood volume in a forest, particularly in an overmature forest•. The large quantity of wood remaining on the forest floor after logging is a menace where the risk of fire is great. It is this wood, otherwise unusable in the normal run of saw-log operations, which wood-chipping utilizes.

The results of the wood-chip operation near Eden in New South Wales indicate that, at 40 years, volume production of the regenerated forest will be twice that of the overmature forest it replaced[24]. The quality of the trees for timber production has been substantially improved. If we accept that it is useful to use forests for sawn timber, we should also accept the benefits which a market for wood-chips provides. For the karri forest, it is essential that the Forests Department be supported in ensuring the tightest control of safeguards so that the maximum benefit of the wood-chip market can be obtained with minimum damage to the environment.

(i) Effects of harvesting on water quality

It goes without saying that the maintenance of the quality of water in the rivers and streams of the karri belt must have the highest priority. In the high rainfall zone (greater than 1200 mm per year) of the karri forest there has been no increase in salinity of streams following cutting for sawlogs and woodchips[49,50]. Indications are that salinity will not be a problem within the Woodchip License Area — clear-felling is at present disallowed in the north-east of the Area where annual rainfall is less than 900 mm. Logging operations have been increasingly limited in wet weather to ensure that sediment loads in streams are kept to a minimum. Like the wood-chipping industry discussed above, this is a matter for rigid control of operations by the Forests Department.

* Karri trees up to 15 years old are intolerant of fire and may be killed. Older trees are quite tolerant and, in this respect, karri is unlike mountain ash[48].

• It should be noted that the proportion of the plant which is harvested — "the harvest index" — is low for most crops, just as it is for forests. In other words, much of the net primary production of plants is allocated to processes other than building the mass of that which we harvest.

(j) The size and management of conservation areas

The size of a "viable" area for conservation of the karri ecosystem has caused considerable debate, with specific estimates ranging from 6,000 to 12,000 ha. I will not enter that debate. I believe, however, that areas for conservation cannot be considered as "islands unto themselves" since they will be surrounded by the mosaic of forest types of which karri is a part. The fact that this surrounding forest will eventually be also a mosaic of age classes will, in my view, further complement the virgin forest which is to be conserved.

Some flexibility in the management of any land is essential and was specified for Conservation MPAs in General Working Plan No 87[17]. The Forests Department[12] has clearly stated that "flexibility" does not mean that conservation areas will be exploited for timber production. Rather "any plan must recognize that future changes may require appropriate response"; for example "clearfelling would only be undertaken should a major natural disaster create a need for regeneration"[14].

The timber industry has been quoted (KATC[7]) as suggesting that overmature karri, even in National Parks, will have to be logged. This threat is often accompanied by the stated fear that visitors may be in danger of falling limbs from the decaying trees. Management prescriptions for conservation areas should establish clearly that there will be no need to log these areas in the foreseeable future and should put "flexibility" into its proper perspective. The virgin karri trees will still be there in a hundred years, and decisions on logging the Conservation MPAs now should have no priority whatsoever.

(k) The planting of introduced species

I view one practice as incompatible with the best interests of the karri forest:

> "The Forests Department has every intention of continuing to experiment with exotic trees, especially in sites such as compacted landings, worked out gravel pits and other mined over areas where regeneration is difficult"[28].

I can accept small areas of exotic planting for a specific purpose (for example, *Eucalyptus muellerana*, about 100 ha per year, on a 40 year rotation within the 100 year rotation of the karri forest). Experiments with exotics generally, however, should be confined to arboreta. If certain areas become problem areas due to harvesting, the solution is to experiment with techniques of re-establishing the native forest through site-preparation and amelioration, not to experiment with exotics which may tolerate the problem site.

Further to this point, there are some areas of exotic planting (particularly of pine) within the main karri belt which have failed and which now serve no purpose. Their performance should be properly recorded for posterity, and the plantation should now be destroyed and converted back to native vegetation.

ISSUES ASSOCIATED WITH THE SHANNON RIVER DRAINAGE BASIN

The history of the Shannon Basin was reviewed for EPA in 1976 by a Special Review Committee[14]. This Committee questioned the suitability of the Shannon Basin in terms of the criteria originally proposed by the Conservation Through Reserves Committee[3]. Instead of recommending the whole of the Shannon River Drainage Basin for reservation, the Special Review Committee proposed a series of forest parks to represent the full range of karri and karri-marri ecotypes. The important recommendations of EPA[11] in relation to the Shannon Basin, based on the Special Review Committee's[14] findings, are:

a. ". . . a new South Coast National Park be proclaimed between the Scott River area and Nornalup and be declared a Class A reserve, for the purpose of National Parks and Water, vested in the National Parks Authority. . ." (2.3(1));

b. reservation of part of Curtin block and the Lower Shannon south of Dog Pool (2.4);

c. rehabilitation, by regeneration, of much of the fire-damaged central part of the Shannon, "with a view to reservation of the rehabilitated forest at some time in the future" (2.4);

d. restriction of cutting during the period 1976-81 to less than 9% of the Shannon Basin. This last recommendation was seen as "important to conservation in the public mind" while still acknowledging the need for rehabilitation as in (c) above (2.4).

The EPA[11] recommendations recognized the excellent stands of karri in the northern part of the Shannon Basin (The Curtin block) and the desirability of reserving the southern part of the Shannon which, together with the proposed South Coast National Park, would make a substantial and viable area of considerable value for conservation and for recreation. EPA[11] considered that the forest in the central part of the Shannon "is badly in need of rehabilitation and regeneration if it is ever to become suitable for reservation". The EPA[11] (1976) concluded that, given this approach to management within the Shannon Basin, "the Karri forest of the Shannon (in the future) will be of a quality suitable for reservation as a 'forest park'."

It is perhaps worth recording some details of the Shannon Basin (Table 9). Only 8.6% of the area of the Shannon Basin is covered by pure virgin karri forest; 63% of the area supports forests other than karri and non-forest areas (low vegetation, sand, water). The present allocation of MPAs for Conservation, for Road Reserves and for River and Stream Reserves means that about 40% of the Shannon Basin is effectively protected (Table 10). These MPAs contain about 54.7% of the total area of pure virgin karri forest in the Basin, 20% of this total area in MPAs for Conservation of Flora, Fauna, and Landscape and for Recreation (Table 10). (It should be noted here that EPA[11] recommendations for the South Coast include "that the Forests Department's Road Reserves . . . should be managed as for forest parks, with priority given to the preservation of aesthetic values, and that the Forests Department's Stream Reserves . . . should also be managed as for forest parks, with priority given to the preservation of the water resource").

TABLE 9

A. CONTROL OF LAND IN THE SHANNON RIVER DRAINAGE BASIN

Forests Department	44,433 ha
National Park	357 ha
Other Crown Land	14,244 ha
Private Property	847 ha

B. PRINCIPAL VEGETATION TYPES IN THE SHANNON RIVER DRAINAGE BASIN

VEGETATION TYPE	AREA (hectares)	PER CENT OF TOTAL
VIRGIN KARRI — PURE	5,183	8.6
— MIXED	12,130	20.3
CUTOVER KARRI — PURE	2,466	4.1
— MIXED	2,500	4.2
OTHER FOREST	21,089	35.2
NON-FORESTED LAND	16,513	27.6
TOTAL	59,881	100

The Shannon River flows into Broke Inlet. In the original *Conservation Through Reserves Committee*, 1974[3] proposals, features of Broke Inlet formed an important part of the rationale for considering the whole of the Shannon Basin as a reservation. I have received expert opinion to the effect that Nornalup Inlet is in many respects more valuable for conservation than Broke Inlet. Future reassessments of the suitability of the region for conservation purposes should therefore not isolate the Shannon Basin as a single issue, but should include the basin of the Deep and Frankland Rivers in particular.

TABLE 10

Distribution by vegetation type of MPAs, proposed(a) and existing National Parks, and other Crown Lands in the Shannon River Drainage Basin.
Areas in hectares.

CLASSIFICATION	PURE KARRI		MIXED KARRI		OTHER(b)	TOTAL
	VIRGIN	MIXED	VIRGIN	MIXED		
MANAGEMENT PRIORITY AREA						
Flora, Fauna, & Landscape	1,026	—	1,729	—	6,987	9,742
Road Reserve	370	278	920	374	3,030	4,972
River & Stream Reserve	386	85	1,016	114	1,005	2,606
Forest Values, Catchment Protection, Scientific	—	12	—	26	402	440
Wood Production	2,255	2,076	7,641	1,974	20,039	33,985
NATIONAL PARK	55	—	91	—	208	354
PROPOSED NATIONAL PARK	985	—	386	—	5,119	6,490
OTHER CROWN LANDS	79	16	100	12	238	445
TOTAL	5,156	2,467	11,883	2,500	37,028	59,034

(a) Proposed by EPA, 1976[11].

(b) Includes forests other than karri, and non-forested land. The total land in this category includes almost 21,000 ha of jarrah forest.

Although the concept of reservation of an entire catchment as proposed by the Conservation Through Reserves Committee, 1974[3], has some appeal, I remain unconvinced from a number of view points that the Shannon River Drainage Basin is ideal. In my view, the procedures of recommendations and public review in relation to the issue of the Shannon River Drainage Basin resulted in a series of sound and realistic recommendations for management. My recommendations follow simply:

a. the areas recommended as choices for reservation by EPA, 1976, and now listed as MPAs for Conservation of Flora, Fauna and Landscape should become (as should all Conservation MPAs in the main karri belt, Table 2) *forest sanctuaries* (as recommended by EPA, 1976, and as recommended earlier);

b. rehabilitation, by normal harvesting procedures and regeneration techniques applicable to Wood Production MPAs, of the fire-damaged forests of the central part of the Shannon should proceed, the "5 year, less than 9%" period of cutting restriction having been adhered to and now ended;

c. the fire-damaged forests of the central Shannon having been rehabilitated, the suitability of the central Shannon for reservation should be reviewed at some time (perhaps one or two decades) in the future.

d. recommendations of EPA, 1976, in respect of the South Coast National Park should be fully implemented. This recommendation has particular relevance to that land immediately to the south and south-east of the Lower Shannon, including the Pingerup Plains.

Failure to implement the EPA[11] recommendations for the South Coast National Park in their entirety would, in my view, seriously undermine many years of careful planning for balanced conservation of land systems within the entire karri forest belt. In any system of multiple-use of a resource, compromises must be reached — "the greatest sustainable benefit" to all users can only be obtained by each user opting for less than the maximum benefit available (Fig. 1). Failure to secure the South Coast National Park could be viewed, and rightly so I believe, as surrendering too much.

SUMMARY AND RECOMMENDATIONS

The karri forests of Western Australia are widely recognized and acclaimed as one of the great botanical associations of the world. Karri is mainly confined to a small area in the south-west of the State where rainfall is high. This main karri belt is characterized by great diversity, both of soils and of vegetation. The nature of the karri forest changes across its range, and conservation must ensure that the full range of ecotypes is included.

1.1 **Alternative views of the forest resource**

In 1976, the Environmental Protection Authority (EPA) recommended a system of reservations which aimed at covering the range of karri ecotypes. The recommendations of EPA were endorsed by Cabinet but have not yet been fully implemented. Since that time, there has been a considerable controversy on conservation of the karri forest. Conservation groups have submitted that the area of reservations within the karri belt should be substantially increased above that recommended by EPA. This increased area would include the Shannon River Drainage Basin. The Forests Department and other groups have submitted a plan for management which follows, fairly closely, the earlier recommendations of EPA; these plans involve a substantial reduction of the saw-log harvest (as does the plan of the conservation groups). Both submissions agree on the principle of multiple-use; the disagreement is as to the balance between reservation and utilization.

1.2 **Area of forest types conserved**

The recommendations of EPA were planned in great detail and formulated after much investigation. In my view, they provide a sound basis for conservation of the karri forest. These recommendations have been accommodated so far by the allocation of forest areas to Management Priority Areas (MPAs) for Conservation of Fauna, Flora, and Landscape and for Recreation. These MPAs, together with proposed and existing National Parks, cover 16% of the area of the karri forest. A further 17% of the karri forest is effectively reserved in Road Reserves and in River and Stream Reserves. Timber production will have priority over 57.5% of the karri forest. I therefore conclude:

1.2.1 that the Government's policy of multiple-use priorities in the karri forest is in accord with the conservation ethic of greatest sustainable benefit of all of the values of the forest;

1.2.2 that EPA recommendations for reservations within the main karri belt are, in terms of the biology of the species, adequate;

1.2.3 that EPA recommendations for reservations within the main karri belt, particularly in respect of National Parks, should be fully implemented.

The area of virgin karri in existing and proposed National Parks amounts to 14% of the total virgin karri forest. While the coastal National Parks are large, those inland are small and, in my view inadequate. I therefore recommend:

1.2.4 that Beavis and Giblett MPAs be reclassified to MPAs for Conservation of Flora, Fauna, and Landscape;

1.2.5 that Beavis, Giblett, and Strickland MPAs be managed by the Forests Department according to prescriptions suitable to a National Park;

1.2.6 that, at some future time, Beavis, Giblett, and Strickland MPAs be amalgamated with Beedelup National Park.

1.3 **Security of purpose**

Conservation of the karri forest is recognized as a responsibility at all levels — state, national, and international. In view of this responsibility, I recommend:

1.3.1 that security of purpose for all MPAs for Conservation of Fauna, Flora, and Landscape within the main karri belt is ensured by reclassification of these MPAs within a new priority, to be established, of Forest Sanctuary;

1.3.2 that security of purpose for all MPAs for Recreation within the main karri belt is ensured by reclassification of these MPAs within a new priority, to be established, of Forest Park;

1.3.3 that any proposal to utilize a Forest Sanctuary or a Forest Park in a manner which affects its value for its primary purpose should be considered at Cabinet level, and then only after there has been a thorough and rigorous study.

1.4 **Compatibility of management objectives**

Management prescriptions for MPAs have not yet been formulated for general discussion. The relatively small area of many of the National Parks and MPAs for Conservation of Fauna, Flora, and Landscape and for Recreation means:

1.4.1 that it is essential that areas surrounding National Parks and MPAs for Conservation, Fauna, Flora, and Landscape and for Recreation are managed so that diversity is maintained by a broad series of age classes.

Furthermore, the core and buffer concept in management of these MPAs has not been formulated or defined. Again, because of the small areas, I recommend:

1.4.2 that the core and buffer concept within MPAs for Conservation of Fauna, Flora, and Landscape and for Recreation be discarded, and that the entire area of these MPAs be managed for their primary objective — by this recommendation, it will then be necessary to manage the area surrounding the MPA in sympathy with the primary objectives of management for the MPA.

It is essential that management of the greater part of the forest is vested in a single authority. In my view, the Forests Department is outstanding among the forest services in Australia, and is best suited, both in skills and experience, to manage the karri forest. However, I conclude:

1.4.3 that the Forests Department should employ more professionals in disciplines appropriate to this wider view of management;

1.4.4 that greater effort is required to identify those recreational and other values which people seek from the forest, and to organize management so that these values may be readily obtained.

Some forestry practices which have been the subject of controversy are reviewed. In general, karri appears to be a versatile species and, from my view, I would judge:

1.4.5 that management practices generally are based on a great deal of experience, and that there are no evident indications in the karri forest that past management practices have caused a deterioration in the diversity of fauna and flora, or a deterioration in productivity of the ecosystem;

1.4.6 that research and quantification continue, particularly in relation to the effects of clear-felling and of prescribed burning on productivity, diversity, and water quality, and that management continues to be developed on the basis of research and quantification;

1.4.7 that the Forests Department should be supported in enforcing the strictest safeguards and controls so that the forests in MPAs for Wood Production are regenerated with minimum damage to the environment.

Some doubts exist as to the meaning of "flexibility" in the management of MPAs for Conservation of Fauna, Flora, and Landscape and for Recreation. Management prescriptions should make it clear:

1.4.8 that MPAs for Conservation of Fauna, Flora, and Landscape and for Recreation will not be logged in the foreseeable future.

Finally, I recommend:

1.4.9 that experiments with the planting of exotics in the karri forest be restricted to arboreta, and that existing plantations of exotics which have failed should be destroyed.

2 **The Shannon River Drainage Basin**

EPA recommendations for the Shannon River Drainage Basin included reservation of an area containing some fine karri forest in the north, rehabilitation of fire-damaged forest in the central region with a view to reservation at some time in the future, and reservation of an area containing island karri and flat lands to the south. This latter area was planned to form, together with the proposed South Coast National Park (the proposal being endorsed by Cabinet in 1976) a large, contiguous area of very great value to conservation, recreation, and tourism. The securing of the whole South Coast National Park is therefore vital to EPA recommendations and to the subsequent plan for conservation of the karri forest put forward by the Forests Department. In my view, EPA recommendations are soundly based, and I therefore recommend, in agreement with EPA:

2.1 that the areas within the Shannon River Drainage Basin recommended as choices for reservation by EPA and now listed as MPAs for Conservation of Fauna, Flora, and Landscape should become (as should all Conservation MPAs in the main karri belt) Forest Sanctuaries;

2.2 that rehabilitation, by normal harvesting procedures and regeneration techniques applicable to MPAs for Wood Production, of the fire-damaged forests of the central part of the Shannon should proceed;

2.3 that, the fire-damaged forests of the central Shannon having been rehabilitated, the suitability of the central Shannon for reservation should be reviewed at some time (perhaps one or two decades) in the future;

2.4 that recommendations of EPA in respect of the South Coast National Park should be fully implemented.

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Appendix B

SUMMARY OF PUBLIC COMMENTS RECEIVED BY THE EPA ON *CONSERVATION OF THE KARRI FOREST*

The Forests Department's report *Conservation of the Karri Forest* was released initially for a two month public review period but which was extended by a further month to close on 2 April, 1982. During this time a total of 505 public comments were received. These have been divided into four broad categories:

	BROAD CATEGORY	NO. RECEIVED
A	Duplicated letters of support for the conservationists' joint submission *Karri at the Crossroads* and for reservation of the Shannon Basin as a National Park.	302
B	Individual letters mainly of support for the conservationists' joint submission and for reservation of the Shannon Basin as a National Park.	179
C	Comprehensive submissions mainly supporting the principles of increased and more secure reservation of Karri forest.	20
D	Submissions supporting the Forests Department's strategy contained in *Conservation of the Karri Forest.*	4
	TOTAL	505

Dr Attiwill had access to all public submissions during his consultancy and his terms of reference included detailed examination of the most comprehensive received: *Karri at the Crossroads* and its associated paper *Redirection of the Karri Forest Economy.* The submission, a joint report by a number of conservation groups, is therefore not discussed in this summary. The EPA acknowledges the voluntary effort required to make such a submission and was impressed with the endeavour made to put forward positive alternatives to strategies with which the groups disagreed.

A Duplicated letters of support for the conservationist's joint submission *Karri at the Crossroads* and for reservation of the Shannon Basin as a National Park.

A number of different forms of duplicated letters were amongst these 302 submissions received. (Unsigned letters were not accepted). The letters all made two or more of the following points:

- supported the conservationist's joint submission *Karri at the Crossroads*
- recommended reservation of the Shannon Basin as 'A' Class Reserve vested in the National Parks Authority for National Park
- concerned for security of purpose of MPAs
- believed that karri forest conservation be placed in national and international perspective
- complained that approval of the Forests Department's General Working Plan No. 87 was granted before public comments were received on *Conservation of the Karri Forest*
- supported the original CTRC (1974) recommendation for the Shannon Basin.

B Individual letters mainly of support for the conservationist's joint submission and for reservation of the Shannon Basin as a National Park.

The 179 individual letters received generally covered the same points in A. (above). However some submissions also raised the following:

- believed that the karri forest had a higher recreational value than that ascribed in *Conservation of the Karri Forest*
- recommended increased funding for the National Parks Authority to manage karri forest vested in it
- expressed concern about the lack of flowering karri for commercial apiarists.

C Comprehensive submissions mainly supporting the principles of increased, and more secure, reservation of karri forest.

The 20 submissions received in this category include *Karri at the Crossroads* and its associated paper *Redirection of the Karri Forest Economy*. Most of the others supported or offered similar arguments to this major submission and many came from professional organisations and community groups. A number also critically analysed *Conservation of the Karri Forest*. The following are additional points raised and not generally covered in *Karri at the Crossroads*:

- the clearfelling of karri as a regeneration technique was questioned because of its effect on nutrient loss through slash burning, soil erosion and on wildlife, particularly invertebrates
- specialist user groups pointed out the need for very large buffers for wildlife recordists and for the need for major river reserves similar to those protected under the United States' Wild and Scenic Rivers Act
- the whole karri forest should be subject to a detailed flora and fauna study because of the present lack of biological data. Also the whole karri forest should be made an MPA for landscape so more emphasis would be placed on landscape assessment for different user groups including monitoring effects of such groups on the landscape
- it was noted that most of the conservation and recreation MPAs were in the Forests Department's strategic fire protection buffers and it was assumed that this would mean burning at 7-8 year intervals
- amongst reasons advocated for reserving the Shannon Basin should be added that it contains rare flora and fauna and it has special advantages for bushwalkers
- a cost benefit analysis should be made of the wood-chipping and sawmilling industries
- the EPA should make recommendations on the basis of appropriateness, not those obtainable politically.

D Submissions broadly supporting the Forests Department's strategy contained in *Conservation of the Karri Forest.*

The 4 submissions supporting the Forests Department's strategy made the following points:

- accepted constraints placed on the timber industry by a gradual reduction in the hardwood cut
- expressed concern at the impact on the timber industry of immediately removing the Shannon Basin from cutting. Emphasized also, that the Shannon Basin is not all virgin forest

- supported multiple-use forestry and reservation of a range of forest eco-types. Noted that access to the karri forest is primarily by roads created by the forest-based industries

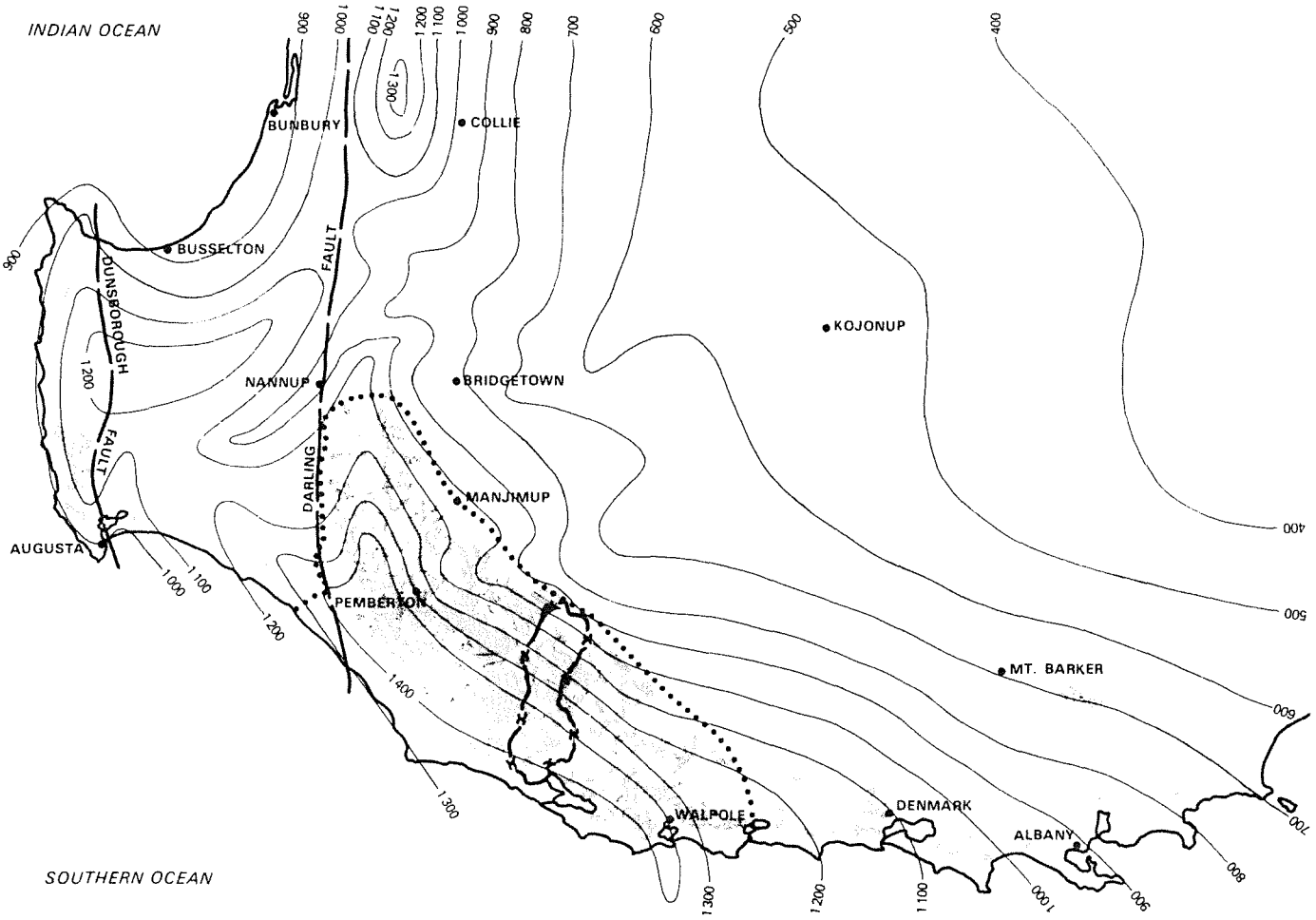
- supported increased security of purpose for conservation and recreation MPAs, and recommended that changes to them be made only in the Parliament

- supported full implementation of the South Coast National Park recommendation of the EPA

- pointed out that all forests need management and for the purposes of achieving management objectives in reserved areas, some logging and regeneration would most likely be required

- emphasized the need to expand tourism to replace jobs lost by reducing the hardwood cut.

Appendix C. General Location Map.



KARRI DISTRIBUTION

LEGEND

MAIN KARRI BELT

KARRI OCCURRENCE

SHANNON WATERSHED

ISOHYET (mm) 400

N

SCALE 1:1 500 000

0 10 20 30 40 50 60 kms

Source: Forests Department (1981) — *Conservation of the Karri Forest*