This Management Plan for Barmah State Park and Barmah State Forest is approved for implementation. Its purpose is to direct all aspects of management in the Park until the Plan is reviewed. A proposed plan for the Park and Forest was published in February 1990. A total of 38 submissions were received. Copies of this Plan can be purchased from:

Information Centre  
Department of Conservation & Environment  
240 Victoria Parade  
EAST MELBOURNE  3002

Benalla Region  
Department of Conservation & Environment  
57 Bridge Street West  
BENALLA  3672

For further information on the Plan, please contact:

Senior Planning Officer  
National Parks and Public Land  
Department of Conservation & Environment  
240 Victoria Parade  
EAST MELBOURNE  3002  
Phone (03) 412 4472

Planning Officer, Conservation and Recreation  
Benalla Region  
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Published in September 1992 by Department of Conservation and Environment, 240 Victoria Parade, East Melbourne 3002 Victoria.

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APPROVED MANAGEMENT PLAN

This approved Barmah Management Plan contains a summary of resources, a review of present and future use, management objectives and detailed aims and actions.

A Proposed Plan was released for public comment in February 1990 and 38 submissions were received. These submissions, and other comments made in meetings and discussions with interested parties, have been carefully considered in preparing this approved Plan.

The approved Management Plan will now become the basis for all aspects of the management of Barmah State Park, and will operate in conjunction with the forthcoming Mid-Murray Forest Management Plan for the management of Barmah State Forest.

Ian Harris  
Director of National Parks and Wildlife

Richard Rawson  
General Manager, Gippsland
1 INTRODUCTION

Barmah Forest covers 29 500 ha of Murray River floodplain about 225 km north of Melbourne (Figure 1). The area is called a forest, but it could equally be termed a wetland, since large parts of the area are frequently flooded. Acting on recommendations from the Land Conservation Council (LCC), the Victorian Government proclaimed 7900 ha of the forest as Barmah State Park in 1987. The Government also accepted recommendations for the declaration of two Reference Areas covering 280 ha. The remaining area is classified as State Forest.

This Management Plan, whilst taking into account these three land-use designations, treats the forest as a single unit. Where 'forest' or 'Barmah Forest' are used in this Plan they should be taken to mean State Park, Reference Areas and State Forest.

Major features of the area are:

- wetlands of international significance
- presence of a number of rare animal and plant species
- important examples of Aboriginal culture and history
- the largest resource of River Red Gum timber in Victoria
- recreational opportunities along the Murray River.

The forest also has considerable value for research, interpretation and education based on these natural resources. Adjoining the forest is the Millewa group of forests in NSW, and together they form the largest River Red Gum (Eucalyptus camaldulensis) forest in the world. The name River Red Gum distinguishes this species from others in the red gum group of eucalypts, but often, as in this Plan, it is simply referred to as River Red Gum.

The Mid-Murray Forest Management Plan, which is currently being prepared, addresses timber production and associated environmental and recreation issues in Barmah and other mid-Murray forests.

1.1 FOREST MANAGEMENT

The LCC (1985) defined the major functions of each land-use category as follows:

**State Park**

- to provide opportunities for recreation and education associated with the enjoyment and understanding of natural environments
- to conserve and protect natural ecosystems
- to act as part of the river regulation and flood mitigation system of the Murray River

**Reference Areas**

- to maintain natural ecosystems as a reference to which those concerned with studying land for particular comparative purposes may be permitted to refer, especially when attempting to solve problems arising from the use of land
- to prohibit activities (such as grazing, exploration for minerals and gold, mining, logging, and beekeeping) that conflict with the purposes of a reference area
State Forest

- to produce hardwood timber
- to conserve native plants and animals, and provide opportunities for the development of wildlife conservation techniques
- to provide opportunities for open-space recreation and education
- to provide for flood mitigation
- to produce honey, forage, sand and other forest produce such as charcoal
- to protect values in identified nature conservation and historic sites by implementation of management prescriptions.

The major challenges confronting management of the forest are:

- to conserve and protect biological, geomorphological and historical features from impacts such as altered water regimes, logging, grazing, introduced plants and animals, and visitor activities
- to provide high quality River Red Gum timber at a sustainable level to a viable timber industry
- to promote and encourage use and enjoyment of the forest without adversely affecting other values
- to protect the forest and its visitors from the threat of wildfire.

1.2 THE MANAGEMENT PLAN

This document is an Approved Plan, which will remain in force until replaced by a revised plan. The need to revise the Plan will be considered in 1996, unless circumstances warrant an earlier review.

The process of developing this Plan included the publication of a Proposed Plan in February 1990 (CFL 1990). Public comment on the Proposed Plan comprised a total of 38 submissions. These submissions have been taken into account in the preparation of this Approved Plan.

The purposes of this Management Plan are:

- to provide broad strategic directions for management of the forest
- to provide a series of detailed management actions to address the problems that will require action in the next five years.

The Plan is derived from a consideration of a range of legislation, Government Strategies, Departmental plans and policies, and of the regional and local settings of the forest, its resources and current conditions.

It is essentially a guide for managers, setting out intentions for the forest and directions to staff responsible for its management. The Plan also informs the public about these management recommendations and actions.
The Plan has fourteen chapters:

- The first two chapters outline the various factors which form the basis of the Plan.

- The remaining chapters set overall management directions and establish detailed aims and actions for management. Specific information is also included to assist in the understanding of particular issues.

More detail on the natural and cultural resources of the forest was provided in Part C of the proposed plan (CFL 1990). Further information is available in the references cited, and from Department of Conservation & Environment offices at Dharnya, Nathalia, Benalla and Melbourne.
2 BACKGROUND

2.1 REGIONAL SETTING

The Barmah Forest and the adjoining Millewa Forest in NSW are located on the Murray floodplain and surrounded by an extensive area of agricultural land.

The economy of the region is agriculturally based, with beef cattle, dairying, cropping, and fruit growing being the major activities. The value of this agricultural production is of national importance, especially with respect to fruit and dairy products based on irrigation (LCC 1983).

River Red Gum (Eucalyptus camaldulensis) timber production has been a significant component of the local economy for over a hundred years. Tourism is of increasing importance to the region, with people being drawn to the peaceful river settings and historical attractions of centres such as Echuca.

Manufacturing, retailing and service industries are located in the major towns of the region, at Shepparton, Échuca, Kyabram and Deniliquin.

2.2 LAND STATUS, BOUNDARIES AND ADJACENT LAND USE

LCC recommendations for the Murray Valley Study Area (LCC 1985) were accepted by the Government in 1986 with minor amendments, but many of the recommendations have not yet been implemented. The boundaries of the various land-use classifications in Barmah Forest are shown in Figure 1.

The Barmah State Park (7 900 ha) recommended by the LCC (LCC 1985) was proclaimed under the National Parks Act 1975 in 1987. The Park has two sections, one incorporating wetlands and forests at Top Island, War Plain and Barmah Lakes, the other covering a drier area of River Red Gum and box forest, including the former Ulupna Island Flora and Fauna Reserve.

The LCC also recommended that timber production and grazing be phased out of the State Park no later than three years after its proclamation. However, Parliament provided for timber harvesting in the Park under Section 25B of the National Parks Act 1975 and grazing according to Section 32E of the National Parks Act 1975.

The Park contains two Reference Areas, Top Island (160 ha) and Top End (120 ha), which are to be proclaimed under the Reference Areas Act 1978 in accordance with LCC Recommendations (LCC 1985).

The LCC recommended that 35 ha of State Forest adjacent to Barmah Lakes become a Recreation Reserve under the Crown Land (Reserves) Act 1978. This Plan recommends that this area of State Forest be zoned for Intensive Recreation and be used as a camping ground.

A sixty metre wide Public Purposes Reserve along the Murray River is reserved under the Crown Land (Reserves) Act 1978. The rest of the forest is reserved as State Forest and administered under the Forests Act 1958.

Morgans Beach, a recreation reserve on public land flanked by State Park, is managed under the Crown Land (Reserves) Act 1978 by a Committee of Management, the Shire of Numurkah. A block of freehold land known as the Yelima Pre-emptive Right is located on the Murray River and surrounded by State Forest. The small areas of public land adjoining the southern boundary of the forest are water frontage or recreation reserves (Figure 1).
In 1980 the High Court of Australia ruled that the northern boundary of Victoria follows the top of the southern (left) bank of the Murray River. The river bed and land between the river and high bank (when the river is less than bank full) are therefore part of NSW and managed by the NSW Department of Lands. A river bend on Ulupna Island, which was formed by a natural alteration of the Murray's course, is also in NSW and managed by the NSW Forestry Commission (Figure 1).

Across the river in NSW are the Millewa group of State Forests. The Thornley State Forest is opposite Ulupna Island. Private land fronts the River in NSW at Picnic Point and for about 4 km downstream of Ulupna Island.

Most of the land adjacent to the southern boundary of the forest is privately owned and has been cleared for agriculture. Planning for these areas is administered under the Planning and Environment Act 1987 by the Shires of Nathalia and Numurkah.

The Shire of Numurkah has an approved Planning Scheme which includes a River Corridor Zone between the Bearii-Mywee Road (Figure 1) and the forest. The minimum subdivision recommended for this zone is 80 ha, with provision for excision of one house lot per block. However this is a guideline only, and the Shire may make exceptions for developments which are in accord with the agricultural or tourist values of the area.

The Shire of Nathalia is preparing a Planning Scheme, and at present operates under a planning policy. Adjacent to the forest the policy defines three rural zones. Most of the forest adjoins Rural 1 Zone, which has a minimum subdivision size of 80 ha, with provision for excision of a 1 to 4 ha house block. In the vicinity of Bearii (Figure 1), there is a Rural Living Zone with a 4 ha minimum subdivision, and in the vicinity of Barmah township a Rural 2 Zone which has a 40 ha minimum subdivision.

2.3 MANAGEMENT AUTHORITY

The forest is managed by the Benalla Region of the Department of Conservation & Environment (DCE), with the State Park managed under delegation from the Director of National Parks and Public Land (NPPL). The Benalla Region, of 12 000 square kilometres, includes 1730 square kilometres (15 per cent) of public land. Major public land blocks in the Region are Barmah Forest, Strathbogie Ranges, Mt Samaria, Toombullups, and frontages along the Murray and Goulburn Rivers.

The Barmah Advisory Committee was established in 1988 under Section 14 of the National Parks Act to advise the Minister for Conservation & Environment, Director of National Parks and Wildlife (NPW) (and the Department on any matters relating to the management of Barmah State Park and Barmah State Forest. Other advisory committees which provide input into management of the forest are discussed in Section 13.3.

The Dharnya Committee of Management was established in 1991 under Section 50(3)(a) of the Forests Act 1958 (Chapter 10).

2.4 INTERNATIONAL AGREEMENTS, LEGISLATION, GOVERNMENT STRATEGIES AND POLICY

A broad range of agreements, legislation, Government strategies and DCE policies and plans control or influence management.

International agreements

Barmah Forest has been declared a wetland of international significance under the Ramsar convention (UNESCO 1971), to which Australia is a signatory. The convention provides for conservation of wetlands, establishment of wetland reserves, and international cooperation on wetland issues, especially with respect to waterfowl.
The Japan-Australia Migratory Birds Agreement (JAMBA 1974) recognises that certain species of bird migrate between Australia and Japan and that some of these are endangered in one or other country. Part of the agreement is that the two countries will conserve habitats of these species. A similar agreement (CAMBA 1986) has been negotiated with China. Victoria has given undertakings to the Australian Government that it will conserve habitats of bird species listed in the agreements.

Birds recorded for Barmah Forest which are covered by one or other of the agreements are Cattle Egret (Ardeola ibis), Great Egret (Egretta alba), Red-necked Stint (Calidris ruficollis), Greenshank (Tringa nebularia), Sharp-tailed Sandpiper (Calidris acuminata), White-throated Needletail (Hirundapus caudacutus), Fork-tailed Swift (Apus pacificus), Latham’s Snipe (Gallinago hardwickii), Glossy Ibis (Plegadis felcinellus), White-bellied Sea-eagle (Haliaeetus leucogaster), Rainbow Bee-eater (Merops ornatus) and Caspian Tern (Hydroprogne caspia). Specific management actions are outlined for some of these species in Section 5.3, and the remainder will be adequately protected by the management guidelines in Chapters 3, 4, 5 and 8.

Legislation


The National Parks Act 1975 establishes how National, State and other Parks are created and managed. Under the provisions of Section 17 of the Act, the Director of NPW must:

- ensure that each National Park and State Park is controlled and managed in a manner that will:
  - preserve and protect the Park in its natural condition for the use, enjoyment and education of the public
  - preserve and protect indigenous flora and fauna in the Park
  - exterminate or control exotic fauna in the Park
  - eradicate or control exotic flora in the Park
  - preserve and protect wilderness areas in the Park and features in the Park of scenic, archaeological, ecological, geological, historic or other scientific interest

- ensure that appropriate and sufficient measures are taken to protect each National Park and State Park from injury by fire

- promote and encourage the use and enjoyment of National Parks and State Parks by the public and the understanding and recognition of the purpose and significance of National Parks and State Parks

- prepare a plan of management in respect of each National Park and State Park.

Barmah State Park is proclaimed under Schedule Two B Part 3 of the Act, which also provides for timber and minor forest produce to be harvested from the Park according to Section 25B of the Act. Section 32E of the Act allows the Minister for Conservation & Environment to grant a licence to graze cattle in the Park, except for Reference Areas and Ulupna Island, to persons recommended by the Barmah Forest Grazing Advisory Committee. Section 32F defines the composition of the Barmah Forest Grazing Advisory Committee, and establishes its function as giving advice to the Minister on any matters relating to grazing. Sections 32G and 37 provide for hunting of feral animals in the Park by persons authorised by the Director of NPW.

The Reference Areas Act 1978 provides for reference areas to be proclaimed by the Governor-in-Council, and establishes a committee to advise as to how reference areas should be protected controlled and managed so as to preserve areas in perpetuity as a reference against which persons concerned with the study of land may be permitted to refer for comparative purposes particularly when solutions to problems that arise from the use of land by people are being sought.
The Forests Act 1958 outlines the responsibilities and powers of the Director-General of DCE with respect to management, protection and utilisation of State Forest and other public land. The Act provides for:

- the taking, processing and sale of any timber or other forest produce from State Forest
- the preparation and implementation of working plans with respect to the control, maintenance, improvement, protection and utilisation of State Forest
- the provision of facilities for public recreation and for the protection of native flora and fauna in State Forest
- fire prevention and protection on public land.

The Flora and Fauna Guarantee Act 1988 has been enacted to conserve Victoria's native flora and fauna by protecting important habitat areas and controlling processes which may pose a threat to native species and communities. The aim of the Act is to ensure that all Victoria's native plants and animals can survive, flourish and maintain their potential for evolutionary development in the wild. DCE must manage areas for which it is responsible in a way which is compatible with these objectives.

Other Acts and Regulations of relevance are:

Aboriginal Lands Act 1970
Archaeological and Aboriginal Relics Act 1972
Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984
Conservation, Forests and Lands Act 1987
Crown Land (Reserves) Act 1978
Emergency Management Act 1986
Environment Protection Act 1970
Fire Authorities Act 1984
Fisheries Act 1968
Forests Regulations 1978 & amendments
Land Act 1958
Land Conservation Act 1970
Land Conservation (Vehicle Control) Act and Regulations 1972
Marine Act 1988
Park Regulations 1992
River Murray Waters Act 1982
River Improvement Act 1958
Vermin and Noxious Weeds Act 1958
Water Act 1989

**Major Government strategies**

The Victorian Government has developed three major strategies - the Conservation Strategy, the Economic Strategy and the Social Justice Strategy - to help achieve the interrelated major goals of environmental conservation, economic development and social justice. Directly, and through a number of subsidiary strategies, they form an important policy basis for forest management.

**Conservation Strategy**

The strategy (Government of Victoria 1987a) sets out several priority programs, three of which, 'Flora and Fauna', 'Reviving Rivers, Coasts and Wetlands' and 'Protecting the Forests', are particularly relevant to Barmah Forest.
The objectives for conserving flora and fauna are:

- ensure that all Victorian native species can survive, flourish and retain their potential for evolutionary development
- protect representative and ecologically viable samples of all Victoria's natural ecological systems
- preserve genetic variability within Victorian plant and animal species
- preserve remaining areas of high wilderness quality
- protect areas of special value for natural heritage, flora and fauna habitat, or for maintenance of ecological process.

Barmah Forest, and in particular the State Park, contribute to four of the above objectives (the wilderness objective is not applicable because there are no areas of high wilderness quality in the forest). The means by which the specific objectives are achieved forms the basis for the detailed prescriptions outlined in Chapters 5 to 14 of this Plan.

The Government's objectives for protecting forests are:

- ensure that the use of forests is sustainable for the full range of products and benefits that forests provide
- protect the ecological condition of native forests
- ensure native forest management and timber harvesting operations are consistent with forest protection
- minimise the permanent removal of native forest and increase the current net area of public native forest
- encourage reforestation.

The Conservation Strategy, in considering the importance of wetlands, states that no further reduction in area of lakes, marshes and other valuable wetlands will be allowed, unless there is a compelling public interest.

The Wetlands Conservation Program For Victoria (Government of Victoria 1988) outlines a more detailed course of action for conserving the wetlands of Victoria. Major objectives of the Program for wetlands on public land are:

- to manage wetlands for long-term, sustainable public benefit, consistent with essential conservation requirements
- to protect and maintain and the complete range of wetland types present at the time of European settlement
- to manage wetlands to fulfil local, State, national and international obligations regarding conservation and management of plants and animals, as set out in legislation, Government policy statements, interstate and State-Commonwealth agreements and international treaties
- to encourage and facilitate the public appreciation of the many values of wetlands through education, scientific investigation and other means.

The Program also outlines a process for:

- identification of high value wetlands
- preparation of interim funding strategies for these wetlands
- establishing the costs associated with implementation of the Program
identification of priority wetlands for implementation of the program, including preparation of management plans.

Until these processes are established, the program outlines interim criteria for identifying high value wetlands. Barmah forest satisfies several of these criteria, including being:

- covered by an international treaty
- recognised as having State significance by the Victorian Government
- of special value for maintaining the genetic and ecological diversity of a region, because of the quality and particular characteristics of its flora and fauna
- a particularly good example of a specific type of wetland characteristic of its region.

The program states that 'natural wetlands of high value will be protected from further damage and degradation'. A study being funded by the Murray Darling Basin Commission will provide information vital to determining the most appropriate methods of achieving the aims of the program. The results of this study will be incorporated into a supplement to this Management Plan (Section 5.1).

Social Justice Strategy

This strategy (Government of Victoria 1987b) has as its objectives, to provide:

- fair access to goods and services
- opportunities for participation
- protection of people's rights.

The strategy is relevant to many aspects of forest management. Provision of equitable access to experiences and facilities can be achieved through, for example, design for disabled access. Publicity, information and education services can be designed and made available to a wide range of groups and individuals.

Economic Strategy

First released in 1984 and republished in April 1987 as the document 'Victoria: The Next Decade' (Government of Victoria 1987c), this Strategy has as its main objective 'to ensure prosperity and a high standard of living for all sections of the community'. It pays specific attention to:

- allocation of resources to areas of competitive strength
- provision of regionally balanced outcomes
- concentration on activities that provide support to the balance of trade.

The Economic Strategy also notes the contribution of the Dharnya Centre to regional tourism.

Timber Industry Strategy

The strategy (Government of Victoria 1986) was developed with extensive public participation following the Timber Industry Inquiry. It undertakes to balance environmental values, social and economic needs of the community, and the capacity of forests to provide for sustainable levels of all forest values, timber and non-timber.

Under the strategy, the timber industry and forest management will:

- be economically viable with respect to the provision of wood and other market goods
- be environmentally sensitive with respect to the provision of non market goods and services
- be sustainable with respect to the interest of future generations
- be assisted by public participation in the planning process.

The Mid-Murray Forest Management Plan (Chapter 1) and other Forest Management Plans are being produced to facilitate implementation of the Timber Industry Strategy.
Tourism Strategy

This strategy (Government of Victoria 1984) was released by the Government in 1984 as part of the State Economic Strategy. Its main objectives are:

- identify Victoria's competitive advantages
- enhance attractions
- promote more intensive use of assets
- identify opportunities for complementary tourism development.

Much of the State's outdoor recreation and tourism is based on the natural environment. The long-term viability of the tourist industry is therefore contingent on conservation and maintenance of areas such as the Barmah Forest.

Tourism is one of the broad industry sectors offering significant economic development and growth potential. A major Government marketing campaign has been initiated for the Murray River area.

Policies and plans

This Plan is prepared in accordance with DCE policies for the management of Parks, and with other policies prepared by the Department for all public lands. It is part of a hierarchy of plans including the DCE Corporate Plan, the DCE Benalla Regional Profile, and Area Plans prepared by the Department to assist in implementing legislation, Government strategies and policies.

Other plans and policies which will operate in conjunction with the Barmah Management Plan are the Mid-Murray Forest Management Plan and the Benalla Region Fire Protection Plan.

2.5 SIGNIFICANCE OF THE FOREST

This section briefly outlines the major features of the forest. More detail on these features is provided in Chapters 5 to 10 and in Part C of the proposed plan (CFL 1990).

Water and wetlands

The forest features a variety of permanent and temporary wetlands, including lakes, swamps, lagoons and flooded forest. These wetlands provide habitat for a large number of bird species. They are of particular importance as a breeding area for many common birds such as egrets, ibis and herons. Significant species such as Freckled Duck (Stictonetta naevosa) and Latham's Snipe (Gallinago hardwickii) are occasional visitors to the forest.

The extent and timing of flooding in the forest has been dramatically altered since large-scale regulation of the Murray River commenced in the 1930s. Altered water regimes have had a significant impact on the forest and the viability of its wetlands.

Flora

Barmah forest features River Red Gum, Grey Box (Eucalyptus microcarpa), Yellow Box (Eucalyptus melliodora) and Black Box (Eucalyptus largiflorens) woodlands, grasslands and various wetland vegetation. Over 550 plant species have been recorded for the forest. Because of their rarity or limited distribution, 27 of these plants have statewide significance. The box forests support the highest diversity of understorey species.
**Fauna**

Forests and wetlands in Barmah are important habitat for many animal species, including 31 mammals, 219 birds, 16 reptiles and 8 amphibians. Significant animals which require special management include the Squirrel Glider (*Petaurus norfolcensis*), Tuan (*Phascogale tapoatafa*), Superb Parrot (*Polytelis swainsonii*), Grey-crowned Babbler (*Pomatostomus temporalis*) and Carpet Python (*Python spilota variegata*). A number of significant fish species are also present in waterways in and around the forest.

**Landscape**

Open, park-like forests of a character uncommon in Victoria, grassy plains, lagoons, lakes and the Murray River are the main scenic features of the area. The most significant landscapes are located along the Sand Ridge, Gulf and River Roads, and the Murray River.

**Cultural heritage**

The forest has a wealth of historical associations with both the Aboriginal and European cultures. The Yorta Yorta Aboriginals have a long and continuing association with the Barmah area, and hundreds of archaeological sites occur throughout the forest. European heritage includes not only old sawmill sites and other features associated with the early timber and grazing industries, but also the forest itself, whose structure is a consequence of these activities.

**Commercial uses**

About 2.5 million cubic metres of River Red Gum timber has been harvested from the forest since the 1860s (FCV undated). The range of products includes sawlogs, sleepers, piles, poles, posts, firewood and charcoal. Grasslands in the forest have been grazed since the 1840s. Honey is produced from River Red Gum and box trees.

**Recreation**

The forest receives about 100 000 visitor days per year. Most are campers and day visitors who are attracted by the river and its associated recreational opportunities. Camping, fishing, boating, swimming, hunting and pleasure driving are some of the more popular activities.
3 MANAGEMENT OBJECTIVES

The following management objectives provide a broad framework for management of Barmah Forest.

Management will:

1. protect and conserve natural ecosystems and the natural environment, whilst recognising that such systems are dynamic, that irreversible alterations may have occurred, and that modified systems may have become or are in the process of becoming established

2. conserve and where possible rehabilitate wetlands

3. maintain the existing diversity of native plant and animal species

4. give special protection to significant flora and fauna

5. protect the health and viability of River Red Gum forest

6. allow controlled, sustainable forest utilisation for products such as timber, grazing and honey, where consistent with other objectives

7. develop existing opportunities and provide additional opportunities for visitors to participate in recreational activities, where consistent with other objectives

8. protect sites and areas of Aboriginal and European cultural significance

9. protect landscape values

10. control and where possible eradicate introduced plants and animals

11. provide for flood mitigation

12. protect the forest, life and property from fire

13. take adequate precautions for the safety of visitors

14. provide appropriate opportunities for scientific research, especially that which will provide information of value for future management

15. promote public awareness, appreciation and understanding of the natural and cultural environment through appropriate interpretative and education programs

16. facilitate the involvement of the Yorta Yorta Aboriginals, local and state-wide interest groups and the general public in the management of the forest

17. minimise the impact of surrounding land and water uses on the forest.
Chapters 5 to 13 set out in detail the issues involved in managing the forest, and define specific management aims for each topic. Management actions to achieve these aims are presented, together with a statement of their relative priority:

<table>
<thead>
<tr>
<th>Priority</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Urgent and important issue, on which action is required as soon as possible.</td>
</tr>
<tr>
<td>Medium</td>
<td>Issue of moderate importance and/or urgency, proposed for action generally after high priority tasks have been completed.</td>
</tr>
<tr>
<td>Low</td>
<td>Less urgent actions, which may none the less be of considerable importance in the longer term.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>An action that requires the continuing attention of Departmental staff.</td>
</tr>
<tr>
<td>As needed</td>
<td>An action or issue to be addressed when the relevant situation arises.</td>
</tr>
</tbody>
</table>
4 ZONING

Zoning is a tool to assist achievement of the management objectives outlined in Chapter 3.

Zoning indicates which management objectives are appropriate and which have priority in each part of the forest. It identifies the places where conservation is a critical requirement, and establishes broadly the intensity and types of use that are appropriate for different parts of the forest. Its purpose is to pre-empt conflicts between uses, and to provide a basis for assessing the suitability of management proposals.

Zones are derived by overlaying maps of:

- natural, conservation and landscape values
- timber resources
- capability and suitability to provide and withstand various uses
- recreational opportunities
- Government decisions relating to land use.

In this way, areas of conservation significance, recreational potential, and land use conflict are highlighted.

Five zones have been defined for the forest. Zone characteristics are shown in Table 1, and the zones are mapped in Figure 2. The contributions of the zones towards achieving management objectives are listed in Table 2.

The scale of Figure 2 means that the boundaries of Zones 1 and 2 adjacent to tracks are only approximately indicated. Zone 1 extends 60 m either side of the Gulf Track, with wider sections where the track passes through or near box forest at Grinders Ridge, Cherry Tree and Hammys Plain, and 60 m west of the forest boundary along Moira Lakes Road. Zone 2 extends 60 m south of the River Road between the eastern and western sections of the State Park, and 20 m east of the River Track on Barmah Island.

In Zone 1 (Conservation & Limited Utilisation Zone), priority will be given to conservation of native flora, fauna and natural ecosystems, in the context of the legislative provision that logging and grazing continue. Areas within Zone 1 which are excluded from logging and grazing are shown in Figure 6. Recreation of differing intensities is primarily catered for in Zones 2 (Conservation & Recreation) and 3 (Intensive Recreation). Zone 4 (Multiple Use Zone) has timber production as a primary use. Zone 5 (Reference Zone) is discussed in Section 5.5.

Not all small sites with important features (e.g. Aboriginal sites, wetlands, and sites of rare plant or animal species) are contained in Zones 1 or 2, as this would produce a multitude of tiny zones. Where these features occur in the Multiple Use Zone, adequate protection is provided by prescriptions, as specified in Chapters 5, 6 and 8. The relationship between recreation activities and zones is given in Table 9.
### TABLE 1 MANAGEMENT ZONES

<table>
<thead>
<tr>
<th>Zone 1 - Conservation &amp; Limited Utilisation</th>
<th>Zone 2 - Conservation &amp; Recreation</th>
<th>Zone 3 - Intensive Recreation</th>
<th>Zone 4 - Multiple Use</th>
<th>Zone 5 - Reference</th>
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</thead>
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<td><strong>Conservation Management</strong></td>
<td>Management will balance...</td>
<td>Significant natural values...</td>
<td>Utilisation will take...</td>
<td>Natural processes...</td>
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<td>are not located in this zone</td>
<td>into account...</td>
<td>to continue...</td>
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<td>cultural values with recreation</td>
<td></td>
<td>significant natural and cultural values, and sites protected where necessary</td>
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<td>wetlands, box forest, significant flora...</td>
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<tr>
<td>and fauna, Aboriginal sites</td>
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<tr>
<td><strong>Recreation Management</strong></td>
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<td>Modified settings, where...</td>
<td>Management will balance...</td>
<td>No access, except to...</td>
</tr>
<tr>
<td>Natural settings will be maintained,...</td>
<td>but may have modifications...</td>
<td>facilities may be complex and</td>
<td>utilisation, conservation and recreation</td>
<td>authorised officers and researchers</td>
</tr>
<tr>
<td>facilities minimal or absent</td>
<td>designated camping areas and...</td>
<td>cater for large numbers of...</td>
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<tr>
<td></td>
<td>picnic facilities</td>
<td>people</td>
<td></td>
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<tr>
<td><strong>Utilisation Management</strong></td>
<td>Logging to be managed under...</td>
<td>Logging, grazing and apiculture not appropriate</td>
<td>Primary management objective to provide sustainable yield of wood products, grazing and apiculture permitted</td>
<td>No utilisation</td>
</tr>
<tr>
<td>Logging not permitted, grazing</td>
<td>special prescriptions, grazing...</td>
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<tr>
<td>permitted (except on Ulupna Is.)</td>
<td>and apiculture to continue, with bee and camping sites placed so as to minimise conflict</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pending ecological research, apiculture permitted</td>
<td>Logging not permitted, grazing and apiculture to continue, with bee and camping sites placed so as to minimise conflict</td>
<td>Primary management objective to provide sustainable yield of wood products, grazing and apiculture permitted</td>
<td>No utilisation</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 2 CONTRIBUTION MADE BY ZONES TOWARDS ACHIEVING MANAGEMENT OBJECTIVES

<table>
<thead>
<tr>
<th>Management objectives</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
<th>Zone 4</th>
<th>Zone 5</th>
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</thead>
<tbody>
<tr>
<td>to protect and conserve the natural environment</td>
<td>***</td>
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<tr>
<td>to protect or rehabilitate wetlands</td>
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<tr>
<td>to maintain diversity of native flora and fauna</td>
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<tr>
<td>to protect rare and unusual features</td>
<td>***</td>
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<tr>
<td>to protect the health of River Red Gum forests</td>
<td>***</td>
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<td>*</td>
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</tr>
<tr>
<td>to allow utilisation for forest products</td>
<td>**</td>
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<tr>
<td>to provide a range of recreation opportunities</td>
<td>**</td>
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<tr>
<td>to protect sites of cultural significance</td>
<td>***</td>
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<tr>
<td>to protect landscape values</td>
<td>***</td>
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<tr>
<td>to control introduced plants and animals</td>
<td>***</td>
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<tr>
<td>to provide for flood mitigation</td>
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<tr>
<td>to protect the forest, life and property from fire</td>
<td>***</td>
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<tr>
<td>to take precautions for visitor safety</td>
<td>***</td>
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<tr>
<td>to provide opportunities for research</td>
<td>***</td>
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<tr>
<td>to promote understanding of the forest</td>
<td>***</td>
<td>***</td>
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<td>**</td>
</tr>
</tbody>
</table>

- *** Zone as far as possible maximises achievement of objective
- ** Zone partially achieves objective
- * Zone makes minimal or no contribution to achieving objective

Zone 1 Conservation & Limited Utilisation
Zone 2 Conservation & Recreation
Zone 3 Intensive Recreation
Zone 4 Multiple Use
Zone 5 Reference
5 MANAGEMENT OF NATURAL RESOURCES

This Chapter sets out aims and actions for those aspects of forest management relating to the protection and conservation of the natural environment. Particular emphasis is placed on water regimes, the protection and management of wetlands, and significant plant and animal species.

The basic objectives of managing flora and fauna are to preserve the viability of ecosystems and maintain all native species. On a broad scale, the forest will be managed for species richness and structural diversity, and where appropriate take into account particular significant species. Management for species richness is achieved by maintaining a broad range of habitat conditions. Characteristic ages of each plant community will as far as possible be adequately represented, and information on habitat needs of each animal incorporated into management prescriptions or guidelines.

5.1 WATER

5.1.1 Surface water and wetlands

A variety of wetlands - lakes, billabongs, effluents, rushlands, flooded grasslands, flooded River Red Gum forest - are present in the forest. These wetland types are described in Section 15.4 of DCE (1990).

Natural waterways in the forest are all anabranches of the Murray River. A section of the river known as the Barmah Choke (Figure 1) has a relatively low capacity, and water flowing down the main channel of the Murray is often diverted via a series of effluent creeks into the forest and wetlands. Under a natural water regime the forest would usually flood in winter and spring and dry out during summer and autumn.

Several impoundments and diversions upstream have changed the amount and timing of water flowing in the Murray, and hence into the forest. Water from heavy winter and spring flows is stored in Hume and Dartmouth Dams and released during spring, summer and autumn for use in irrigation and water supply.

The forest is therefore receiving less water in winter and spring. The most severe reduction in flood frequency has occurred for small to mid-range floods. The incidence of major floods has not been markedly altered, because of the limited capacity of dams upstream.

Under natural conditions, 70 per cent of the forest would be flooded for an average of 2.9 months in 78 per cent of years. Since regulation, this level of flooding is only experienced for an average of 1.3 months in 37 per cent of years (Leitch 1989, Bren 1988). These changes are having major impacts on the various wetland types and the animals dependent on them (Section 15.4 of CFL 1990).

Large-scale measures to counteract the impacts of altered water regimes are currently being investigated by consultants funded by the Murray Darling Basin Commission. The Commission have also provided funds to DCE for monitoring water quality and depth, wetland productivity, wetland flora and fauna, and native fish populations. DCE is also developing an integrated strategy for watering of wetlands along the Murray River.

Barmah Forest satisfies the interim criteria for a high value wetland as defined by the Wetlands Conservation Program (Section 2.4). The Program recommends that:

- water be provided to high value wetlands in the volume, quality and seasonal patterns that approximate natural conditions or that maintain or enhance existing conservation values and that no further reduction in the area of lakes, marshes and other valuable wetlands will be allowed unless there is a compelling public interest
wetlands receive a high priority when decisions are made on the distribution of surplus water. The allocation of such water will not be deducted from environmental allocations. Sources of water which may be available to alleviate the adverse effects of altered water regimes are:

- provision of small volumes of water by Murray Darling Basin Commission for environmental purposes
- 195 000 ML of Victoria’s share of Dartmouth’s capacity which is unallocated
- 25 000 ML of Dartmouth’s capacity which has been allocated annually to environmental uses in Victoria
- surplus water is available for diversion from the Murray River into the forest when there are no other demands to be met - this may occur when Lake Victoria is full or assured of filling, if the flow in the river exceeds channel capacity or if irrigation releases are not required because of rain.

To minimise loss of irrigation water and prevent water entering the forest during summer (causing tree deaths, vegetation changes and hampering logging, grazing, fire suppression and recreation activities), regulators have been constructed on the major effluents (Figure 1). The regulators are operated by DCE under direction from the Murray Darling Basin Commission.

Irrigation water diverted from the river upstream of the forest and subsequently not used also flows into the forest via three artificial channels. One drain carrying run-off from adjacent farmland passes through the forest and outfalls into the Murray River. Results from a water quality monitoring program being undertaken by the Rural Water Commission are given in Section 15.4 of CFL 1990.

As part of the Draft Shepparton Land and Water Salinity Management Plan (SPPAC 1989), consideration is being given to discharging additional water from the Murray Valley Irrigation District of the Shepparton Irrigation Region into or through the forest. The Salinity Management Plan includes:

- investigating whether drainage flows can be diverted around Barmah Forest
- monitoring of water quality in existing drains
- investigating the likely impacts of disposing of drainage water into the floodplain and wetland communities of Barmah Forest
- investigating the likely impacts of rising water tables under Barmah Forest.

A new body, the Salinity Program Advisory Council, which comprises representatives from DCE and other relevant organisations, is responsible for implementation of the plan. The Rural Water Commission is currently assessing proposals for small-scale community drainage schemes which would drain additional water into or through the forest. Drainage water could degrade the forest and associated wetlands by:

- introducing additional nutrients which will lead to short term eutrophication and long-term vegetation changes
- introducing pesticides and herbicides which will interrupt natural ecological processes and result in long-term changes of species diversity and composition
- possible saline water effects
- causing summer or autumn flooding which would lead to gross vegetation changes, including tree deaths.

The Wetland Conservation Program requires that high value wetlands:

- will not be adversely affected in the planning and execution of drainage works unless such works are in the public interest
- will be protected from damage and degradation due to activities such as irrigation supply, filling, dredging, river management, major recreational and industrial developments, extractive industry and the construction of roads, power lines and other utilities.
Management of natural resources
Other recommendations in the Program concerning access, grazing and boating are dealt with in Sections 7, 8.2 and 9.2.4 respectively.

A number of wetlands in the forest, in particular Top Island and Barmah Lakes, appear to be silting up very rapidly (Leitch 1989). This means higher rivers are necessary to effectively flood these areas. Although siltation is a natural process, the rate of sediment build up seems to have accelerated over recent years. This may be partly a consequence of natural changes in hydrological patterns, as described in Section 15.4 of DCE (1990).

At many locations along the river, erosion of the bank appears to be occurring at an unnaturally rapid rate. Recent studies based on bed and bank surveys carried out in 1876, 1930 and 1976 suggest that the river is in general becoming broader and shallower (Loder and Bayley 1988). Whether this process has been caused by changes in the flow regime or other agencies of human origin is unknown. Increased erosion may be caused by the continually high river levels necessary to satisfy irrigation demands. Boat wash may also be a contributing factor. Research on bank erosion is currently being undertaken by the Murray Darling Freshwater Research Centre (MDFRC 1989).

Aims and actions

To as far as possible recreate the pre-regulation water regimes indicated in Table 14 of DCE (1990)

To as far as possible maintain the current area of each type of wetland (Section 15.4 of CFL 1990)

To provide sufficient water to ensure the breeding success of colonial water birds, consistent with the protection of other forest values

To alleviate the adverse effects of altered water regimes on wetlands, timber and conservation values

To monitor wetlands and the effects of applied water regimes

To as far as possible maintain flood protection for neighbouring private property and areas downstream of the forest

To minimise unnatural river bank erosion and wetland siltation

To ensure disposal of drainage water into the forest does not adversely affect vegetation, wildlife, timber production or recreation values

High Liaise with the Salinity Program Advisory Council and Rural Water Commission to ensure that any proposals to drain additional water into or through the forest:

- involve a comprehensive environmental assessment
- are consistent with the Wetlands Conservation Program
- do not result in discharge of salt, nutrients, herbicides or pesticides at levels which may have an adverse effect on the forest
- do not result in unseasonal flooding of the forest
- do not involve earthworks or alteration to natural drainage patterns unless these works aid watering of the forest with appropriate timing, location and volumes of water and would not have an adverse effect on recreation, landscape or other forest values.
High Liaise with the Murray Darling Basin Commission to refine the operation of regulators by using computer models to predict the extent of natural flooding in open wetlands and redgum swamps that would have resulted from weather conditions actually experienced each month. Use these figures as a basis for setting regulators in the above action.

High Construct a small regulatory structure at Goose Neck (Figure 1) to enable control of water flowing into and out of Goose Swamp. Operate the regulator to as far as possible recreate natural water regimes in Goose Swamp, taking particular account of the Variable Spike-sedge (*Eleocharis minuta*) (Section 5.2) and quality of water in Broken Creek.

Note: During periods of high flow, water in Broken Creek is relatively clean. However the initial flush after rain does contain high concentrations of impurities, and allowing water from the Creek into Goose Swamp at these times should be avoided (Robinson pers. comm.).

High Improve flow from the river into effluents and wetlands:

- desilt and desnag Island and Sapling Creeks (Figure 6) to improve water flow into Top Island
- remove willows along War Creek and Cutting Creek to improve water flow onto grasslands at War Plain (Figure 6)
- ensure effluent channels are maintained in such a condition as to allow natural discharge rates by removing unnatural blockages such as willows and logging debris.

Note: Snags in waterways are important habitat for many aquatic organisms and fish. Removal of snags will be the minimum required to improve water flow into significant wetland areas.

High Record, using aerial photography, the current location and extent of each major wetland type and species, including:

- Giant Rush (*Juncus ingens*)
- Common Reed (*Phragmites australis*)
- Cumbungi (*Typha orientalis*)
- Moira Grass (*Psuedoraphis spinescens*)
- as extensive grassland
- as small areas between Giant Rush
- River Red Gum (*Eucalyptus camaldulensis*) regeneration on areas of former Moira Grass plain
- River Red Gum incursions into areas of Giant Rush/Moira Grass

with priority given to the key wetlands at Top Island, Boals Deadwoods, Reedy Lakes and War Plain.

Repeat the aerial survey every three years to enable changes in the distribution of these species and communities to be monitored.

High Establish procedures for monitoring, reporting and recording:

- water quality and depth in key wetland areas
- changes in distribution of the species and communities indicated in the previous action
- types, numbers and breeding success of water birds.
Using funds provided by the Murray Darling Basin Commission, monitor water quality and depth, wetland productivity, wetland flora and fauna, and fish populations. Coordinate this monitoring with other monitoring and research proposed in this Plan.

Assist the consultants funded by the Murray Darling Basin Commission to determine the most appropriate method(s) of recreating the water regimes indicated in Table 14 of DCE (1990), especially for Moira Grass and River Red Gum SQI. The work will include:

- a review of current operating procedures for regulators with a view to increasing the volume of surplus flows entering the forest during winter and spring
- an investigation of the opportunities for using 195,000 ML of unallocated water from Dartmouth Dam
- assessing the feasibility and desirability of constructing the following regulators, artificial impoundments and channels to more efficiently use available water or additional releases:
  - a weir on the Murray River to increase the duration of forest flooding
  - additional regulators in the eastern end of the forest to allow extra watering of River Red Gum forest and control of flows along the Smiths Creek system
  - diversion channels, banks and regulators along Smiths Creek to increase the area and duration of floods. Low banks would have the capacity to pond and spread water over the forest floor, pass water over bank crests and allow slow drainage of ponded water
  - an embankment in the vicinity of Portland Race to spread water across War Plain and other grasslands.

Seek to ensure 195,000 ML of water from Dartmouth Dam remains unallocated until the consultants funded by the Murray Darling Basin Commission indicate whether this water could be effectively used to aid watering of the Barmah Forest.

Experiment with small barriers across drainage channels to aid spread and retention of surplus water or environmental flows in Boals Deadwoods, in order to recreate natural water regimes for these areas when measures outlined in the previous actions prove insufficient.

Encourage participation of community groups such as the Victorian Field and Game Association and Bird Observers Club in surveys of water birds.

Connect Nookes Lagoon (Figure 5) to the river by a pipe regulator to as far as possible restore pre-regulation water regimes for this lagoon using surplus flows. Undertake similar works on Red Tank Lagoon (Figure 5) upon completion of the sampling program currently being undertaken by the Murray Darling Freshwater Research Centre.

Examine the feasibility and desirability of undertaking localised excavations in wetlands to improve diversity of habitat for waterbirds.

Liaise with the Murray Darling Freshwater Research Centre, Murray Darling Basin Commission, NSW Maritime Services Board and NSW Department of Lands to investigate bank erosion along the Murray.
Management of natural resources

Medium

Encourage research into the rate and mechanisms of sediment deposition in the forest.

Ongoing

Continue to keep a map record of the extent of flooding in the forest.

Ongoing

Ensure that as far as possible measures to aid forest watering do not result in breaching or overtopping of the levee banks protecting neighbouring private property, or diminish the flood mitigation capability of the forest.

As needed

Incorporate the results of the Murray Darling Basin Commission consultancy, and any additional information regarding wetland management which becomes available following the publication of this Plan, into a Supplement to this Management Plan.

As needed

In order to recreate the natural water regime for rushlands (Table 14 of CFL 1990), liaise with the Murray Darling Basin Commission to have small volumes of surplus and/or regulated flows used for environmental purposes. Regulators at the Gulf, Boals, Sapling and Island Creeks will be opened sufficiently to provide water for about 1500 ha of rushlands and Moira Grass plain at Top Island, Boals Deadwoods, Reedy Lake, Harbours Lake, Little Rushy Swamp and Duck Hole Plain (Figure 1). In most years water will be required from August to December, with the flow gradually being reduced from November onwards. Sudden drops in water level will as far as possible be avoided.

As needed

When colonial species such as ibis are nesting, operate regulators such that a sufficient water level is maintained in the breeding habitat to enable successful breeding (Section 15.4 of CFL 1990). If this watering is not in accord with a natural water regime, ensure it does not have an adverse impact on other forest values.

5.1.2 Groundwater

A network of bores has been established by the Rural Water Commission and the University of Melbourne to monitor ground water levels and research groundwater movements in the area. In the forest, the water table ranges from eleven to fourteen metres below the surface (Reid and Nolan 1989). The water table is generally highest adjacent to the river where sandy sediments occur in the river bank (Ife 1988). Groundwater is transmitted laterally in sand aquifers confined by a clay surface (Bren 1988).

At present salinity is not a problem in the forest or on neighbouring farmland. However, the Shepparton Irrigation Region south of the forest has a water table generally within two metres of the surface. This water table 'mound' is expanding, and moving northwards towards the forest (SPPAC 1989). A permanently high water table with no downward leaching of salt would probably result in the death of trees (Reid and Nolan 1989). The effect may be aggravated by upward pressures from deep aquifers underlying the forest (Ife 1988).

The Wetland Conservation Program (Government of Victoria 1988) states that:

- where a wetland of high value is being threatened by dryland or irrigation salting, the wetland and its catchment will be given a high priority for investigation and for protection and rehabilitation in regional and sub-regional salinity plans

- wetlands will not be adversely affected in the planning and execution of salinity mitigation works

- proposals for salinity mitigation works (including surface drainage, sub-surface drainage and evaporation basins) will be approved in the context of a regional or sub-regional salinity plan which will include reference to the value of the wetlands and the effects of proposed works.
Aims and actions

To protect the forest against possible adverse effects of rising water tables and salinity

To prevent adverse impacts on the forest arising from salinity mitigation works

Ongoing Liaise with the Salinity Program Advisory Council, Rural Water Commission and University of Melbourne to monitor and research groundwater levels and movements in and around the forest.

Ongoing Liaise with the Salinity Program Advisory Council and Rural Water Commission in the development of drainage and salinity control strategies for the Shepparton Irrigation District, and ensure any proposals comply with the Wetlands Conservation Program.

5.2 FLORA

Effective vegetation management involves maintenance of species and structural diversity, and protection of significant plant species and communities. Other aspects of forest management which impinge on these requirements for vegetation include the provision of appropriate water regimes (Section 5.1), preservation of fauna habitat (Section 5.3), maintenance or enhancement of the forest landscape (Section 5.6), management of timber production (Section 8.1) and grazing (Section 8.2), and control of pest plants (Section 11.2) and animals (Section 11.3).

The zoning scheme adopted for the forest (Chapter 4) in part reflects vegetation conservation requirements, but specific measures are required in a number of cases.

5.2.1 Vegetation management

Vegetation considered in this section includes recognised plant communities (Chesterfield et al. 1984), areas which support a number of significant species, and vegetation which exhibits a significant structural form. Plant communities are described in Section 15.5 of DCE (1990), and their distribution indicated in Figure 3.

The majority of vegetation types in the forest do not require specific management, other than actions set out elsewhere in this Plan, particularly in relation to logging, grazing, fire protection and water management. However some vegetation has characteristics and values that require particular management actions.

Grey Box (Eucalyptus microcarpa) and Yellow Box (Eucalyptus melliodora) communities (Figure 3) contain the most diverse range of plant species in the forest. Yellow Box occurs on sandy soils, so that understorey plants are particularly sensitive to activities such as grubbing (the digging of bardi grubs for fishing bait) or logging which disrupt the soil surface (Wilson pers. comm.). Most Yellow, Grey and Black Box (Eucalyptus largiflorens) stands have been included in Zone 1.

Box forest in the eastern end of the Park supports a number of shrub species rare in the forest, such as Desert Cassia (Cassia nemophila), Berrigan (Eremophila longifolia), Waterbush (Myoporum acuminatum), Grey Parrot-pea (Dillwynia cinerascens), Eutaxia (Eutaxia microphylla), Leafy Templetonia (Templetonia stenophylla), Wedge-leaf Hop-bush (Dodonea viscosa ssp. cuneata), Willow Wattle (Acacia salicina) and Pale-fruit Ballart (Exocarpus strictus). The box ridge near Machonicies Crossing (Figure 1) supports a particularly varied and significant flora (Chesterfield et al. 1984, Frood 1988, Beauglehole 1986).

The River Red Gum forest in Goose Swamp (Figure 1) adjoins stands of Black Box (Eucalyptus largiflorens). Three rare species, Upright Sunray (Helipterum strictum), Fairy Spectacles (Menkea crassa) and Violet Swainson-pea (Swainsonia microcalyx ssp. adenophylla), are found in a zone between Black Box and River Red Gum, and the area also contains a remnant salt bush flora that is uncommon in the region. Black Box itself is has a restricted distribution. Also present are mature
stands of River Red Gum and the Variable Spike-sedge (*Eleocharis minuta*) which, prior to its recent collection at Goose Neck (Figure 1), was thought to be extinct (Chesterfield *et al.* 1984).
Lyons (1988) notes that Barmah forest, prior to European settlement, featured many open park-like areas with well-spaced veteran trees. Forest of this type is now uncommon in the area due to timber harvesting, altered water regimes and, possibly, control of wildfires caused by lightning and the absence of Aboriginal fires. Areas which still exhibit this vegetation structure are mainly in the southern central and eastern parts of the forest. However, veteran mature trees are scattered throughout most areas of the forest.

Herbfields of floodways and depressions are often markedly different from adjacent forest. Species of interest which occur on these sites include Button Rush (*Lipocarpha microcephala*), Fringe-sedge (*Fimbristylis* spp.), Hypsela (*Hypsela tridens*), Mueller Daisy (*Brachyscome muelleroides*), River Swamp Wallaby-grass (*Amphibromus fluitans*) and *Stellaria* sp. (Frood 1988).

Barmah Forest has the most extensive areas of Moira grasslands (*Pseudoraphis spinescens*) in Victoria (grasslands of this species are widespread in northern Australia). They are being progressively invaded by rushes and River Red Gum due to altered water regimes. Grazing may also have an adverse impact on the grasslands (Section 8.2).

It is probable that the palatable Common Reed (*Phragmites australis*) and native Cumbungi (*Typha orientalis*) were much more prevalent until the introduction of cattle and alteration to water regimes. Conversely, the non-palatable Giant Rush (*Juncus ingens*), which is also apparently favoured by the hydrological changes caused by river regulation, has become more widespread (Chesterfield *et al.* 1984). Wetlands rich in Cumbungi are of high value for waterfowl (Frith *et al.* 1969) and are also valuable habitat for waterbirds such as Spotless Crake (*Porzana tabuensis*), Little Bittern (*Ixobrychus minutus*) and the Brolga (*Grus rubicundus*), which is now absent from the forest.

**Aims and actions**

**To maintain and protect the structural and floristic diversity of natural plant communities**

**To protect plant species and communities that are threatened or of special significance**

**To protect and encourage the re-establishment of mature River Red Gum woodland**

**To promote applied ecological research, particularly to assist future forest management**

**High**

Protect the flora of box ridges by:

- prohibiting timber harvesting, gathering, processing or snigging in, around or through box forest in the State Park and Zone 1, and harvesting Grey Box in Zone 4 under strict prescriptions (Section 8.1)
- reducing access to Machonicies Ridge (Chapter 7)
- fencing portions of Machonicies Ridge (Section 8.2) and Tongalong Ridge (Section 5.2.2)
- investigating regulations to enable control of grubbing in State Forest, and enforcing regulations prohibiting grubbing in the State Park (Section 9.2.3)
- monitoring populations of rare plants at Machonicies and Tongalong Ridges, and if necessary institute further conservation measures.

**Low**

Encourage further general surveys of flora, including research into the requirements of individual species and communities and the effects of fire.

**Ongoing**

Monitor populations of significant plants in Goose Swamp. Logging will be permitted in the area under special prescriptions (Section 8.1). Grazing will only be allowed for approximately a two week period each year at muster time (Section 8.2).
Management of natural resources

Ongoing  Maintain and where possible re-establish mature River Red Gum woodland in Zones 1 and 2 through application of appropriate logging prescriptions (Section 8.1).

Ongoing  Monitor vegetation communities in depressions and floodways and determine the effect of the proposals outlined in Section 5.1.

Ongoing  Monitor encroachment of Moira Grass plains by rushes and River Red Gum. Where necessary to maintain the current extent of Moira Grass plain, remove River Red Gum regeneration. Strategies outlined in Section 5.1 will help maintain this community.

Ongoing  Monitor the extent of Cumbungi, Common Reed and Giant Rush.

5.2.2 Management of significant plant species

Of the 553 plant species in the forest (Appendix I of CFL 1990), 27 species are of State significance and require specific management actions (Chesterfield et al. 1984, Beauglehole 1986, Frood 1988, Marshall pers. comm.). Species of State, regional and local significance are noted in Appendix I of DCE (1990).

A number of outstanding River Red Gum trees have been identified and measured. As well as their intrinsic value and interest, several of these trees are a valuable seed resource for growing River Red Gums with a silviculturally desirable form.

Aims and actions

To protect significant plant species

To protect significant River Red Gum trees

High  Determine specific locations and population sizes of all significant species and maintain a register of this information.

High  Protect significant plants vulnerable to grazing by fencing or other appropriate methods.

Medium  Prepare detailed management prescriptions for species listed in Table 3 based on detailed ecological study. Research on the effects of grazing (Section 8.2) will enable more informed management of significant species.

Ongoing/Medium  Protect significant individual River Red Gum trees listed in Table 4 from harvesting operations. Indicate the identity of the trees by a suitable marker (several are already marked) and measure the unmeasured trees.

Ongoing  Manage species identified as having statewide significance (CFL 1988b) as indicated in Table 3.

As needed  Develop appropriate management actions for any further species identified, through survey or taxonomic revision, as rare and endangered.
TABLE 3 MANAGEMENT ACTIONS FOR SIGNIFICANT PLANTS

<table>
<thead>
<tr>
<th>Species</th>
<th>Status in Victoria</th>
<th>Location and significance</th>
<th>Management action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umbrella Wattle ((Acacia osswaldii))</td>
<td>D</td>
<td>Has become depleted in Victoria due to grazing and clearing of woodlands. One specimen occurs in Goose Swamp.</td>
<td>Monitor and determine the affects of grazing. Fence if necessary.</td>
</tr>
<tr>
<td>Buloke ((Allocasuarina luehmannii))</td>
<td>D</td>
<td>Buloke has become depleted in Victoria because of clearing and grazing of box forests. Occurs with Yellow Box on ridges at Machonies, Mannions, Long Plain and Tongalong Ridge. Significant stands have been included in Zone 1. Fence 50% of Tongalong Ridge and monitor to determine the effects of grazing (both cattle and rabbits).</td>
<td></td>
</tr>
<tr>
<td>Buloke Mistletoe ((Amyema linophyllum))</td>
<td>V</td>
<td>Uncommon mistletoe found in association with Buloke, especially on Tongalong Ridge.</td>
<td>Monitor.</td>
</tr>
<tr>
<td>Yellow-tongue Daisy ((Brachyscome chrysoglossa))</td>
<td>V</td>
<td>Rare species, confined to the mallee area and Machonies ridge in Barmah Forest.</td>
<td>Monitor and determine the effects of grazing. Fence if necessary.</td>
</tr>
<tr>
<td>Mueller Daisy ((Brachyscome muelleroides))</td>
<td>E</td>
<td>In Victoria known only from the Barmah Forest and scattered locations in the Nathalia Shire. Occurs on Machonies Crossing, Forcing Yards, Ulupna Island and other sites.</td>
<td>Monitor and determine the effects of grazing.</td>
</tr>
<tr>
<td>Reader's Daisy ((Brachyscome readerii))</td>
<td>R</td>
<td>Known from only five locations in northern and western Victoria. Is found on Ulupna Island.</td>
<td>Monitor.</td>
</tr>
<tr>
<td>Bear's-ears ((Cymbonotus lawsonianus))</td>
<td>R</td>
<td>Localised herb known in Victoria from four disjunct localities in the eastern highlands and Murray River. Recorded from Ulupna Island, Tram Island and the western section of the State Park.</td>
<td>Monitor.</td>
</tr>
<tr>
<td>Flaccid Flat-sedge ((Cyperus flaccidus))</td>
<td>V+</td>
<td>Rare species found in Rowes Swamp. Other Victorian occurrences are near Dimboola and in Cobram Regional Park.</td>
<td>Monitor, and if possible determine favoured water regimes.</td>
</tr>
<tr>
<td>Silky Umbrella Grass ((Digitaria ammophila))</td>
<td>V</td>
<td>Localised and rare, confined to Mildura, Warracknabeal, Picola, Madowla Park and Barmah Forest. Found on sand ridges on Barmah Island and Bucks Sandhill.</td>
<td>Monitor effects of grazing and protect if necessary.</td>
</tr>
</tbody>
</table>

Table 3 (cont.)

<table>
<thead>
<tr>
<th>Species</th>
<th>Status in Victoria</th>
<th>Location and significance</th>
<th>Management action</th>
</tr>
</thead>
</table>
### Table 3 (cont.)

<table>
<thead>
<tr>
<th>Species</th>
<th>Status in Victoria</th>
<th>Location and significance</th>
<th>Management action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth Minuria</td>
<td>R</td>
<td>Species of savannah and grassland, now rare in the State.</td>
<td>Assess distribution and status in the forest and surrounding area.</td>
</tr>
<tr>
<td>(Minuria integerrima)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waterbush</td>
<td>R</td>
<td>In Victoria, localised and rare in the northwest and Murray Valley, on roadsides, box forests and riverine locations. It occurs in the State Park at Machonies.</td>
<td>Monitor.</td>
</tr>
<tr>
<td>(Myoporum acuminatrum)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Status</td>
<td>Description</td>
<td>Action</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Sweet Leek-orchid (<em>Prasophyllum odoratum</em>)</td>
<td>?</td>
<td>Taxonomy and status of this species is uncertain.</td>
<td>Assess status and distribution in the forest and surrounding area.</td>
</tr>
<tr>
<td>Small Psoralea (<em>Psoralea parva</em>)</td>
<td>E</td>
<td>Rare plant found at Machonicies Crossing, Tongalong Ridge, Grinters Ridge and other locations in the forest. Formerly of scattered distribution on lowland plains of Victoria, now appears to be extinct south of the divide and known only from a small number of stands in the Murray Valley. Its status in other states is in doubt. Barmah Forest may be the best location to obtain security for this species.</td>
<td>Monitor and if necessary protect from grazing.</td>
</tr>
<tr>
<td><em>Rorripa</em> sp. nov. 'S'</td>
<td>E⁺</td>
<td>Undescribed species of unknown distribution.</td>
<td>Assess status and distribution in the forest and surrounding area.</td>
</tr>
<tr>
<td><em>Stellaria</em> sp. nov.</td>
<td>R⁺</td>
<td>Undescribed species of unknown distribution.</td>
<td>Assess status and distribution in the forest and surrounding area.</td>
</tr>
<tr>
<td>Violet Swainson-pea (<em>Swainsonia microcalyx ssp. adenophylla</em>)</td>
<td>R</td>
<td>Known from Diamantina River, Minindee in south-west NSW, and in Victoria only from Machonicies and Trickey’s Track in Barmah.</td>
<td>Monitor.</td>
</tr>
<tr>
<td>Leafy Templetonia (<em>Templetonia stenophylla</em>)</td>
<td>D</td>
<td>Formerly widespread, now rare in grassy vegetation of northern and western Victoria. In Barmah is found at Machonicies, Tongalong Ridge.</td>
<td>Monitor.</td>
</tr>
</tbody>
</table>

**Status key**

- X  Presumed extinct
- E  Endangered
- V  Vulnerable
- R  Rare
- D  Depleted

Notes on location and significance from Chesterfield et al. (1984), Frood (pers. comm.), Wilson (pers. comm.), Marshall (pers. comm.).
### TABLE 4 SIGNIFICANT TREES

<table>
<thead>
<tr>
<th>Tree</th>
<th>Location</th>
<th>Height (m)</th>
<th>Girth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Munro's pile</td>
<td>Reedy Lake</td>
<td>46.6</td>
<td>2.9</td>
</tr>
<tr>
<td>Tingate's pile</td>
<td>Sapling Landing</td>
<td>43.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Galloway's tree</td>
<td>Punt Paddock</td>
<td>43.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Dexter's tree</td>
<td>Green Engine</td>
<td>45.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Assessor's pile</td>
<td>Island Lagoon</td>
<td>42.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Code's pile</td>
<td>Sand Ridge Track</td>
<td>46.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Silent Walter's tree</td>
<td>Black Engine Creek</td>
<td>39.5</td>
<td>2.7</td>
</tr>
<tr>
<td>E91</td>
<td>River Road</td>
<td>35.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Sleeman's Idol</td>
<td>Smiths Creek</td>
<td>not measured</td>
<td></td>
</tr>
<tr>
<td>Wright's tree</td>
<td>War Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cockatoo tree</td>
<td>Barmah Creek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suthy's pride</td>
<td>Barmah Island</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unnamed</td>
<td>Barmah Island</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moloney's tree</td>
<td>Barmah Island</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marshall's fancy</td>
<td>Barmah Lake</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 5.3 FAUNA

Mammals, birds, reptiles, amphibians and fish present in the forest are discussed in Section 15.6 and listed in Appendices II-V of DCE (1990). General fauna management involves maintenance of habitats. Detailed information is also required on the breeding, refuge, dietary requirements and distribution of all species in the forest. Control of introduced predators, especially foxes, is also important for the protection of some species (Section 11.3).

The quality of indigenous fauna habitat in the forest varies according to the degree of disturbance to breeding, feeding and refuge areas. These disturbances include the removal of tree hollows, invasion of habitat by pest plants, competition and predation by pest animals and disruption of understorey by cattle.

Threatened wildlife in Victoria's has been classified (CFL 1987d, Baker-Gabb 1991) according to whether a species is:

- endangered and may become extinct unless action is taken (E)
- vulnerable and under considerable threat (V)
- restricted distribution, rare or both (R)
- indeterminate, possibly threatened (I)
- requiring careful monitoring (M).

Some species require no specific action other than the general protection of a diversity of natural communities and the continuation of ecological processes. They include the Common Brushtail Possum (*Trichosurus vulpecula*), Ringtail Possum (*Pseudocheirus peregrinus*) and many bird species. However, the species discussed below require specific management actions.

Eastern Grey Kangaroo (*Macropus giganteus*), in combination with introduced herbivores, can exert considerable grazing pressure on the flora of the forest.

The Squirrel Glider (*Petaurus norfolcensis*) (R) occurs in mature River Red Gum, box and ironbark woodlands. In the mid-Murray area its major stronghold is near the confluence of the Goulburn and Murray Rivers, where sap from Silver Wattle (*Acacia dealbata*) appears to be an important food source. DCE are developing a research project to examine the relationship between the distribution of Silver Wattle and Squirrel Gliders. In Barmah, Silver Wattle occurs in scattered stands along the...
Management of natural resources

river. Though the Barmah population is not as large as the one noted above, it still merits special attention (Menkhorst et al. 1988, Fisheries and Wildlife 1983).

The Brush-tailed Phascogale or Tuan (Phascogale tapoatafa) (R) has declined in numbers over the past few decades, and although records are widespread, they are relatively common in only a few areas. The Tuan is a hollow dweller and forages amongst diverse ground litter and logs (Fisheries and Wildlife 1983). It has been recorded from the vicinity of Hut Lake and Thistle Bed (Figure 1).

Koalas (Phascolarctos cinereus) (M) were abundant in the forest until about 1910, but subsequently became extinct in the area. A Koala population has become established on Ulupna Island following translocation of animals from disease-free coastal populations. DCE is currently undertaking a translocation program in Barmah, with the first release being near Dharnya in May 1989.

The Large-footed Myotis (Myotis adversus) (I) was once considered to be a very rare bat, restricted in Victoria to the southern side of the divide. However, this species has recently been found in the Murray Valley, including Barmah Forest (Fisheries and Wildlife 1983).

Unconfirmed reports suggest Tiger Quoll (Dasyurus maculatus) (V) and an unidentified small macropod may be present in the forest (Section 15.6.1 of CFL 1990).

The Superb Parrot (Polytelis swainsonii) (R) is restricted to northern Victoria and central NSW. In Victoria it formerly ranged south to the centre of the State, but now only occurs near the Murray, where it is considered rare and/or restricted (Webster & Ahern 1989). It feeds largely on seeds of grasses and herbaceous plants, but will also take fruits, nectar and blossoms from eucalypts and wattles. In Barmah it has been observed feeding on fruiting mistletoe on River Red Gum, in flowering Yellow Box, and on grain in nearby paddocks (Loynd pers. comm.).

It is dependent on the hollow limbs of eucalypts for nest sites and utilises box forest for foraging. Nests are usually located in River Red Gum along major watercourses, and no further than 9 km from box forest. The birds nest from September to November and appear to be absent from Victoria during winter (Webster 1988). In NSW River Red Gums in riparian locations along the Edward and Murray Rivers which have a breast-height diameter greater than 150 cm are retained for Superb Parrot habitat. In Barmah no harvesting occurs in the area between the River Road and the river, where several possible nest sites are located.

The location of all nest sites is currently being investigated by DCE to enable protection from activities such as timber harvesting (Section 8.1). From recent research it has been shown that three areas (Tongalong Creek, Bucks Crossing and Doctor's Point) have significant numbers of nest trees.

The Grey-crowned Babbler (Pomatostomus temporalis) (V) is a woodland species which has suffered a dramatic decline in numbers in Victoria. It is dependent on a diverse leaf and branch litter for foraging and is vulnerable to intensive management because of its colonial and sedentary life-style (Fisheries and Wildlife 1983). There are small numbers of this bird in Barmah Forest, mainly on Top Island and in association with areas of box forest.

The Barking Owl (Ninox connivens) (R) inhabits mature open forest and woodland. It relies on an abundance of prey species including possums and gliders (which also favour mature forest) and terrestrial species such as rabbits. The reason for its rarity in southern Australia is not understood.

Regent Honeyeaters (Xanthomyza phrygia) (E) have been infrequently observed in Barmah. This nomadic species has declined in numbers and is listed as endangered in Victoria. It is closely dependent on flowering box and ironbark (Robertson et al. 1983).

Bush Thick-knee (Burhinus magnirostris) (V) used to be common in the drier parts of the forest, but are now rarely seen. An inhabitant of open woodland, it has declined dramatically in southern Australia. It feeds and nests on the ground and is very susceptible to predation by cats and foxes (Fisheries and Wildlife 1983).
White-bellied Sea-eagle (*Haliaeetus leucogaster*) (R) and Peregrine Falcon (*Falco peregrinus*) (M) nest in large old River Red Gums in the forest, and the occasional vagrant Square-tailed Kite (*Lophoictinia isura*) (V) has also been observed nearby (Chesterfield *et al.* 1984).

Maintenance of wetland habitat is of particular importance for a number of waterbirds. Rare waterbirds recorded for Barmah include Freckled Duck (*Stictonetta naevosa*) (R) and Latham's Snipe (*Gallinago hardwickii*) (M) (Chesterfield *et al.* 1984).

The Hooded Scaly-foot (*Pygopus nigriceps*) (E) is a legless lizard which is at the southern limit of its range in Victoria, and is only known from a few records. It is sensitive to understorey disturbance (Fisheries and Wildlife 1983, Robertson *et al.* 1983) and has been recorded from Ulupna Island, though its status in the forest is unknown (Brown 1981).

The Carpet Python (*Python spilota variegata*) (V) was once widespread in woodlands and along watercourses in northern Victoria. It is a slow-moving, nocturnal species, and populations have declined drastically due to habitat disturbance and collecting for the pet trade. It is dependent on diverse ground litter, including abundant fallen timber. Large hollow trees are important, especially in inundated areas (Fisheries and Wildlife 1983, Robertson *et al.* 1983).

Other significant reptiles which may be present, but which have no recent confirmed records from Barmah, are the Bandy Bandy (*Vermicella annulata*) (V) and Curl Snake (*Suta suta*) (R).

In the past fifty years the distribution and abundance of native fish such as Trout Cod (*Maccullochella macquariensis*) (E), Murray Cod (*Maccullochella peeli*) (V) and Silver Perch (*Bidyanus bidyanus*) (V) have dramatically declined in Victoria (Cadwallader *et al.* 1984). Other significant fish (CFL 1989b) are Macquarie Perch (*Macquaria australasica*) (V), Freshwater Hardyhead (*Craterocephalus stercusmuscarum*) (I), Golden Perch (*Macquaria ambigua*) (R), Blackfish (*Gadopsis marmoratus*) (I) and Flat-headed Galaxias (*Galaxias rostratus*) (I). The significance of waterways or flooding in the Barmah area for these species is not known.

**Aims and actions**

**To protect and maintain native fauna by maintaining suitable habitat**

**To actively manage threatened or significant species**

**To undertake continuing research and surveys of native wildlife**

**High**

Conduct surveys to:

- determine whether Tiger Quoll are present in the forest
- establish the identity of a small macropod thought to be present in the forest.

**Medium**

Monitor populations of Eastern Grey Kangaroo.

**Medium**

Encourage systematic survey of reptiles in the forest, and determine the distribution of the Carpet Python and Hooded Scaly-foot and whether the Curl Snake and Bandy Bandy are present in the forest.

**Low**

Encourage further general surveys of fauna, including invertebrates, and research into the biology and habitat requirements of fauna.

**Ongoing**

Manage significant fauna as indicated in Table 5.
## TABLE 5 MANAGEMENT ACTIONS FOR SIGNIFICANT ANIMALS

<table>
<thead>
<tr>
<th>Significant species</th>
<th>Requirements</th>
<th>Management actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squirrel Glider</td>
<td>Depends on tree hollows for breeding and shelter.</td>
<td>Monitor populations, and protect any areas shown to be critical habitat. Investigate food sources and the utilisation and distribution of Silver Wattle in the forest. Retain mature forest, especially Yellow Box (Section 8.1).</td>
</tr>
<tr>
<td>Tuan</td>
<td>Needs tree hollows for breeding and shelter and a diverse litter layer for foraging.</td>
<td>Identify areas of critical habitat. Monitor populations, retain and restore mature forest habitat in Zones 1 and 2 (Section 8.1). As far as possible retain a diverse litter layer, particularly in the Park.</td>
</tr>
<tr>
<td>Koala</td>
<td>Suitable food trees - River Red Gum.</td>
<td>Monitor, and allow further translocations into the forest from disease free populations elsewhere in the State.</td>
</tr>
<tr>
<td>Large-footed Myotis</td>
<td>Utilises tree hollows near flowing water.</td>
<td>Retain and restore mature forest habitat in Zones 1 and 2 (Section 8.1).</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superb Parrot</td>
<td>Dependent on tree hollows in River Red Gum for nest sites. Box ridges may be important for foraging.</td>
<td>Implement management actions contained in the Flora and Fauna Guarantee Action statement (No. 33) for the Superb Parrot including: Implement timber harvesting exclusion zones for Superb Parrot colonies. Maps and descriptions of these areas will be held in DCE offices for management purposes. Ensure that any additional nest trees discovered in the future are immediately afforded 100 m buffers from which logging and silviculture are excluded. Where two or more nest trees occur within 200 m of each other (that is, they form a colony), the outermost buffer boundaries should be rationalised to form a single exclusion zone.</td>
</tr>
<tr>
<td>Significant species</td>
<td>Requirements</td>
<td>Management actions</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Significant species</strong></td>
<td></td>
<td><strong>Management actions</strong></td>
</tr>
<tr>
<td>Barking Owl</td>
<td>Mature trees for nest hollows and as habitat for prey species, particularly gliders.</td>
<td>Retain and restore mature forest habitat in Zones 1 and 2 (Section 8.1).</td>
</tr>
<tr>
<td>Regent Honeyeater</td>
<td>Nomadic, utilises box species</td>
<td>Assess status in forest.</td>
</tr>
<tr>
<td>Grey-crowned Babbler</td>
<td>Colonial, sedentary species, depends on a diverse ground litter for foraging and structural diversity in the tree cover.</td>
<td>As far as possible retain and encourage a structurally diverse vegetation (Sections 5.2, 8.1).</td>
</tr>
<tr>
<td>White-bellied Sea-eagle</td>
<td>Nests in large old River Red Gums and hunts over water.</td>
<td>Protect traditional nest trees from disturbance.</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>Utilises timbered habitat, nests in old River Red Gums and hunts over open areas.</td>
<td>Protect known nest trees from disturbance.</td>
</tr>
<tr>
<td>Freckled Duck</td>
<td>Shallow wetland habitat.</td>
<td>Retain and where possible improve wetland habitat in the forest (Section 5.1).</td>
</tr>
<tr>
<td>Latham's Snipe</td>
<td>Wetlands, especially Cumbungi and thick vegetation along the margins.</td>
<td>Retain and where possible improve wetland habitat, monitor distribution of Cumbungi (Section 5.1).</td>
</tr>
</tbody>
</table>

Table 5 (cont.)

- Review the need for Superb Parrot buffers and exclusion zones after 10 years, or if the total area of buffer zones exceeds 200 hectares whichever occurs first.
- Monitor the use of known foraging sites from August to December each year and continue to seek incidental reports on additional foraging locations. Monitor known nests and investigate foraging and dispersal patterns. Continue to compile details of the Superb Parrot diet.
- Close access to camping sites adjacent to nest trees along the river during the breeding season (August-December).
### Table 5 (cont.)

<table>
<thead>
<tr>
<th>Significant species</th>
<th>Requirements</th>
<th>Management actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carpet Python</td>
<td>Depends upon a diverse ground litter, including abundant fallen timber and large hollow trees, especially along the river.</td>
<td>Assess status, determine favoured locations, and restrict firewood collection in these areas (Section 8.1). Retain a diverse litter layer in association with mature forest.</td>
</tr>
<tr>
<td>Hooded Scaly-foot</td>
<td>Requires good cover of ground vegetation and litter.</td>
<td>Assess status, determine favoured locations, and restrict firewood collection in these areas (Section 8.1). Monitor the impact of grazing.</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trout Cod, Murray Cod, Golden Perch &amp; others listed in text</td>
<td>Spring flooding, especially when extensive areas of floodplain are connected to major waterways.</td>
<td>Undertake surveys to determine the significance of Barmah Forest for these fish, and monitor the effects of manipulating water regimes (Section 5.1).</td>
</tr>
</tbody>
</table>

### 5.4 GEOLOGY AND GEOMORPHOLOGY

The geological and geomorphological features of Barmah Forest are described in Section 15.2 of DCE (1990). The forest, particularly the western section, contains all the characteristic geomorphological elements of the Riverine Plain. Examples of prior streams, lakes, lunettes, ancestral rivers, source-bordering dunes and deltaic features are evident (Barberis and Mollica 1983).

Major features of interest are the sand lunette along Sand Ridge Track, the digitate delta which separates Barmah Lake from the Murray River, and source bordering dunes near the muster yards and along Moira Lakes Track (Figure 1). The geomorphological significance of these features has not been assessed.

Roading and grubbing (Section 9.2.3) on the sand lunette and source-bordering dunes have potential to degrade these features. Soil disturbance has occurred on Bucks Sand Hill (Figure 1), the highest point on the lunette, as a result of grubbing and, possibly, trampling by cattle.

The deposition processes which gave rise to the digitate delta (Section 15.2 of CFL 1990) are likely to have been modified by the changes to flow regimes since river regulation (Section 5.1).

**Aims and actions**

**To assess and protect sites of geological and geomorphological interest**

**To interpret geological and geomorphological processes**

**Medium** Assess the significance of the geomorphological features in the forest.

**Low** Examine the processes involved in the formation and erosion of the digitate delta and assess the impact of river regulation on these processes.

**Ongoing** Ensure any roadworks or alterations to the alignment of the Sand Ridge Track (Chapter 7) do not cause degradation to or erosion of the sand lunette or source-bordering dunes.
Ongoing Enforce prohibition of grubbing in the Park (Section 9.2.3).

Ongoing Monitor the condition of the sand lunette and source-bordering dunes.

Ongoing Interpret geological and geomorphological features of the area through displays at the Dharnya Centre and publications (Chapter 10).

5.5 REFERENCE AREAS

Two Reference Areas, Top Island (160 ha) and Top End (120 ha), are located in the State Park. The Reference Areas are surrounded by a 100 metre buffer to protect them from adjacent land uses. The location of the Reference Areas (including their buffers) is shown in Figure 1. The areas have yet to be officially proclaimed by the Governor-in-Council under the Reference Areas Act 1978. The LCC (1985) described the areas as follows:

Top Island

Quaternary alluvial soils; flood-plain with floodways subject to frequent flooding from the Murray River; approximate average rainfall 400 mm; elevation approximately 100m; River Red Gum forest with understoreys of Moira Grass, Warrego Summer-grass (Paspalidium jubiflorum), Common Spike-sedge (Eleocharis acuta), River Swamp Wallaby-grass (Amphibromus fluitans); Giant Rush; grasslands dominated by Moira Grass.

Top End

Quaternary alluvial soils; flood-plain; approximate average rainfall 400 mm; elevation approximately 100m; River Red Gum forest with understoreys of Rush Sedge (Carex tereticaulis), Warrego Summer Grass and River Swamp Wallaby Grass; open Grey Box forest.

In common with all references and standards, these areas must not be tampered with, and as far as possible natural processes should be allowed to continue undisturbed.

Both Reference Areas and their buffers have been fenced to exclude cattle. Movement of kangaroos and emus is also restricted by the fences.

The Reference Areas Advisory Committee recommend that apiary sites situated on public land within 2 km of Reference Areas should be relocated to alternative sites as they become available.

The Reference Areas Advisory Committee and the Benalla Region are developing Interim Management Statements which will guide the management of the Reference Areas in the short term. Eventually Reference Area Management Plans will be prepared. In the interim, the Reference Areas will be managed as indicated below.

Aims and actions

To as far as possible allow natural processes to continue undisturbed

To as far as possible prevent modifications or intrusions of unnatural origin

To allow for scientific research

To prohibit activities that conflict with the purposes of Reference Areas

High Prepare Interim Management Statements for Top Island and Top End Reference Areas

High Arrange for the proclamation of Top Island and Top End Reference Areas.
High Close selected tracks around the Reference Areas to discourage access (Chapter 7 and Figure 4).

High Relocate the licensee of the apiary site in the Top End Reference Area to an adjacent vacant site. Relocate the site adjacent to the Top Island Reference Area so that its range does not impinge on the Reference Area. Relocate sites within 2 km of the Reference Areas if alternative sites become available in the forest (Section 8.3).

High Investigate the use of fences which exclude cattle but allow passage of kangaroos. Examine the possibility of using wooden post and rail fences.

High Undertake a comprehensive survey of the flora and fauna in the Reference Areas and establish an ongoing monitoring program.

Medium Prepare Reference Area Management Plans for Top Island and Top End Reference Areas.

Ongoing Prohibit all forms of access, except that required for management or research.

Ongoing Exclude grazing, logging, beekeeping and recreation.

Ongoing Manage bordering land in order to avoid interference with the Reference Areas.

Ongoing Allow research in accordance with the guidelines developed by the Reference Areas Advisory Committee. Types of uses permitted are:

- surveys to complete inventories within the Reference Areas
- surveys for comparison with land of the same type outside the Reference Areas
- studies (not involving manipulation) to analyse relationships between biota and the environment (LCC 1988).

As needed Carry out fire suppression operations on adjacent land wherever possible rather than in Reference Areas. Restore land damaged by fire suppression operations when necessary.

As needed Liaise with the Reference Areas Advisory Committee regarding control of those introduced plants and animals which may pose a threat to the natural ecology of the Reference Areas.

As needed Require the approval of the Director of NPW for the conduct of all research in Reference Areas.

5.6 LANDSCAPE

The Barmah Forest is characterised by its low topographic relief, extensive cover of mixed-age River Red Gum forest, and diversity of water bodies. To the south of the forest are extensive agricultural lands and small townships. The area lies within the Murray Basin Plains Landscape Character Type (Leonard and Hammond 1984).

Features which contribute to the appeal and visual quality of this landscape are:

- Murray River and its forested banks
- lagoons, lakes and creeks
- flooded forest
The various combinations of these features produce landscapes of different relative visual quality. When evaluating landscape, the areas of greatest concern combine both high scenic quality and a high level of scrutiny (or sensitivity) by the general public. Public sensitivity is greatest within and adjacent to high use recreation areas. In Barmah Forest these sensitive areas are:

- Murray River and environs
- Barmah Lake
- Dharnya Centre
- The environs of major access routes - River Road, Moira Lakes, Sand Ridge and Gulf Tracks, and tracks into Ulupna Island and Morgans Beach.

Relative landscape value has been considered in the formulation of the zoning scheme for the forest (Chapter 4), and all areas of high value have been included in Zones 1 or 2. Mature forests with an open, park-like character are uncommon in Victoria, and good examples in the eastern section of the Park, around Reedy Lake and in Goose Swamp are included in Zone 1.

Changes to the landscape need careful management so that as far as possible existing visual quality is retained or improved. Some potential causes of change are:

- management activities, including the development of buildings, roads and tracks, power lines, levees, drains, recreation facilities, fire protection works and pest plant control
- logging
- altered water regimes, which reduce the extent of grasslands, modify wetlands and aid establishment of River Red Gum thickets
- cattle and horses
- unauthorised signs (often attached to trees, especially along the river)
- debris, including the barrel of a concrete truck located on an Aboriginal site, car bodies, derelict charcoal kilns and other rubbish, is scattered throughout the forest. A rubbish tip is located in the Park near Machonicies ridge.

Aims and actions

To protect and preserve landscape values, especially in areas of greatest scenic quality and viewer interest

To minimize the impact of management activities on all landscapes

To remove undesirable visual intrusions

High  Prepare site development plans in liaison with DCE National Parks & Public Lands Division, for camping areas as indicated in Section 9.2.2.

High  Remove unauthorised signs from the forest.

High  In liaison with the Barmah Cattleman's Association, improve the appearance of the muster yard area by painting the buildings and other means as appropriate.

Medium  Remove visual intrusions such as the concrete mixer barrel on the Sand Ridge (in consultation with the Yorta Yorta Murray Goulburn Rivers Clans Inc.), car bodies, derelict charcoal kilns, scrap metal and waste material.

Medium  Bury the rubbish at the tip site near Machonicies and rehabilitate the site.
Ongoing  Manage landscapes in the forest according to the following guidelines:

- protect landscape values in Zone 1 by ensuring that as far as possible any alteration to the natural landscape is in evident

- site and design all facilities in Zone 2 (picnic tables, fireplaces and camping areas), to blend in with the environment with a minimum of artificiality or site modification

- site and design all facilities in Zone 3 (camping grounds and buildings), to be compatible with the naturally established characteristics of the area

- allow management alterations in Zone 4 to be visually apparent and yet subordinate to established landscape patterns, and ensure any dominant impact on the natural landscape is temporary and that alterations are not obvious after a period of about two years

- ensure logging plans take into account landscape values, especially in Zone 1

- adopt the Recreation Facilities Manual (CFL 1987a) and DCE Signs Manual as standards for design work.
6 MANAGEMENT OF CULTURAL RESOURCES

6.1 ABORIGINAL HERITAGE

The Yorta Yorta Aboriginals have a long and continuing association with the Barmah Forest and adjacent NSW forests. They consider these areas living examples of Aboriginal cultural heritage and an important part of their ancestral homelands. A brief summary of Aboriginal history is given in Section 16.1 of CFL 1990.

The forest contains many sites of cultural significance to the Aboriginal people, and therefore also of general historical and scientific significance. Sites include burial grounds, mounds, middens and scarred trees. A survey of a small area undertaken by the Victoria Archaeological Survey (VAS) in conjunction with the Yorta Yorta community (Bonhomme in press) identified 182 sites in the forest. Many more sites are thought to be present and need to be located, identified, catalogued and management requirements assessed.

The Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984 makes provisions for protection of Aboriginal places throughout Victoria, such that ‘A person shall not wilfully deface, damage otherwise interfere or do any act likely to endanger an Aboriginal object or Aboriginal place.’ Severe penalties apply to breaches of this Section. The Archaeological and Aboriginal Relics Act 1972 also makes provision for protection of Aboriginal sites.

Many sites are currently being subjected to impacts from logging, grubbing (the digging of bardi grubs for fishing bait), cattle, horses, rabbits, vehicles, vandalism, recreation activities and riverbank erosion. Some sites require specific management actions whilst most can be adequately protected and managed according to general guidelines.

The hunting of native wildlife and collection and use of native plants for food and ceremony is an integral part of Aboriginal culture. At present it contrary to the National Parks Act 1975 (for State Park) and Wildlife (General) Regulations 1980 under the Wildlife Act 1975 (for State Forest) for anyone to catch and kill animals such as kangaroo in the forest. A variety of traditional food plants can also be found in the forest (Wilson 1990). DCE is currently preparing a State-wide policy on the taking of native plants and animals by Aboriginals for traditional purposes.

Two Aboriginal Cultural Officers are employed in the Dharnya Centre (Chapter 10). The Yorta Yorta Murray Goulburn Rivers Clans Inc. (MGRC) has representatives on the Barmah Advisory Committee. There is potential to further involve Aboriginal people in the management of the forest.

Aims and actions

To identify and protect Aboriginal sites

To interpret, where appropriate, Aboriginal sites and culture

To promote, and encourage investigation into, Aboriginal history and culture

To provide opportunities for greater Aboriginal involvement in forest management

High In consultation with the Yorta Yorta MGRC, manage those Aboriginal sites under particular threat as indicated in Table 6.

High Liaise with VAS to review the specific site information contained in Bonhomme (in press) and assess the need for any further actions in relation to particular sites.

High Ensure any fencing undertaken to protect sites takes into account landscape values. Assess the feasibility and desirability of using wooden post and rail fences.
Management of cultural resources

High Liaise with the Yorta Yorta MGRC and VAS to update and maintain a register and map record of all known Aboriginal sites in the forest.

High Encourage completion of the archaeological survey of the forest.

High In consultation with the Yorta Yorta MGRC, select and interpret sites to increase public awareness of Aboriginal culture and history.

High Encourage and support further opportunities for employment and training of Aboriginals in the forest (Section 13.1).

Medium Encourage studies examining fenced (Table 6) and unfenced sites to determine the effect of cattle, horses and uncontrolled access on Aboriginal sites.

Medium Encourage the Yorta Yorta MGRC to establish a liaison committee to coordinate management of Aboriginal sites and deal with other issues of importance to the Yorta Yorta people in Victoria and NSW. The committee could comprise of representatives from the Yorta Yorta MGRC, Victoria Archaeological Survey, DCE, NSW Forestry Commission and NSW National Parks and Wildlife Service.

Medium Allow limited hunting and gathering of traditional foods in Zone 4 by Aboriginal people if and when arrangements for such use are established by DCE policy and related regulations.

Ongoing Manage Aboriginal sites according to the following guidelines:

- as detailed in the Mid-Murray Forest Management Plan, ensure all Aboriginal sites within logging areas are protected from roading, snigging or falling operations
- in consultation with the Yorta Yorta MGRC, fumigate rabbit infestations occurring on Aboriginal sites
- avoid disturbing any Aboriginal sites by consulting with the Yorta Yorta MGRC and VAS prior to commencing any potentially damaging works
- where necessary reduce the potential for fire damage to scarred trees by removing debris from around their bases
- enforce Regulations with respect to grubbing (Section 9.2.3) and off-road vehicle use (Chapter 7).

Ongoing Develop and maintain an inventory of Aboriginal artefacts associated with the forest.

Ongoing/High Prevent the removal of artefacts from the forest, and encourage the recovery of artefacts which have been removed in the past.

Ongoing Continue to promote awareness of Yorta Yorta culture through the Dharnya Committee of Management.

As needed Notify the Yorta Yorta MGRC and VAS of any Aboriginal sites discovered in the forest, and liaise with them regarding site management.
<table>
<thead>
<tr>
<th>Site type</th>
<th>Locality</th>
<th>Management actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burial Ground</td>
<td>Sand Ridge</td>
<td>In consultation with the Yorta Yorta MGRC, fence and if appropriate signpost the site.</td>
</tr>
<tr>
<td>Mound</td>
<td>Barmah Lake</td>
<td>Remove fireplace and use appropriate barriers to prevent access. In consultation with the Yorta Yorta MGRC, interpret site.</td>
</tr>
<tr>
<td>Mound</td>
<td>Dharnya-Lakes walking track</td>
<td>Site walking track and if necessary use appropriate barriers to prevent access, and in consultation with the Yorta Yorta MGRC, interpret the site.</td>
</tr>
<tr>
<td>Mounds</td>
<td>Goose Neck</td>
<td>Close access track between Goose Neck and Dharnya (Figure 4) and relocate the fence adjacent to the boundary track so that it separates the large mound near Broken Creek from the road.</td>
</tr>
<tr>
<td>Mounds</td>
<td>Sand Ridge</td>
<td>Discourage access, relocate the Sand Ridge Track where practicable and necessary, and monitor.</td>
</tr>
<tr>
<td>Mound</td>
<td>Punt Paddock Lagoon</td>
<td>Relocate picnic table (Figure 5) and use appropriate barriers to prevent access.</td>
</tr>
<tr>
<td>Mounds</td>
<td>Top Island</td>
<td>Include three sites in the fenced area around Top Island Reference Area. Encourage monitoring of these sites and comparison with neighbouring unfenced sites to determine the effects of cattle and horses.</td>
</tr>
</tbody>
</table>
6.2 EUROPEAN HERITAGE

Many sites of historical interest are located in the forest, which has itself been shaped by human activity. A brief historical summary is given in Section 16.2 of DCE (1990), and more detail is available in Fahey (1988), LCC (1983) and Curr (1965). Several sites of interest are outlined below. However, very few artefacts are left in the forest, and a name and location is all that remains of most sites.

Cornalla Landing (Figure 5) is the site of a crossing to Cornalla Station directly over the river in NSW. The property was settled in 1843 - one of the earliest in the district. Stores and livestock were brought across the river by punt. In the 1880s a mill on this site was exporting railway sleepers to India.

There were various spot mills in the forest in the period 1860 to 1910. Green Engine (Figure 5) is the site of one of these mills which was powered by a bright green steam engine. At Thistle Bed (Figure 5), an old boiler near the river is from a sawmill operated by Corry from 1924 to 1934. Other mills were located at Barmah Island, Ramp Track, Trickeys Track, Bunyip Waterhole, Tram Island, Eddies Track, Tarra, Stewart's Kitchen, Cornalla Landing, Long Plain Track and near Black Engine Lagoon (Figures 1 & 5). Several mills were also located just outside the forest.

Punt Paddock Lagoon (Figure 5) was named after a cable operated punt which connected the colonies of Victoria and NSW in the 1860s and '70s. The punt could be swung downstream to let river boats and barges through and was large enough to carry a buggy and several horses. The paddock was used to hold cattle waiting to cross on the punt. The punt keeper lived in a hut by the river bank.

This hut was later moved to the Cherry Tree yards (Figure 1). The area was often used as a camping area for forest workers during flood times. A well and a couple of wooden huts were established, but no evidence of these remain. However, remnants of the wooden fences which were used to hold cattle up until the 1950s are still present.

Several cuttings were dug in the forest to aid the transport of logs by pontoon or paddle steamer. The remains of one of these cuttings can still be seen between Harbours Lake and Compass Swamp (Figure 1).

Late last century logs were removed from the Tram Swamp and Tram Island area via a wooden tramline running to Nicholas Mill, which was situated at the site of the present Murrays Mill (Figure 1).

Long Landing was the site of a landing used for loading logs for transport via the river to Echuca from 1860 to 1930s. Other similar landings along the river were located at the Gulf, Honeymoon Bend, Stewart's Kitchen, Mill Log Landing, Bull Paddock, Sapling Landing, Rowes Camp and Burnt Landing (Figure 5).

Reminders of early logging techniques, including stumps with springboard holes and logs from which sleepers were hewn with a broad axe, are scattered through the forest.

During summer local people used to go to the Picnic Ground (near the Rookery, Figure 1) to use water from the nearby water holes. The area became established as a place for meeting friends and socialising. A regular event known as the Harvest Home and Farmers Union Picnic was organised, and sporting activities took place on a prepared track. The picnic was held in the forest in most of the years between the 1880s and 1944.

Mannions Yards (Figure 1) were formerly used for mustering on the Yielima end of the forest. They were shifted to this site from the Picnic Ground in 1922.
Aims and actions

To protect sites and artefacts of historical interest

To undertake further documentation of historical features

To improve interpretation of historical features

High Compile a register and map record of European historical sites and artefacts in the forest.

Medium Encourage compilation and publication of an inventory of place names and their origins.

Medium Revise and republish the Barmah Forest Self-drive Tour leaflet (Chapter 10), emphasising selected features of historical interest, including the boiler at Thistle Bed and cattle yards at Cherry Tree.

Ongoing Monitor visitor use of historic sites.

Ongoing Ensure management actions do not adversely affect old sawmill machinery at Thistle Bed, cattle yards at Cherry Tree, and evidence of the pontoon cutting near Harbours Lake.

As needed Investigate areas prior to earth works to ensure that features of historical or cultural interest are identified and protected.
7 MANAGEMENT FOR ACCESS

A network of tracks exists over the entire forest, so that no area is much more than a kilometre from the nearest vehicle access. However floodwaters make many tracks impassable for several months each year. DCE is responsible for the maintenance of all tracks within the forest.

Public vehicle access is important in providing opportunities to use and enjoy the forest. The current network of tracks is adequate for fire suppression, timber harvesting and recreation requirements. Whilst improvement in the standard of some tracks may be desirable for ease and comfort of access, regular flood damage makes extensive upgrading impractical.

Since recreation activities are concentrated along the river, it is appropriate that vehicle access be provided to suitable sections of the river, consistent with overall management objectives. Good quality access is also required on suitable routes for nature drives and general recreation access.

Tracks in the forest have been classified according to their function and degree of use (Figure 4). Primary Tracks are major access routes through the forest, and are extensively used by day visitors for pleasure driving, as well as by other recreationists and forest users. Secondary Tracks are used by recreationists to gain access to camping, fishing or hunting areas, and by timber workers and DCE staff. Management Tracks may only be used by DCE staff or other authorised persons.

Tracks are generally rough, but accessible to two-wheel drive vehicles if they are not wet. Severe damage to tracks is caused by flooding and indiscriminate use by four-wheel drive vehicles. Cattle and horses also cause extensive damage by pugging the surface of wet tracks. Many tracks are graded every year, as the need arises and funds permit.

Sections of the public levee (Figure 6) are commonly used by vehicles, especially between Morgans Beach and Ulupna Creek. This practice causes damage to the levee and can be dangerous when the surface of the levee is slippery. Alternative access is available adjacent to the levee, except when the forest is flooded. Tracks entering the eastern half of the forest also cross the levee. The levee is maintained by the Ministry of Planning and Housing.

There are twenty-nine access points into the forest. Their number and location pose difficulties for management of vehicular activities and restriction of access when the forest is flooded.

Four-wheel drive vehicles and trail bikes are often used off-road, especially to gain access to camping or fishing sites along the river. Off road vehicle use is prohibited by the Land Conservation (Vehicle Control) Regulations 1973 of the Land Conservation (Vehicle Control) Act 1972.

Opportunities for walking without vehicle intrusion are limited because of the extensive vehicular track network. There is potential for closing roads in the State Park to broaden recreation opportunities, aid preservation of ecosystems and protect Reference Areas. Tracks may either be closed and revegetated, or closed to public access and maintained for management purposes.

A vast network of unofficial tracks exists along the river, where people have gained access to campsites and fishing spots. Some of these tracks cause unacceptable vegetation damage, soil compaction and disturbance to the river bank.

Aim and actions

To provide access for a wide range of uses and visitors, including timber production, grazing, apiary, pleasure driving, camping, horse riding and walking, consistent with other values.

To prevent damage to wet tracks by four wheel drive vehicles.

To reduce the accessibility of Reference Areas.

To improve the opportunities for walking unaffected by vehicles.
To prevent the proliferation of undesirable tracks, particularly along the river

**High** Close and allow to revegetate War Plain and Bullock Hole Tracks (Figure 4), to reduce damage to wetlands and broaden recreation opportunities (Chapter 9).

**High** Rationalise the track network along the river (Figure 5), maintaining those tracks indicated, closing and where necessary revegetating designated tracks or tracks which do not appear in Figure 5. Where necessary, delineate acceptable tracks, camping and parking areas according to approved site plans (Section 9.2.2) and the guidelines given in Section 9.1.

**High** Ensure all public roads and tracks are adequately signposted (Section 9.1) and that accurate maps are available (Chapter 10). Where appropriate signs should indicate the destination of the track.

**High** Close the following tracks (Figure 4) except to management vehicles:

- Emu Track, Pig Hole Track, Little Budgie Track (to reduce access to Reference Areas)
- Island Lagoon, Gowers (part), Boals, Steamer, Centre, Dinny's Dip, and Mill Log Tracks, River Track in the vicinity of the Cutting, and various minor unnamed tracks (to reduce damage to key wetlands and box ridges, close unnecessary access and improve opportunities for walking and recreation away from vehicle traffic).

**High** Close Reference Track and maintain access for management vehicles following outside the new fence line (Section 8.2, Figure 6).

**High** Develop signs and barriers to ensure that as far as possible road closures are effective.

**Medium** Close and allow to revegetate any tracks not indicated in Figures 4 and 5.

**Medium** Close duplicated sections of tracks, except where duplication is required for the passage of heavy vehicle around bridges.

**Medium** Close some access points into the forest to the general public as indicated in Figure 4. Access at these points will still be available for management vehicles and in case of emergency.

**Medium** Maintain the Sand Ridge Track, the River Road between Thistle Bed and the Gulf (Figure 5) and the Gulf Track to ensure a suitable route through the forest for buses. Ensure the maintenance causes minimal disturbance to vegetation, drainage patterns and landscape values.

**Medium** Improve the road from the Sand Ridge Track to Budgee Creek via Hut Lake (Figure 4) and construct a turning circle to allow visitors ease of access to and from Hut Lake and Budgee Creek.

**Low** Investigate the opportunities for relocating some tracks to less flood-prone alignments.

**Ongoing** Provide the road access system shown in Figures 4 and 5 for public use. Maintain these tracks as funds permit, giving priority to primary tracks.
Ongoing Liaise with the Ministry of Planning and Housing to:

- maintain those sections of track which cross the public levee (Figure 6)
- allow DCE to use the levee for management access
- prevent public access to the levee (except where the levee is crossed by public tracks).

Ongoing/ As needed Monitor the impact on Top End Reference Area of visitor pressure arising from use of nearby camping areas (Figure 5). If there is evidence of unauthorised access into the Reference Area, investigate prescribing these areas for day visitor use only, or closing access to this section of the river altogether.

Ongoing Enforce the Land Conservation (Vehicle Control) Regulations 1973 of the Land Conservation (Vehicle Control) Act 1972, which prohibit the use of vehicles off-road. Use ranger patrols and written material to educate visitors regarding legal and acceptable vehicle use, and where this fails, prosecute offenders.

Ongoing Liaise with the Shires of Nathalia and Numurkah regarding maintenance of access roads to the forest and closure of access points into the forest. Liaise with the Shire of Nathalia regarding sealing the section of gravel road between Barmah township and the entrance to the forest.

As needed Close roads when flood waters make them impassable or liable to excessive damage.

As needed Allow the creation of temporary tracks for management purposes such as fire suppression and legitimate uses such as logging. Upon completion of operations these tracks will be closed and if necessary rehabilitated.
8 MANAGEMENT FOR UTILISATION

Utilisation of the forest for timber, grazing, apiary and other purposes is permitted under the National Parks Act 1975 and the Forests Act 1958. These activities will be managed to minimise their impact on flora, fauna, recreation, cultural and landscape values.

8.1 TIMBER AND WOOD PRODUCTS

Extensive logging has been carried out in Barmah Forest since the 1860s. It has been estimated that 2.5 million cubic metres of River Red Gum (Eucalyptus camaldulensis) logs have been harvested since that time (FCV undated). The range of wood products taken from the forest includes sawlogs, railway sleepers, piles, poles, fence posts, firewood and charcoal (Dexter 1978). A small volume of Grey Box (Eucalyptus microcarpa) is also cut. Yellow Box (Eucalyptus melliodora) and Black Box (Eucalyptus largiflorens) are not harvested.

In harvesting operations preference is given to production of sawlogs, with sleepers cut from the tree heads and lower quality trees. Piles and poles are also obtained on a thinning basis and faulty sections are sometimes utilised for sleepers. Firewood is cut from logging residue under commercial and domestic licences, and is gathered and used by campers. Charcoal for use in barbeques, steel production, industrial filters and cosmetics is occasionally produced from River Red Gum in a metal kiln located in the forest (Figure 6).

The silvicultural system applied to the majority of River Red Gum stands in the forest is called a 'selection system'. This technique creates an uneven aged forest in which the oldest trees are harvested when they reach optimum commercial size. Younger trees are thereby released from competition and regeneration occurs in the gaps. Younger trees which will not benefit from release or are of poor form may also be harvested for sleepers or farm timbers.

Selective harvesting takes place over areas between 30 ha and 150 ha for sawlogs and up to 200 ha for sleepers. In some cases, to create favourable sites for regeneration, groups or patches of trees may be felled, leaving a number of seed, habitat and merchantable trees within the patch. If the patch size is greater that 10 ha, then the area is deemed to be under a clearfelling system. Very little clearfelling has taken place in Barmah Forest.

In most of the forest regeneration has occurred after logging, but in places this regeneration is being suppressed by remaining older trees. Past utilisation and damage by fire and insects has created some areas of unmerchantable forest, with a high proportion of trees unsuitable for sawlogs or sleepers.

Regeneration needs to be of sufficient density to ensure minimal branching and long bole-length. Once this has been established and the dominant trees are readily identifiable (usually after 20 or 30 years), thinning may be required to maximise growth of the dominant regenerating trees (Incoll 1981, Minko 1987). At present there is no market for such thinnings, which has discouraged desirable silvicultural treatment.

Three sawmills take logs from the forest and another two operators have small scavenger licences. One sawmill is located in the forest (Figure 6) in accordance with occupation licence No. 169 issued under the Forests Act 1958.

V/Line is virtually the sole market for sleepers and production is regulated by allocation of fixed quotas to a number of licensed cutters. During 1988-89, five permanent and one temporary cutters were working in the forest.

The major objective of the Timber Industry Strategy is to manage forests on a sustainable basis for sawlogs and for all other non-wood products and values.
Sustainable sawlog and sleeper resources based on the timber assessment of the Barmah Forest (CFL 1987e) and the requirements of Section 25B of the National Parks Act (see below) are shown in Table 7. In July 1989, fifteen year licences (for the State Forest) and five year licences (for the State Park) were made available to the timber industry for harvesting the sawlog volumes shown in Table 7. Similar licences for annual allocations of 2000 sleepers were also offered to each of the five sleeper cutters, and two further quotas made available to bring the cut up to sustainable cut.

Extraction of firewood, fencing materials and charcoal will be managed according to prescriptions and guidelines outlined in the Mid-Murray Forest Management Plan.

In the State Forest 22 per cent of the total area (37 per cent of sawlog volume and 27 per cent of sleeper resource) has been excluded from harvesting to protect recreation and landscape values, and minimise the impact of logging on wetlands, wildlife, waterways and other features. These exclusions will be reviewed by the Mid-Murray Forest Management Plan.

About 13 per cent of the sustainable sawlog and sleeper resource is in the State Park. Parliament provided for timber harvesting in the State Park under Section 25B of the National Parks Act 1975. Section 25B Sub-section 7 also indicates that timber harvesting may continue indefinitely in Barmah State Park.

**TABLE 7  TIMBER RESOURCES**

<table>
<thead>
<tr>
<th>Sawlogs (cubic metres per annum)</th>
<th>Sleepers (number per annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Cut State Forest</td>
<td>3 430</td>
</tr>
<tr>
<td>Sustainable Cut State Park</td>
<td>530</td>
</tr>
<tr>
<td>Total Sustainable Cut</td>
<td>3 960</td>
</tr>
</tbody>
</table>

An agreement drawn up under Section 25B of the Act outlines the prescriptions that apply to harvesting of River Red Gum in the Park, including the following conditions:

- sawlogs may be harvested, and sleepers and minor forest produce only taken from the sawlog residues - there will be no 'sleeper only' operations

- harvesting is excluded from:
  - between the River Road and the Murray River
  - within 100 m of the high water line of Barmah Lakes and other semi-permanent treeless swamps
  - between Barmah Lakes, Cutting Creek and the Murray River
  - within 40 m of box ridges near Machonies, Top Duck Holes, Mannions Yards, Boyles Crossing and Bunyip Hole
  - within 20 m of main tracks and creeks
  - east of Morgans Beach Recreation Reserve
  - within sites of special ecological, historic, recreational, education or landscape value and a surrounding buffer sufficient to protect the feature from damage, as defined on maps held in the Benalla Regional Office

- harvesting will attempt to provide a balanced distribution of age class and tree forms, and a representative proportion of the dominant class will be retained in each coup. These dominant trees will be reserved from harvesting in future cutting cycles.
The above exclusions and non-productive areas comprise about 60 per cent of the Park area (Figure 6). DCE staff monitor logging that takes place under the agreement and make annual inspections of areas to be logged. There is no provision in the agreement for future harvesting of box species within the Park. The agreement will be reviewed during the next three years.

Aims and actions

To provide a sustainable supply of timber products to the community

To maintain a viable local timber industry

To thin forest where economically viable and environmentally and silviculturally desirable

To provide maximum possible protection for all native plants and animals in the State Park

To minimise the effects of logging on significant plants and animals

To minimise impact of logging on cultural, recreation and landscape values

State Park

Ongoing  Harves River Red Gum in the Park, excluding the areas shown in Figure 6, according to the agreement reached under Section 25B of the National Parks Act. Do not harvest box species.

State Forest

High  Conduct thinning and culling operations according to the Mid-Murray Forest Management Plan.

Medium  Issue a licence under the Forests Act 1958 to the owner of the charcoal kiln for occupation of the kiln site (Figure 6).

Ongoing  Harvest River Red Gum timber from Zone 4 according to the prescriptions detailed in the Mid-Murray Forest Management Plan.

Ongoing  Harvest River Red Gum timber from those parts of State Forest included in Zone 1, according to the following guidelines:

. Marking of trees to be harvested will follow a single tree or group selection system with the intention of retaining individual trees of good form in all age classes.

. A representative proportion of the present dominant class will be retained in each coup after harvest.

. Trees having special value as habitat for native fauna are to be retained and protected from damage as far as is practicable. These should include all veteran trees, selected large trees and trees with hollows, and trees with nesting sites for waterbirds, birds of prey, or species listed in Table 5.

. In addition to those areas excluded by prescriptions contained in the Mid-Murray Forest Management Plan, exclude harvesting from the vicinity of:

  . Black Box forest and associated rare plants (Section 5.2) in Goose Swamp
  . Flaccid Flat-sedge (Cyperus flaccidus) in Rowes Swamp
  . Variable Spike-sedge (Eleocharis minuta) at Goose Neck.
Management for utilisation

Ongoing Permit low intensity harvesting of Grey Box in Zone 4 in accordance with prescriptions outlined in the Mid-Murray Forest Management Plan.

Ongoing Exclude harvesting (except where necessary for public safety, to maintain the health of stands, or works associated with road maintenance, approved desnagging or river bank protection works) from:

- Zones 2 and 3
- the vicinity of various wetlands, creeks, tracks and other features as identified and detailed in the Mid-Murray Forest Management Plan.

Ongoing Allow removal of firewood in Zone 4 under licence according to the Mid-Murray Forest Management Plan. Licences will direct collectors to specified areas, which will exclude box ridges and areas shown to be significant habitat for the Tuan, Carpet Python (*Python spilota variegata*) and Hooded Scaly-foot (*Pygopus nigriceps*) (Section 5.3).

Ongoing Issue a licence under the Forests Act 1958 to Murrays Sawmills Pty Ltd for occupation of a 1.2 ha sawmill site (Figure 6).

General

High Encourage research into the effects of timber harvesting on native flora and fauna and improve management prescriptions as further information becomes available. Undertake a survey of timber resources to assist in establishment of cutting levels and desirable forest structure.

Medium Encourage further silvicultural research on topics such as thinning, regeneration, culling unmerchantable trees, and harvesting techniques.

Ongoing Avoid impacting on populations of significant plant species and protect them as necessary (Section 5.2).

Ongoing Ensure a diverse litter layer of branches leaves and logs is maintained to provide habitat for species such as Grey-crowned Babbler (*Pomatostomus temporalis*), Tuan and Carpet Python (Section 5.3).

Ongoing Protect forage trees of the Squirrel Glider and nest trees of Superb Parrot, White-bellied Sea-eagle (*Haliaeetus leucogaster*) and Peregrine Falcon (*Falco peregrinus*) (Section 5.3).

8.2 GRAZING

The Barmah Forest has been grazed by stock since 1840. Initially the area was mainly used to graze sheep. Sheep were excluded from the forest in 1885, and since then grazing has been restricted to cattle. Most of the forest is grazed under agistment, but several small areas are also grazed under licence.

Grazing licences

Grazing is carried out according to grazing licences issued under the Forests Act 1958 and a water frontage licence issued under the Land Act 1958 (Figure 6).

Four grazing licences (No.’s 4934, 5459, 6317, 6465) and part of water frontage licence No. 14 702 cover areas now within the State Park. Continuation of grazing in these areas requires licences to be issued under the National Parks Act 1975. Licences 4934, 6465 and 14 702 cover small areas fronting Ulupna Creek, thereby giving stock access to water. When Ulupna Creek is low, cattle sometimes cross the creek and intrude onto Ulupna Island. Because of its floristic values, the Ulupna Island section of the Park has been unavailable for grazing since 1980.
Two grazing licences are held over areas of State Forest. Licence No. 4590 covers a partially cleared area adjacent to Yielima P.R. which is used to graze cattle and grow crops, and licence No. 6474 covers a cleared area adjacent to Broken Creek.

**Agistment**

DCE offers members of two grazing associations (Barmah and Yielima) agistment for cattle on two segments of the forest, which are separated by a fence running south from Yielima P.R. (Figure 6). In 1988-89, 43 agistees grazed 1850 head of cattle on the Barmah run and 100 head on Barmah Island, while three agistees had 400 cattle on the Yielima run. Lower numbers are grazed during the winter.

Grazing by agistment helps maintain the viability of local farms. In 1984 the average income from forest grazing was of $4-5000 per farm, or 10 to 12 per cent of gross margins. Overall this represents $100 000 to $300 000 income to the region (ACIL 1984).

Most cattle are grazed during the summer, when the relatively well watered grass in the forest provides considerable feed in comparison to dry home paddocks. Cattle show a preference for Moira Grass (*Pseudoraphis spinescens*), which grows both on grass plains and as an understorey to River Red Gum. Moira Grass flourishes in the summer through to February after which time it becomes unpalatable to cattle. Other native and introduced grasses are also grazed.

Cattle quotas for summer and winter seasons are determined by DCE on the advice of the Barmah Forest Grazing Advisory Committee, which was formally established under Section 32F of the National Parks Act 1975. DCE employs a herdsman to manage cattle in the forest and oversee their mustering.

Cattle are mustered over a one to two week period in autumn. Cattle from the Barmah run are mustered into a holding paddock at Goose Swamp (Figure 1), then moved to a muster yard and some taken from the forest.

A bunkhouse and kitchen in the muster yard is used for accommodation during the muster and as a base for the social activities which follow. Fences and yards used for cattle management are shown on Figure 6. DCE is responsible for maintenance of these buildings and fences. Remnants of other fences and yards are also present.

The Victorian Parliament provided for cattle grazing in the State Park according to Section 32E of the National Parks Act 1975:

'the Minister may grant a licence to graze cattle in the Barmah Park to any person or persons whom the Barmah Forest Grazing Advisory Committee recommends as a fit and proper person or persons to be granted a licence.'

A grazing licence may be granted for a period of one year commencing on 1 May and allows the holder to graze cattle in any part of the Barmah Park except a Reference Area and Ulupna Island.

However, the intention of the Victorian Government's Wetlands Conservation Program is that:

'publicly owned wetlands will not be cultivated or grazed by domestic animals, except:

. where specifically permitted by previous Government decisions based on Land Conservation Council recommendations; or ...
. in areas where grazing is an important management tool for vegetation or habitat management, for control of pest plants and harbour of pest animals, for maintenance of areas of open water or for the reduction of fire hazard'

and

'Grazing on publicly owned wetlands of high value will be phased out within five years of a wetland being recognised as being of high value.'
Since Barmah is a high value wetland (Section 2.4), management must ensure grazing does not have a significant detrimental effect on wetland values.

Grazing by cattle, rabbits and horses may have altered the species composition and structure of several plant communities in the forest. However, no long-term studies have been done, so it is not possible to definitely correlate vegetation changes with grazing. Grazing by rabbits, horses and kangaroos is discussed in Section 11.3.

Some areas which once supported palatable reeds (Common Reed (*Phragmites australis*) and Cumbungi (*Typha orientalis*) have been taken over by Giant Rush (*Juncus ingens*). This may in part be due to grazing (Chesterfield *et al.* 1984). Most birds found in reeds also occur in Giant Rush, but some species find Cumbungi particularly attractive. Decline in the extent of reeds may have caused the demise of Brolga (*Grus rubicundus*) populations in the forest, as these birds feed on the tubers of Cumbungi. Other birds whose absence or low numbers may be due to insufficient reed habitat are Little Bittern (*Ixobrychus minutus*) and Spotless Crake (*Porzana tabuensis*) (Chesterfield *et al.* 1984).

Cattle graze and trample plants on the periphery of wetland areas, which may deprive waterbirds of food and shelter. Latham's Snipe (*Gallinago hardwickii*), which is protected under the Japan-Australia Migratory Birds Agreement, favours thick growth on swamp margins and may be adversely affected by grazing (BOC 1983).

Disturbance of understorey vegetation by cattle may have an adverse effect on species which feed, nest or shelter close to the forest floor. Breakdown of the soil caused by trampling hooves of cattle may have adversely affected burrowing snakes and lizards that were once more common in these forests (LCC 1983). Birds such as Brown Thornbill (*Acanthiza pasilla*) and Silvereye (*Zosterops lateralis*), and reptiles such as the Olive Legless Lizard (*Delma inornata*) and Hooded Scaly-foot (*Pygopus nigriceps*) are species which may be disadvantaged (Robertson *et al.* 1983).

When the forest is flooded cattle and other animals are forced to graze on areas of high ground, which typically support box woodlands. These floristically diverse communities have thus been subjected to particularly heavy grazing pressure, and changes in species composition and abundance have probably taken place. Overgrazing of box ridges exposes mineral earth and permits dense colonies of introduced species to become established. In addition, the herbaceous flora of box ridges is more sensitive to grazing than the grasses and sedges which predominate under River Red Gum. Experiments in mixed River Red Gum and box woodland near Cavendish in western Victoria (Arnold 1977) showed that grazing reduces both number of species and the biomass of ground plants.

The effects of cattle on significant plant species listed in Section 5.2 is unknown. The species now widely distributed and abundant in the forest are likely to be in equilibrium with current management, but this may not be so for less common species. The extent to which grazing has contributed to the status of the rarer species is unknown. The Flora and Fauna Guarantee Act 1988 requires that all taxa of Victoria's flora and fauna, other than disease organisms, survive, flourish and retain their potential for evolutionary development in the wild.

If grazing were removed there might be an initial heavy growth of weeds, especially on box ridges, as disturbed areas undergo a succession to a new equilibrium. However, it is not known how many introduced plant species would remain and compete successfully with native vegetation if grazing ceases, or what contribution grazing makes to the establishment, maintenance and control of weed populations.

Cattle cause considerable localised soil disturbance, especially on wet or muddy ground, churning up wetland areas and damaging roads and tracks. Tracks are often located on the higher ridges and therefore subject to concentrated use when the forest is flooded.

It is apparent from the above discussion that there is much that is not known about the impact of cattle on the forest. Removal of cattle could benefit native flora and fauna because of reduced grazing pressure and physical disturbance, but this benefit must be weighed against possible additional competition from weed species, at least in the short term, and an increased risk of high intensity fires.
High intensity fires were probably uncommon in the Barmah area before European settlement, because of the regular low intensity burning practised by Aboriginal people (Curr 1965, Lyons 1988). Now, however, it is not possible to use fuel reduction burns and maintain existing uses such as timber production (Section 11.1).

Definitive research is therefore required on the environmental costs and benefits of cattle grazing, and how cattle impact on the management objectives outlined elsewhere in this Plan, especially with respect to flora and fauna. The two Reference Areas, whose main function is to enable comparison of disturbed and undisturbed ecosystems especially when attempting to solve problems arising from the use of land (Section 1.1), will play a major role in this research (see actions below).

Aims and actions

To determine the effects of herbivores on wetlands, box ridges, native plants (especially significant species), weeds, fuel load, and Aboriginal sites

To manage cattle grazing to minimise impacts on forest values as far as is practicable

To manage grazing such that, where consistent with other aims, any contribution cattle may make to reducing fuel loads and controlling weed species is utilised

To maintain economic benefit to farmers and the local community provided this does not jeopardise other forest values

State Park

High Review grazing licence numbers 4934, 5459, 6317, and 6465 and that part of water frontage licence 14702 within State Park, and issue revised grazing licences under the National Parks Act 1975. Include in the licences conditions to control stocking levels and grazing seasons, prevent stock from straying onto Ulupna Island (in particular fencing of a 200 metre section of licence 14702), and other matters as required to ensure protection of Park values.

Ongoing Issue grazing licences under Section 32E of the National Parks Act as follows:

- summer and winter grazing on those parts of the Barmah run in the Park to members of the Barmah Forest Cattleman's Association
- summer and winter grazing on those parts of the Yielima run in the Park to members of the Yielima Forest Graziers Association.

Note: Since cattle which graze in State Park are not separated from those which graze in State Forest, one third of the total quota will be deemed to graze in the Park.

Ongoing Exclude cattle from Ulupna Island and Reference Areas.

State Forest

Ongoing Exclude cattle from Goose Swamp except for approximately two weeks during muster, or when grazing is desirable for reducing fuel load in the vicinity of Dharnya Centre and/or the forest boundary.

Ongoing Allow grazing by agistment as follows:

- summer and winter grazing on the Barmah run and Barmah Island to members of the Barmah Forest Cattleman's Association
- summer and winter grazing on the Yielima run to members of the Yielima Forest Graziers Association.
As needed Renew grazing licence Numbers 4590 and 6474 under the Forests Act 1958.

**General**

**High** Undertake a research project to assess the effects of herbivores on wetlands, box ridges, native plants (especially significant species), weeds, and fuel load. On the basis of this research, review cattle numbers, and the length and timing of grazing seasons, and where necessary determine further measures required to protect wetlands or native flora and fauna.

The project will use fences to differentially (where possible) exclude cattle and other herbivores, with replicate plots in all major vegetation types. About 25% of Tongalong Ridge and part of Machonies Ridge adjacent to the Top End Reference Area (Figure 6) will be fenced, and the two Reference Areas will also be utilised in the experiment. Suggested locations for other exclusion plots are shown on Figure 6, and discussed in Section 15.5.2 of DCE (1990).

**High** Use fences to exclude cattle from selected Aboriginal sites and encourage research on the impact of cattle as indicated in Section 6.1 and Table 6.

**Medium** Seek funds to undertake a cost/benefit analysis of cattle grazing.

**Ongoing** Liaise with the Barmah Forest Grazing Advisory Committee regarding cattle quotas and details of stock management.

**Ongoing** When practicable, the herdsman will direct cattle to areas where they will make maximum contribution to fire protection.

**Ongoing** Monitor the effects of cattle on populations of significant plant species and protect them as necessary (Section 5.2).

**Ongoing/Medium** Maintain fences, yards and buildings indicated in Figure 6 to an adequate standard for efficient cattle management. Remove remnants of unused fences, except at Cherry Tree where they are of historical interest.

### 8.3 APICULTURE

Honey production is permitted in both the State Park and State Forest (LCC recommendation approved by Government), but not in Reference Areas (LCC 1985). Under Section 21 of the National Parks Act 1975, the Director may grant a permit to keep an apiary in a Park for a period not exceeding six months, at a site designated by the Minister. The Reference Areas Advisory Committee has recommended that sites within 2 km of a Reference Area should be relocated if alternative sites become available (Section 5.5).

Apiary sites in the forest are administered under the Forests Act 1958, according to Forests 1976 Standing Instruction M311. The Instruction provides for Bee Farm and Range (BF&R) sites and temporary bee sites. BF&R licences are granted for a period of 12 months, and sites have a nominal radius of 1.6 km (range), and include a satisfactory location for placement of hives (bee farm) near the central point of the range.

A temporary bee site is an area which is useful to apiarists, but does not qualify for licensing as a BF&R because of its small size, poor access, short working season or other deficiency. Temporary sites generally have a nominal radius of 0.8 km and licences may be granted for three or six month periods.
DCE is currently reviewing the administrative arrangements and developing policies for the management of apiculture on public land. Eighteen apiarists have licences for 23 BF&R sites in the forest. There are also 30 temporary sites available. Of these, seven BF&R sites and five temporary sites are in the Park, and the range of five other sites includes sections of the Park. There is a need to rationalise the number and location of sites.

There is concern that introduced bees, both domestic and feral, may adversely effect native flora and fauna. The issue is still a subject of research, and no firm conclusions can be drawn at present regarding the effects of introduced bees on Barmah Forest.

Mature trees are preferred by apiarists because of their superior flowering characteristics. Apiarists use Barmah forest during the period of River Red Gum flowering, which occurs between December and February. In some years the trees do not flower at all, whilst in others there is a profusion of flowers which give a correspondingly heavy honey flow. Yellow Box and Grey Box are also utilised.

Apiarists require sites that have good access, are close to water and unlikely to be subjected to disturbance or vandalism by other forest users. Competition occurs between recreationists and beekeepers for use of some sites.

**Aims and actions**

**To allow apiculture in accordance with LCC recommendations**

**To minimise the impact of apiculture on conservation and recreation values**

**Reference Areas**

**High**
- Cancel the BF&R site impinging on the Top End Reference Area and make an adjacent vacant site available to the licensee.

**High**
- Relocate the BF&R site in State Forest whose range impinges on Top Island Reference Area.

**Ongoing**
- Relocate apiary sites that are within 2 km of the Reference Areas if alternative sites become available in State Forest.

**State Park**

**Ongoing**
- Licence the 11 apiary sites shown in Figure 6 under the National Parks Act 1975 and in accordance with National Parks & Public Land Division policy.

**State Forest**

**As needed**
- Licence the 19 BF&R sites and 18 temporary sites shown in Figure 6 under the Forests Act 1958 and the Forests 1976 Standing Instruction M311.

**General**

**Medium/As needed**
- Review bee farm locations to ensure that as far as possible apiarists do not place hives in close proximity to regularly used camping areas. Where competition occurs between recreationists and beekeepers for use and access to a licensed site, the Regional Manager may authorise the marking of farm sites to indicate that the licensed beekeeper has priority for use of the site.

**Ongoing**
- Allow apiarists to camp at their farm sites, under the same conditions that apply to the general public (Section 9.2.2).
Ongoing Encourage research into the effects of introduced bees on native flora and fauna.

As needed Where appropriate, the Regional Manager may authorise holders of apiary permits to:

- use tracks closed to private vehicles so they may gain access to apiary sites
- slash grass or take other measures to reduce the fire hazard on a bee farm site.

As needed Incorporate into this Management Plan any changes to the management of apiculture arising from the review currently being undertaken by DCE.

8.4 OTHER USES

Sand is extracted from a pit at Cherry Tree (Figure 6) by DCE for use in road maintenance. Unauthorised extraction of sand has also taken place along the Sand Ridge and at a site near Yielima P.R. (Figure 6). Road making materials and sand are readily available from private land surrounding the forest. Extractive industries have the potential to diminish landscape values, damage geomorphological features (Section 5.4) and cause localised damage to vegetation. No mining or exploration licences are current for the forest.

Two pipelines licensed under the Forests Act 1958 (No.’s 7089, 7104) pass for short distances through the forest and allow water to be drawn from the Broken and Ulupna Creeks (Figure 6). A channel site licensed under the Forests Act (No. 5667) and an associated pump and pipe (Figure 6) draw water from the Murray to supply private property. An unlicensed channel, pump and pipeline is located on Ulupna Creek (Figure 6). All these facilities except for the Broken Creek pipeline are within the Park.

The Rural Water Commission have issued 15 year diversion licences under the Water Act 1958 for all of these pipelines and channels. One further application for a pipeline passing through the Park has been received by DCE. Facilities in the State Park need to be licensed under the National Parks Act 1975. Pipelines and channels can have a local impact on landscape values.

Levee banks protecting private property occur on public and private land along the southern perimeter of the forest. The Ministry of Planning and Housing is responsible for the maintenance of the public levee (Figure 6). An unlicensed levee has been constructed on public land to protect the Yielima P.R. (Figure 6). The Murray Darling Basin Commission and their agents require access to regulators (Figure 1).

Military training is a legitimate use of public land (LCC 1985), but may have an impact on conservation and recreation values. The Army, State Emergency Services and Victoria Police occasionally use the forest for training exercises.

Telecom Australia has underground telephone cables passing through the forest to the Yielima P.R. and the Dharnya Centre, and an overhead SEC line passes through the forest to the Dharnya Centre (Figure 6). The SEC line has been sited and designed to minimise impacts on landscape values.

In the past many illegal dwellings were located along the river. DCE has progressively removed these from the forest. The only remaining occupations are a house in the vicinity of Picnic Point and a small shed near Morgans Beach (Figure 6). A private punt moored about 1 km downstream of Morgans Beach is sometimes used as a ferry across the river. Since no roads lead to the punt, access by vehicle is illegal (Chapter 7).

The University of Melbourne and Rural Water Commission are undertaking various research projects in the forest, including experiments relating to the physiology and ecology of River Red Gum and box and examination of groundwater hydrology. As part of this research, various bores and other equipment are located and used in the forest.
Aims and actions

To minimise the impact of sand extraction

To rehabilitate unauthorised sand pits

To allow surrounding landholders access to water, whilst minimising impacts on forest and Park values

To allow for the management of levee banks

To allow for, and minimise the impact of, training exercises by the Defence Forces, State Emergency Services and Victoria Police

To allow maintenance of existing public utilities in the forest

To remove illegal occupations

To provide for and encourage scientific research, especially that oriented towards solving management problems

High

Issue a licence under Section 26A of the National Parks Act 1975 for the pipeline currently licensed under the Forests Act (No. 7104).

High

Request owners to remove the illegal structures near Picnic Point and Morgans Beach. If necessary have the structures removed by DCE staff.

High

Ensure access to the punt moored near Morgans Beach is in accordance with vehicle and Park regulations.

Medium

Issue a licence under Section 26A of the National Parks Act 1975 for the channel site currently licensed under the Forests Act (No. 5667), including provisions for the channel to be replaced by a buried pipeline over the next five years. Adopt a similar procedure for the unlicensed channel, pipe and pump.

Medium

Rehabilitate the extraction area near Yielima P.R.

Medium

License the levee bank around Yielima P.R., giving responsibility for maintaining the levee to the licencee, and including conditions in the licence to prohibit the taking of materials from public land for maintenance of the levee.

Low

Assess historic value of disused pumps, pipelines and channels, and if appropriate remove debris and equipment and fill in disused channels.

Ongoing

Allow authorised Ministry of Planning and Housing personnel to have vehicular access as required for maintenance of the public levee.

Ongoing

Allow authorised Murray Darling Basin Commission personnel and their agents to have access as required to regulators.

Ongoing

permit military, emergency services and police training in accordance with Departmental policies such that:

- the types of activities, their timing and location be subject to agreement between the relevant organisation and DCE
- the training activities be carried out under conditions specified by DCE to avoid any detrimental effects
Management for utilisation

. training be excluded from Reference Areas and Zone 1.

**Ongoing**

Allow authorised personnel to have vehicular access as required for maintenance of Telecom and SEC installations.

**Ongoing**

Issue permits under the National Parks Act 1975 for the conduct of research in the Park. Manage research activities in State Forest in accordance with Departmental policy.

**Ongoing**

Prohibit the private extraction of sand and road making materials from the forest.

**Ongoing**

Site and design new pumps and pipelines, and where necessary modify existing pumps and pipelines, to comply with the following guidelines:

. pipes should traverse as short a distance as possible across public land

. pipes are to be buried for their full length, and after burial the original surface profile restored and the disturbed area allowed to revegetate

. where practicable, pumps should be housed to fit in with the bank profile, and preferably have a cover which sits flush with the river bank and is of suitable colour and material to blend in with the surrounding environment

. where practicable, encourage joint sharing of pump and pipeline facilities.

**As needed**

Extract sand for maintaining roads within the forest from the Cherry Tree Pit. Use of the pit will be designed to minimise impact on landscape values. When necessary for economic or environmental reasons, sand or other materials may be obtained from sources outside the forest, provided that the material is free of weeds or pathogens such as Cinnamon Fungus (Phytophthora cinnamomi).

**As needed**

Renew pipeline licence No. 7089 under the Forests Act 1958.

**As needed**

Assess future applications for pipeline access through the State Park or State Forest in terms of their visual and environmental impact, and where appropriate grant licences.
9 MANAGEMENT FOR RECREATION

This section sets out aims and actions for the many aspects of management that relate to the activities of visitors throughout the forest. Generally, the goals of visitor management are to pre-empt conflicts between visitor use and other values, and between various visitor uses.

The Barmah Forest is a popular destination for people from Melbourne and regional centres in the Murray Valley such as Shepparton and Echuca. The major attraction is the Murray River, which is the focus for most recreational activities. Wetlands and River Red Gum (Eucalyptus camaldulensis) forests are other features of recreational importance.

The importance of the forest to tourism and recreation is reflected in the number of visitors. Total visitor numbers for 1981 (excluding Ulupna Island) were estimated at 40,000 visitor days, with campers accounting for over three-quarters of these (Rumba 1981). Visitor use increased by an estimated 11 per cent per annum between 1978 and 1985 (CFL 1987b). No detailed survey has been carried out since 1981, but it is likely that about 100,000 visitor days were spent in the forest in 1988.

Most visits to the forest are made in the warmer months of the year, with peak periods from Christmas to mid-January, long weekends in January and March, and Easter. Visitor use is concentrated along the river at numerous picnic and camping spots. Due to flooding, access may be difficult or impossible during much of winter and spring.

Outdoor recreation experiences are available in settings that range from natural to highly developed environments. The range of settings determines the range of recreational opportunities. A technique known as the Recreation Opportunity Spectrum (ROS) assesses recreation settings based on access, level of development and intensity of use (CFL 1987f). The technique aims to ensure that a variety of recreation opportunities are available through the provision of a regional diversity of recreational settings.

The combination of activities, settings and experiences are arranged along a spectrum from least developed to most developed. Five classes are recognised in Victoria: remote, semi-remote, roaded natural, semi-developed and developed. Recreation settings in Barmah Forest fall into the semi-remote, roaded natural and semi-developed classes.

The ROS highlights the importance of Barmah Forest for providing recreational opportunities associated with predominantly natural settings. Such settings are uncommon in the mid-Murray region, because most of the land has been cleared for agriculture. In particular, the Barmah and Millewa Forests provide the only opportunities for recreation in semi-remote settings and contain the largest area of roaded natural settings in the mid-Murray region. There is potential for increasing the quality of semi-remote settings in the forest by closing some minor access roads to public vehicles (Chapter 7).

9.1 VISITOR FACILITIES

Few facilities are provided in the forest, in part because of the seasonal threat of flood damage. Vandalism of signs and facilities is also a problem. Fireplaces and picnic tables are located at many points along the river (Figure 5), and accommodation, toilets and interpretive facilities have been provided at Dharnya. A caravan and camping park at Morgans Beach has a kiosk, toilets and unpowered caravan sites. Caravan parks and motels are located in the nearby towns of Barmah, Nathalia and Strathmerton. Camping areas and facilities are discussed in Section 9.2.2.

Major entrances and tracks are well signposted, and State Park boundaries indicated at key locations. Several information shelters and notices of State Park Regulations are located at entrance points to the forest. Maps and brochures are available at DCE offices at Benalla and Nathalia, local tourist information centres and the Dharnya Centre.
A major government initiative is to improve access to parks for all members of the community. Both the Social Justice Strategy (Government of Victoria 1987b) and the Inquiry into Park Access (Government of Victoria 1987d) have recommended that steps be taken to provide a wider range of opportunities for disadvantaged groups. An improvement to facilities and access at the Dharnya Centre for disabled people is desirable.

**Aim and actions**

**To improve recreational opportunities by maintaining existing facilities and where appropriate providing new facilities**

High  Establish and maintain a register of visitor facilities.

High  In consultation with representatives from disabled groups and DCE Landscape & Architectural Services, construct a toilet and install other facilities as required at the Dharnya Centre.

High  Prepare and maintain a Signs Plan for the forest, and erect signs in accordance with the DCE Signs Manual.

Medium  Establish the proposed recreation facilities listed in Table 8.

Medium  Ensure facilities, where practicable, are suitable for disabled visitors.

Ongoing  Maintain and service regularly all the sites and facilities listed in Table 8.

Ongoing  Where practicable site facilities along the Murray River according to the following guidelines:

- locate picnic tables and fireplaces at least 10 m from the high bank
- terminate access tracks and car parks at least 20 m from the high bank
- ensure all signs are attached to posts, not living trees.

**TABLE 8  RECREATION SITES AND FACILITIES**

<table>
<thead>
<tr>
<th>Site</th>
<th>Access</th>
<th>Existing</th>
<th>Required</th>
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</thead>
<tbody>
<tr>
<td>Barmah Island</td>
<td>C,SB,B,H,P,</td>
<td>Pi,F,Uc,</td>
<td>Dc</td>
</tr>
<tr>
<td>Barmah Lakes</td>
<td>C,SB,LB,B,P,</td>
<td>Pi,F,I,Td,W,Uc</td>
<td>T,P,Dc</td>
</tr>
<tr>
<td>Dharnya</td>
<td>C,SB,LB,H,P,</td>
<td>Ic,A,P,Fi,I,W</td>
<td>-</td>
</tr>
<tr>
<td>Lake - Thistle Bed</td>
<td>C,SB,H,B,P,</td>
<td>Uc</td>
<td>W</td>
</tr>
<tr>
<td>Thistle Bed - Gulf</td>
<td>C,SB,H,B,P,</td>
<td>Pi,F,Uc,</td>
<td>Dc</td>
</tr>
<tr>
<td>The Gulf</td>
<td>C,SB,H,B,P,</td>
<td>Pi,F,Uc,Td</td>
<td>T,P,Dc</td>
</tr>
<tr>
<td>Gulf - Ulupna Is</td>
<td>C,SB,H,B,P,</td>
<td>Pi,F,Uc,</td>
<td>Dc</td>
</tr>
<tr>
<td>Morgans Beach</td>
<td>C,SB,LB,H,B,P,</td>
<td>T,K,Uc</td>
<td>P,Dc,I</td>
</tr>
<tr>
<td>Ulupna Island</td>
<td>C,SB,H,B,P,</td>
<td>Uc</td>
<td>T,Dc,I</td>
</tr>
<tr>
<td>Entrances to forest</td>
<td>C,SB,H,B,P,</td>
<td>Uc</td>
<td>I (Figure 6)</td>
</tr>
</tbody>
</table>

**Access Key**

- B Boat
- C Car
- H Horse
- LB Large bus
- SB Small bus
- P Pedestrian

**Facilities Key**

- P Parking bays
- Ic Information Centre
- Pi Picnic tables
- I Information shelter
- F Fireplaces
- T Toilet block
- Uc Undefined campsites
- Td Toilet disposal pit
- Dc Defined camping
- A Accommodation
- W Walking track
- K Kiosk

* Depending on flooding
9.2 RECREATION ACTIVITIES

Some recreation activities may conflict with one another, or may be in conflict with other aspects of forest management. These conflicts can largely be reduced through zoning, but where conflicts still occur within a zone, activities have been separated or further restrictions introduced in that zone.

The recreation activities permitted in each zone are shown in Table 9. The boundaries of zones are shown in Figure 2.

Aims and actions

To manage recreation use to prevent conflicts between users, and to protect the forest environment

To provide a wide range of recreation opportunities appropriate to the forest, particularly those that are limited outside of the forest

To minimize the impact of recreational activities on other values

To permit formal and commercial recreation use consistent with other management objectives

To educate visitors regarding changes of use brought about by declaration of the Park

High Close the roads indicated in Chapter 7 to provide improved opportunities for walking and recreation in a semi-remote setting.

Ongoing Allow recreation activities in zones (Figure 2) in accordance with Table 9.

Ongoing Undertake a long-term education program through ranger contact and publications (Chapter 10) to improve visitor awareness of their responsibilities and obligations when using the forest.

As needed Provide adequate ranger staff at peak periods to enable control over inappropriate and illegal activities and provide additional information to visitors, particularly with respect to the Park (Section 13.1).

9.2.1 Day visitors

Areas set aside for day visitor use where camping is not permitted are desirable to minimise conflict between these two user groups. Facilities generally required for day visitors are picnic tables and fireplaces. At present the only specific day visitor areas are located near the lake at the Dharnya Centre and on Barmah Lakes adjacent to the camping area. Facilities used by day visitors are also scattered in many places along the river (Figure 5). There is potential for another picnic area along the river to be reserved for day visitor use.

Aim and actions

To provide adequate recreational opportunities for day visitors

Medium Set aside an area at the Gulf for day visitor use as determined by the site plan for the Gulf camping area (Section 9.2).

Medium In consultation with DCE Landscape Services, develop the picnic area on the Budgee Creek near Hut Lake (Figure 6) for day visitors.

Ongoing Maintain the day visitor areas at the Barmah Lakes and exclude campers. Development of a site plan for this area (Section 9.2) may result in relocation of day visitor facilities.

Ongoing Maintain the day visitor picnic area at the Dharnya Centre.
TABLE 9 RECREATION ACTIVITIES IN ZONES

<table>
<thead>
<tr>
<th>Recreation Activity</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angling</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Grubbing</td>
<td>No(^a)</td>
<td>Cond</td>
<td>No(^a)</td>
<td>Cond</td>
</tr>
<tr>
<td>Bushwalking</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
</tr>
<tr>
<td>Cycling(^b)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Nature study</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Camping</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Canoeing</td>
<td>Yes</td>
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<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Boating(^c)</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Horse riding</td>
<td>Cond</td>
<td>Cond</td>
<td>Cond</td>
<td>Cond</td>
</tr>
<tr>
<td>Orienteering</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
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<td>Picnicking</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pleasure driving(^d)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Trail bike riding(^d)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Duck shooting</td>
<td>No(^e)</td>
<td>No(^f)</td>
<td>-</td>
<td>Yes</td>
</tr>
<tr>
<td>Hunting of feral animals</td>
<td>No(^g)</td>
<td>No(^f)</td>
<td>No(^f)</td>
<td>Cond</td>
</tr>
</tbody>
</table>

No Not permitted  
Yes Permitted under standard conditions and Regulations  
Cond Permitted under additional conditions (see appropriate section for details)  
- Not available or not applicable  
a Not permitted in the Park, nor in State Forest upon instigation of regulations (Section 9.2.3)  
b On public roads and management tracks, but not walking tracks or off-road  
c Includes Barmah Lakes and various creeks and lakes  
d Only on roads open to public vehicles by licensed drivers in licensed vehicles  
e State Park only, permitted in Zone 1 outside Park  
f Following instigation of regulations (Section 9.2.7)  
g Hunting of feral animals is permitted under permit for pest control (Section 11.3)

9.2.2 Camping

Most camping occurs along the Murray River, especially at Barmah Island, Barmah Lakes, the Gulf, between Yielima P.R. and Morgans Beach and at Ulupna Island. Camping is most popular during the summer vacation period, Australia Day and Labour Day weekends and Easter. Most campers stay for as long as their holidays allow, and many are regular visitors to the forest. About half the campers reside in Melbourne and another third live locally (Chalmers 1980).

Camping can be divided into three categories, depending on intensity of use:

- **camping grounds** provide for large numbers of people concentrated on a particular site (Zone 3)
- **camping areas** are usually small clearings which are regularly used and may cater for small to moderate numbers of people (Zone 2)
- **dispersed camping** occurs at a low intensity throughout Zones 1 and 4, with sites infrequently used.

Current facilities, camping grounds and camping areas are shown in Figure 5. Chalmers (1980) indicates that there is little demand amongst users for expansion or improvement to facilities.

Use of camping grounds and areas approaches saturation during peak periods, and demand for camping along the river is likely to continue to increase (CFL 1987b). Over-use of existing camping sites and ad-hoc creation of new sites will lead to degradation of the river environs (excessive vegetation damage, soil compaction, erosion of river banks, depletion of firewood) and loss of recreational opportunities (lack of secluded camp sites).
Camping grounds are located at Barmah Lakes, the Gulf, Morgans Beach (Zone 3) and on public land outside the forest adjacent to Barmah township. There is potential to more actively manage Zone 3 areas to provide for better waste disposal, reduce soil compaction and track establishment, rationalise firewood use and minimise conflict between campers. Many people use portable toilets, and disposal pits have been provided at Barmah Lakes and the Gulf. This arrangement is unsatisfactory because the pits are prone to flooding. There is also a toilet block located at Morgans Beach.

Camping areas are spread along the river (Zone 2). Facilities at these sites are minimal or non-existent. Track establishment, soil compaction and loss of vegetation are the major problems, as people seek and make access to new sites. Other concerns are rubbish disposal and toilet facilities. At present campers are encouraged to deposit rubbish in large waste bins provided during the summer at major entrances to the forest. Camping in other parts of the forest is generally at a low level, except during duck season, when camps are established in the vicinity of popular duck holes. Under Departmental policy campers are permitted a maximum stay of six weeks at any one site.

Aims and actions

To provide opportunities for a variety of camping experiences

To minimise degradation to the Murray River environs caused by uncontrolled camping

To manage camping along the river by controlling access

High Draw up detailed site plans to manage the number and location of campsites, traffic movement and facilities in Zone 3 (Barmah Lakes, the Gulf, Morgans Beach).

High In association with developments outlined in the site plans, construct sealed-tank toilets at Barmah Lakes and the Gulf. Include in the toilet design provision for disposal of portable toilet waste. Discontinue use of and rehabilitate the toilet disposal pits for portable toilet waste.

High Liaise with Morgans Beach Committee of Management (Numurkah Shire) to arrange for DCE to assume direct management of Morgans Beach Reserve. Ensure the site plan (see above) minimises conflict with the objectives of the adjacent Zone 2 (State Park). Integrate the facilities listed in Table 8 into the site plan.

High Define tracks and camping areas in Zone 2, as outlined in Figure 5 and Chapter 7, and rehabilitate damaged areas where necessary. Where necessary draw up site plans to delineate camping and parking areas, relocate access tracks away from the river and provide for or relocate fireplaces and picnic tables (see also guidelines in Section 9.1).

Medium Construct a pit toilet and an associated facility for disposal of portable toilet waste at Ulupna Beach (Figure 5).

Medium Establish a camping area for walkers on the Murray River at Cutting Creek (Figure 6).

Ongoing Allow dispersed camping in Zones 1 and 4, ensuring restrictions on vehicle access are observed (Chapter 7).

As needed Temporarily close access to any camping area in Zone 2 which becomes degraded until the area is restored to an acceptable condition.

As needed Assess the success of the above actions in preserving recreation opportunities along the river and preventing degradation to the river environs. If necessary to prevent over-use, investigate other measures such as limiting the number of people camping in the forest.
9.2.3 Fishing and grubbing

Fishing is one of the most popular activities for both day visitors and campers. Most fishing takes place along the Murray, and DCE has no jurisdiction over this activity. Licences issued by DCE are required for anglers using streams or waterways in the forest. Standard regulations apply with respect to legal fishing methods and size of fish caught.

Grubbing is the practice of digging or scraping the surface soil to expose the holes of Bardi Grubs, which are then extracted and used as bait. Anglers collect grubs both for their own use and for sale to other anglers. Grubbing is not permitted in the State Park under Park Regulation No. 301. Considerable localised soil disturbance and removal of ground vegetation is caused by grubbing.

Aims and actions

To provide opportunities for fishing without adversely affecting native fish populations

To prevent damage to significant areas caused by grubbing

High Investigate regulations to enable prohibition of grubbing in those parts of Zones 1 and 3 within State Forest (grubbing is not permitted in the State Park).

Ongoing Permit fishing throughout the forest providing the angler holds a current licence and observes the appropriate regulations.

Ongoing Manage grubbing in Zones 2 and 4 in State Forest according to the following guidelines:

- grubbing is not permitted on areas supporting box forest
- grubs may only be procured using hand tools
- soil removed in the process of grubbing must be replaced so as far as possible the original soil profile is restored
- approval of the Regional Manager is required for any commercial grubbing operations.

9.2.4 Boating

Boating is a popular activity along the Murray. A wide variety of craft are used, including power boats, house boats, canoes and dinghies. Management of boating on the Murray is the responsibility of the NSW Maritime Services Board. On waters in Victoria, boating is managed under the Marine Act 1988, and is the responsibility of the Victorian Marine Board. The Marine Act also provides for the appointment of local authorities to manage particular bodies of water.

The Director-General DCE has been appointed as the local authority for all waters within Barmah State Park. In addition, a notice issued under Section 15(2) of the Marine Act 1988 (Government Gazette G42 October 1989) places a speed restriction of five knots on all waters within Barmah State Park.

Under the Wetlands Conservation Program, power boating is not permitted on sensitive wetlands or on wetlands of high conservation value. The Program also recommends that the effects of power boating on wetlands be monitored, and where necessary restrictions on boating introduced.

Power boats, particularly when used for water-skiing, can cause disruption to some campers, may exacerbate river bank erosion and are in conflict with recreational pursuits such as swimming, fishing and general relaxation. Water-skiing is more popular on other sections of the Murray (e.g. around Echuca and Yarrawonga) than through the forest. The NSW Maritime Services Board has established 8 Knot Zones in the vicinity of Picnic Point and Barmah township and a No Skiing Zone from Tonis Bend to Broken Creek (Figure 6).
Boats are launched at many locations along the river. In high use areas boat ramps have been cut into the natural river levee. Proliferation of these ramps is undesirable because of the impact they have on the river bank.

Houseboats often moor at the mouth of Barmah Lakes. In the vicinity of the forest, the NSW Maritime Services Board has issued mooring licences for houseboats at Barmah Township and Yarrawonga (Victorian side of the river) and Picnic Point (NSW side of the river). In the course of a journey, houseboats may moor for short periods of time at other locations along the river. Owners of houseboats moored at Barmah Lakes have in the past established semi-permanent camps adjacent to their houseboats.

DCE has published a leaflet outlining the route of a canoe trail along the Budgee Creek (Figure 4). Canoes are available for hire to groups staying at the Dharnya Centre. There is potential to provide ranger-guided nature tours along waterways in the forest (Chapter 10).

**Aims and actions**

**To encourage safe and responsible use of boats**

**To minimise conflict between power boats, and in particular water skiing, and other recreational activities**

**To protect the natural values of Barmah Lakes and other waterways within the forest**

**To minimise bank erosion**

**High** Liaise with the NSW Maritime Services Board to extend restricted boating zones so that water skiing and/or speed restrictions apply along the Murray from Barmah township to Picnic Point, Nine Panel Bend to the Gulf and in the vicinity of the popular beaches on Ulupna Island (Figure 6).

**High** Ensure owners of houseboats are required to observe the standard time limit of six weeks for occupation of camping sites.

**Medium** Under the Marine Act 1988, seek to have the Director-General DCE appointed as the local authority for waters within Barmah State Forest.

**Medium** Include in the investigation into bank erosion (Section 5.1) an assessment of the impact of power boats.

**Ongoing** Liaise with the NSW Maritime Services Board regarding mooring and use of houseboats.

**Ongoing** Maintain the boat ramps indicated in Figure 5, so as to minimise their impact on landscape values and the river bank. Prevent establishment of additional boat ramps and require persons launching boats outside the designated ramps to observe regulations regarding off-road vehicle use. Boats may be launched from camping or picnic areas that abut the river bank provided no damage is sustained to the bank.

**Ongoing** Monitor the use and impact of power boats on wetlands within the forest.

**Ongoing** Maintain the Budgee Canoe Trail by removal of the minimum amount of debris such as fallen logs.

**9.2.5 Pleasure driving, four-wheel driving and trail bike riding**

Pleasure driving is a popular activity along various roads and tracks in the forest. The River Road is the most popular and scenic route. A self-guided tour has been devised by DCE to introduce visitors to a number of features of the forest. Well signposted tracks and accurate maps are important for safe and enjoyable driving.
Trail bikes are ridden extensively throughout the forest. There is conflict between the riders and people pursuing passive recreation such as camping or fishing. The problem is most evident along the river, particularly at heavily used camp sites. The bikes also cause some localised damage to soil and vegetation. Riders and bikes often breach the Road Safety Act 1986 by being unlicensed.

Off-road driving and riding is not permitted under the Land Conservation (Vehicle Control) Regulations 1973 of the Land Conservation (Vehicle Control) Act 1972. The Wetlands Conservation Program requires that these regulations are vigorously enforced on public wetlands.

Aims and actions

To provide access where appropriate for pleasure driving

To interpret features of the forest visible from major access routes

To minimise conflict between motorised and non-motorised recreation activities

High Ensure tracks are adequately signposted (Section 9.1) and accurate maps are available (Chapter 10).

Medium Revise and republish the Self-drive Guided Tour brochure (Chapter 10).

Ongoing As far as possible maintain approved public access tracks (Figures 4 and 5) in such a condition as to allow comfortable driving, with priority being given to Primary Tracks and access to camping areas.

Ongoing Enforce regulations under the Land Conservation (Vehicle Control) Act, and cooperate with the Victoria Police to prevent off-road and illegal vehicle use.

9.2.6 Bushwalking and cycling

Walking is a moderately popular activity in the forest, although many campers remain in the immediate vicinity of their campsite, and only go for short strolls. The only walking tracks currently available are in the vicinity of the Dharnya Centre (Figure 4). There is potential to develop more walking tracks and it is likely that walking would become more popular in the area if such development took place. It is desirable that as far as practicable walking tracks should be accessible to disabled people (Section 9.1).

A major difficulty in establishing routes in Barmah is the restricted access and damage sustained by tracks when the forest is flooded. New tracks must be designed to be visually pleasing, and should provide an interesting route through a diversity of environments, while not impacting on significant environmental features.

Cyclists occasionally tour through the forest, mainly using established access tracks. Cycling on walking tracks can conflict with walkers' safety and enjoyment.

Aims and actions

To provide opportunities for walking uninterrupted by vehicles and interpret features observed from walking tracks

To provide appropriate access for disabled people and cyclists

Medium Establish a circuit walking route from Barmah Lakes to the Murray River north of the Cutting and return via Hut Lake, as indicated in Figure 4. The route could take one or two days, covers a variety of vegetation types, and provides the opportunity for an overnight stop at a campsite on the Murray at Cutting Creek (Section 9.2.2). Day walkers would be able to undertake shorter sections of the route, commencing from either Barmah Lakes or Hut Lake. The proposed route is regularly covered by floodwaters, so marking of the route is generally more appropriate than constructing a formed track.
Management for tourism and visitor education

Ongoing/Medium

- Maintain walking tracks in the vicinity of the Dharnya Centre and Barmah Lakes (Figure 4), and:
  - construct boardwalks along sections of the tracks to enable access into flooded forest and minimise damage to tracks when they are wet
  - ensure that, where practicable, tracks are accessible to disabled people
  - include consideration of these tracks in the Site Plan for Barmah Lakes (Section 9.2.2)
  - devise a nature trail on one of the tracks
  - publish brochures on the walking tracks and nature trail (Chapter 10).

Ongoing

- Monitor use of the walking track. Review the desirability of closing the River Track south of the Forcing Yard Track (Figure 4) to public vehicles, to further improve walking opportunities along the river.

Ongoing

- Permit cycling on Primary, Secondary and Management Tracks (Figure 4), but not walking tracks.

9.2.7 Hunting and shooting

Duck hunting is a moderately popular activity in the forest, and is controlled on a seasonal basis by DCE. Shooters also hunt pigs, foxes and rabbits. Occasionally, agisted cattle are illegally shot and butchered, and illegal hunting of protected wildlife also occurs.

Under the National Parks Act 1975, the carrying of firearms and hunting are not generally permitted in the Park. Problems with this prohibition arise with the carrying of firearms along Sand Ridge Track, which is a major access route through the Park to neighbouring State Forest. Sections 32G and 37 of the Act provides for firearms to be carried in the Park by authorised persons approved by the Director of NPW for control of feral animals and other purposes. Firearms may also need to be carried and used in the Park for cattle management.

Complaints have been received by DCE regarding the indiscriminate and sometimes dangerous use of firearms, especially with respect to shooting in the vicinity of camping areas.

Aims and actions

To minimise the conflict between shooters and other forest users
To prevent the indiscriminate and dangerous use of firearms
To provide for the use of firearms to assist control of feral animals and cattle management
To manage hunting in the State Forest

State Park

- Permit licensed shooters to carry firearms along Sand Ridge Track in Barmah State Park according to Section 37 of the National Parks Act 1975.

- When necessary for control purposes, allow hunting for feral animals in the State Park by licensed shooters under permit issued by the Director of NPW in accordance with Sections 32G and 37 of the National Parks Act 1975.

- Allow those office bearers of the Barmah Forest Cattleman's Association and the Yielima Forest Graziers Association authorised by the Director of NPW to carry and use firearms for cattle management.

State Forest
High Prepare regulations under Section 99 (29) of the Forests Act 1958 to prohibit shooting in those parts of Zones 2 and 3 within State Forest (firearms may be carried in these areas), and to limit firearm use in those parts of Zones 1 and 4 in State Forest to shotguns (except where other firearms are required for management purposes).

Ongoing Allow hunting of feral animals, and duck hunting in approved seasons, in Zones 1 and 4. Use of hunting dogs is discussed in Section 9.2.10

9.2.8 Horse riding

Local people, riding club members and tourists ride along tracks and off-road through the forest. Groups of riders and their horses camp overnight in the forest. Horses are also used for management of stock. Commercial operators based on private property adjacent to the eastern section of the Park conduct riding tours through the forest and have offered horses and a horse-drawn wagon for hire. Commercial operations in the forest must be covered by an appropriate licence or approval (Section 9.2.9).

Off-road, horses can contribute to the spread of weeds, damage soil and vegetation, especially in wet areas, and promote track establishment. Horses can also cause damage to wet tracks.

Camping with horses significantly increases trampling and grazing impacts. Responsible camping practices are essential in maintaining camp sites.

Aim and actions

To provide opportunities for horse riding without endangering conservation values or conflicting with other users

High Publicise the above guidelines amongst riding clubs and through ranger contact with other riders using the forest.

Ongoing Allow horse riding on Primary, Secondary and Management Tracks, but not on walking tracks (Figure 4).

Ongoing Prohibit off-track riding on Ulupna Island. Encourage riders in the rest of the State Park to ride on tracks. Discourage access to wetlands (especially between May and December), the environs of the Reference Areas and box forest by encouraging riding clubs and other riders to check with the Park office.

Ongoing Allow camping by horse riders and their animals only in Zones 2 and 4 and the muster yards, according to the following guidelines:

- camping locations for groups using between 5 and 15 horses must be approved by the Barmah Ranger-in-Charge or an appropriate Departmental Officer
- allow a maximum group size of 15 horses
- horses should either be tethered or kept in temporary yards of sufficient size to prevent excessive grazing or trampling. Yards should be constructed so as to not disturb any standing vegetation and dismantled after use.
- permit a maximum of two nights stay at any one camp. Vehicles and horse floats must not leave recognised access tracks or parking areas.
- as far as possible weed-free feeds should be used.
- avoid camping in close proximity to other campers.
9.2.9 Organised events and commercial operations

Organised community events, such as the festivities associated with the annual cattle muster, or sporting events such as orienteering, must be managed to ensure environmental impacts and conflicts with other users are minimal. Control of the location and scale of events is therefore necessary.

Commercial operations (concessions) may only occur in the Park under permit or licence in accordance with the National Parks Act 1975. Relevant activities are generally those where a fee is paid to private individuals for instruction, leadership or use of facilities or services including horses, or sale of goods, such as ice to campers.

A kiosk at Morgans Beach Reserve, which is currently managed by the Shire of Numurkah, is to come under DCE control (Section 9.2.2). Commercial operations intending to use State Forest must seek approval from the Regional Manager.

Aims and actions

To manage organised events and commercial operations to minimise impacts on other users and the forest environment

Medium Issue a licence under the Crown Land (Reserves) Act 1978 for the operation of the kiosk at Morgans Beach.

Ongoing Allow organised events, recreational tours, or commercial operations in the State Forest or State Park subject to consideration by the Regional Manager of possible impacts on conservation values and other users. Ensure commercial operators within the Park obtain appropriate permits by application to the Director of NPW.

As needed Issue Guided Leisure and Instruction Permits to commercial operators conducting horse rides in the Park, subject to assessment of possible environmental impacts and conflicts with other users. Specify in the permit maximum size of groups, areas where riding is not to take place and other guidelines as appropriate (Section 9.2.8).

9.2.10 Domestic animals

Campers, day visitors and hunters bring domestic dogs into the forest. Domestic dogs and cats have an impact on native wildlife. They may chase or attack other animals and their scent can distress or drive away some native species. Some visitors also regard domestic animals as an undesirable intrusion into the natural environment. Dogs used by hunters may be particularly aggressive, and can cause problems for other recreationists, native fauna and agisted cattle.

Aims and actions

To minimise disturbance to wildlife caused by domestic animals

To minimise conflicts between dogs, dog owners and other recreationists

State Park

Ongoing Prohibit dogs and other domestic pets in the Park, except:

- in vehicles travelling along the Sand Ridge Track
- working dogs used for stock management by members of the Barmah Forest Cattlemen's Association or the Yielima Forest Graziers Association
- bona fide guide dogs.
State Forest

Medium Develop guidelines for use of hunting dogs.

Ongoing Allow dogs, but not other domestic animals, in State Forest.

9.3 VISITOR SAFETY

Visitor safety is an important element of forest management. The forest must be maintained and presented in a way that as far as is practicable, does not create artificial or hidden hazards that would effect the visitor who is undertaking activities that are usually regarded as safe.

The forest contains situations that naturally present hazards, but these also may offer the opportunities desired by active outdoor recreationists. In such situations hazards must be identified and reasonable warning provided to those who seek the challenges involved.

Threats to visitor safety include major events such as fire and flood. Displan (Government of Victoria 1987e) and the Emergency Management Act 1986 outline strategies to be adopted in the case of a major disaster. DCE has developed strategies for visitor safety during major fires (CFL 1988c). Additional fire safety procedures specifically designed for Barmah are required (Section 11.1).

Localised threats such as from falling tree limbs also occur. Red gum trees are particularly prone in this regard and it is impossible to anticipate potential falling limbs in many cases.

Local knowledge is an important requirement for the efficient operation of any search or rescue. In this context the Police and State Emergency Service personnel will benefit from the assistance of DCE staff, who are often well equipped to aid the organisation and conduct of such operations.

Aims and actions

To protect visitors from unreasonable hazards and injury

To promote and encourage safe practices among visitors concerning the use of the forest

To provide sufficient information on natural hazards in the forest

To cooperate with emergency service organisations

Ongoing/As needed Conduct regular inspections of recreation facilities. Close, remove, repair or replace any facility that becomes damaged or unsafe.

Ongoing Ensure that staff are at all times prepared for emergencies, including having the capability to deal with emergency situations on water bodies in and adjacent to the forest, and that the necessary equipment is maintained and on hand.

As needed Carry out search and rescue or other operations in accordance with Departmental and Government procedures.

As needed Train staff in search and rescue techniques, and in first aid.

As needed Through ranger contact, inform visitors of particular hazards such as fire (Section 11.1) and flood.

As needed Support the Victoria Police and State Emergency Services in search and rescue operations.

As needed Undertake works such as felling or trimming of dangerous trees in areas of high visitor usage.
9.4 MONITORING VISITOR USE

In order to properly manage and plan further for recreation and conservation in the forest it is essential to know the type, level and pattern of visitor use, and to monitor the impact of recreational activities.

Aims and actions

To monitor patterns of visitor use and the impact of recreation activities in the forest

Medium  Conduct periodic visitor surveys, and use them to construct a visitor profile and to determine the degree to which recreation objectives are being achieved.

Ongoing  Monitor the effectiveness of restrictions and regulations in minimising visitor impact on forest values.

Ongoing  Monitor the impact of horse riding, boating, large-group camping and other activities on environmental values and visitor experiences.

Ongoing  Maintain annual statistics of:

- Dharnya information centre visitors
- Dharnya bed occupancy rates
- Authorisations and permits.

Ongoing  Maintain traffic counters and other devices at strategic locations to determine the spatial pattern of visitor use.

Ongoing  Liaise with other DCE Regions along the Murray in the design of visitor surveys to ensure consistency in results and enable legitimate comparison of statistics.
10 MANAGEMENT FOR TOURISM AND VISITOR EDUCATION

The major tourism corridors through the region are the Murray Valley Highway, Goulburn Valley Highway and in NSW, the Cobb Highway.

The mid-Murray Valley contains a diverse range of tourist attractions including:

- water based activities along the Murray, Goulburn and Ovens Rivers, and at Lake Mokoan and Lake Mulwala (NSW)
- the historical port of Echuca
- numerous wineries
- numerous wetlands extensively used for duck shooting and bird observing
- forested areas along the Murray River (Barmah, Gunbower and Millewa (NSW)) which are popular for camping, sightseeing and many other pursuits.

Appropriately resourced, the forest has the potential:

- to provide greater opportunities for people to enjoy an outstanding natural setting
- to attract increasing numbers of Victorian, interstate and international visitors
- to contribute, in so doing, to the development of the regional economy.

Barmah Forest possesses several ingredients for a successful tourist destination, with opportunities for learning about and experiencing Aboriginal culture, together with the natural attractions of Barmah Lakes and the forested environment along the Murray River. However, constraints such as regular flooding and the need to protect sensitive natural features make the forest unsuitable for extensive development of tourist facilities.

The tourism potential of the area can best be realised by promotion of existing attractions, especially the Dharnya Centre, and encouragement of special interest tourism. There is a growing market for tours in which small groups can use existing facilities and experience the forest environment, whilst undertaking specialised activities such as canoeing, nature study or horse riding.

Visitor education can foster public understanding and appreciation of the forest's cultural, natural and recreational values, management practices, safety issues and State Park and Forest Regulations.

Direct contact and active participation are generally accepted as the most effective ways of communicating and of changing attitudes and behaviour. This personal approach is preferred as the basis for interpretation, information and education programs in the forest.

A number of features of the forest are suitable for interpretation to visitors, especially wetlands, nocturnal wildlife, forestry practices and historical sites. Features that are readily accessible and can be protected from visitor pressures are best interpreted on site, with the assistance of suitable publications and, in some cases, by means of guided tours.

The Dharnya Centre is the focus for interpretations work and visitor education. It comprises a museum and display centre, a dining hall and accommodation to allow groups, particularly school children, to stay in and learn about the forest, and a staff residence. The centre is administered by the Minister through the Dharnya Committee of Management. Management of the centre is a co-operative venture between DCE and the Yorta Yorta MGRC.
The aims of the Dharnya Centre are to:

- facilitate greater community understanding of:
  - the ecology of River Red Gum forests and the importance of their conservation
  - the uniqueness and need for the preservation of Aboriginal culture in the area
  - the continuum of human occupation of the Murray Valley
  - the past, present and future management and uses of the forest
- act as a focal point for day visitors to the forest
- provide a focus for community interest in ecological and cultural matters pertaining to the central Murray River forests
- serve as a centre to assist in the training of Aboriginal rangers, cultural officers and site recorders
- develop and maintain strong links with the Aboriginal keeping place at Shepparton.

Two full-time Aboriginal Cultural Officers are employed to run the display centre and provide first hand knowledge of Aboriginal history and culture. A training program for Aboriginal rangers and cultural officers is currently being developed by DCE. A teacher seconded from the Education Department is available on a part-time basis to develop and coordinate educational programs at the Centre. In wet years road access to the Centre can be cut by floodwaters for several weeks.

There are opportunities for establishing theme gardens at Dharnya, based on plants traditionally used by Aboriginal people (Wilson 1990), and cultivated specimens of significant plants found in the forest (Marshall pers. comm.).

Numerous maps, leaflets and publications describing various aspects of the forest are available free or can be purchased at Dharnya or from other DCE offices. Tourist promotion and information displays located outside the forest, and information centres and shelters in the forest are an important means of informing visitors of forest features, facilities and regulations.

Self-guided activities are a useful way of helping visitors learn about the forest at their own time and pace. A self-guided drive through the forest has been devised, featuring sites of historical interest. It was prepared prior to the declaration of the Park, and needs updating.

Organized activities such as talks, ranger-guided walks, spotlighting, Junior Ranger activities, environmental games and campfire nights are effective ways of increasing visitor appreciation of the forest. Contact with rangers and other DCE staff whilst they are on routine patrols is a vital source of information for visitors. Casual discussions between DCE staff and visitors are an important means of fostering understanding of and support for management practices.

**Aims and actions**

To promote, particularly through tourist outlets, the facilities and features available in the forest

To provide visitors with information and knowledge to enable them to discover and appreciate the natural, commercial and cultural features of the forest

To facilitate involvement of the Aboriginal community in interpretations work

To promote interpretation, information and education programs in the forest through personal contact and participation

To provide educational opportunities for schools, tertiary institutions and community groups visiting the forest
To determine the information, interpretation and education needs of forest visitors, and the seasonal variation of such needs

Planning and promotion

High Prepare a business plan for the Dharnya Centre, including assessment of visitor services such as ranger-guided tours.

High Produce and distribute a high quality brochure promoting the facilities available at the Dharnya Centre. Particularly target the brochure at companies offering tours and coach trips.

High Promote the services, facilities and educational programs available to students at the Dharnya Centre by distributing information to schools.

Medium Investigate engaging a Melbourne-based agent to handle bookings and inquiries for the Dharnya Centre.

Medium Provide information for regional tourist displays at Echuca and Shepparton.

Ongoing Distribute published information about the forest through local, regional and State tourist outlets.

Ongoing Liaise with local, regional and State tourist outlets to promote the Dharnya Centre, Barmah Lakes and the forest in general as a tourist destination.

Ongoing Conduct surveys to determine visitor needs.

As needed Consult with regional tourist information associations when planning information and education services.

Information services

High Provide appropriate directional, warning and feature signs, in accordance with the Signs Plan for the forest and DCE Signs Manual.

Medium/Install and maintain information shelters at key entrance points and camping areas (Figure 6).

Ongoing Provide publications, updating where necessary, and introduce new publications in accordance with Table 10, including a revised map of the area which shows tracks available for public access and includes information on camping, boating, grubbing, horse riding, hunting, walking and the Dharnya Centre.

Interpretive and education services

High Develop programs of educational activities for students who stay at the Dharnya Centre.

Medium Develop a nature trail on one of the walking tracks in the vicinity of the Dharnya Centre (Section 9.2).

Medium Investigate appropriate access to Dharnya during floods, in order to:

. keep the Centre operational during these times
. provide opportunities for visitors to experience the forest when it is flooded
. interpret the hydrology and wetland ecology of the forest.
Investigate the opportunities for providing ranger-guided boat tours through the forest during flood times. Any tours will be conducted according to guidelines established by Benalla Region and National Parks & Public Land Division.

Liaise with the Dharnya Committee of Management to establish an interpretive garden of plants traditionally used by Aboriginal people.

Liaise with the Dharnya Committee of Management to investigate the opportunities for establishing an interpretive garden of rare plants found in the forest.

Continue to maintain the Dharnya Centre as the focus for interpretation and education services. Maintain and upgrade displays and information available at the centre in consultation with the Dharnya Advisory Committee.

Make staff available to talk to visitors, and to enhance their appreciation of forest values.

Provide a range of interpretive activities during December/January, using the expertise of DCE Community Education and Information Branch staff, and if necessary employing additional staff and volunteers.
## TABLE 10 MANAGEMENT ACTIONS FOR PUBLICATIONS

<table>
<thead>
<tr>
<th>Publication</th>
<th>Action</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barmah State Park &amp; Forest (map)</td>
<td>Update and publish</td>
<td>High</td>
</tr>
<tr>
<td>Barmah State Park &amp; Forest (leaflet)</td>
<td>Update and reprint</td>
<td>High</td>
</tr>
<tr>
<td>Barmah State Park &amp; Forest Recreation Guide (leaflet)</td>
<td>Prepare and publish</td>
<td>High</td>
</tr>
<tr>
<td>Barmah State Park</td>
<td>Revise and reprint</td>
<td>High</td>
</tr>
<tr>
<td>Aboriginal History &amp; Culture (package)</td>
<td>Prepare and publish</td>
<td>High</td>
</tr>
<tr>
<td>Barmah Forest Self-drive Tour (leaflet)</td>
<td>Revise and reprint</td>
<td>High</td>
</tr>
<tr>
<td>Barmah State Park &amp; Forest Information for Shooters (leaflet)</td>
<td>Update and reprint</td>
<td>Medium</td>
</tr>
<tr>
<td>Budgee Canoe Trail (leaflet)</td>
<td>Revise and reprint</td>
<td>Medium</td>
</tr>
<tr>
<td>Barmah State Park Nature Walk (leaflet)</td>
<td>Prepare and publish</td>
<td>Medium</td>
</tr>
<tr>
<td>Mid-Murray Touring Guide (booklet)</td>
<td>Prepare and publish</td>
<td>Medium</td>
</tr>
<tr>
<td>Barmah Forest (poster)</td>
<td>Publish</td>
<td>Medium</td>
</tr>
<tr>
<td>Birds and Mammals of the Barmah Forest (leaflet)</td>
<td>Revise and reprint</td>
<td>Low</td>
</tr>
<tr>
<td>Dharnya Centre Barmah Forest (leaflet)</td>
<td>Maintain stocks</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Trail Bikes in Parks and Forests (leaflet)</td>
<td>Maintain stocks</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Barmah Forest - A History (book)</td>
<td>Maintain stocks</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
11 MANAGEMENT FOR FOREST PROTECTION

This section sets out aims and actions for those aspects of management relating to protection of the forest from wildfire, introduced plants and animals and other threats.

11.1 FIRE PREVENTION AND SUPPRESSION

Fire management includes the suppression of wildfire, protection by maintaining pre-suppression facilities (such as access tracks and fire breaks), and the use of prescribed burning for vegetation or habitat management and fuel reduction.

DCE has statutory duties to ‘carry out proper and sufficient work for the prevention and suppression of fire in every State forest and national park, and on all protected public land’ (Section 62, Forests Act 1958), and (as agent of the Director of National Parks and Wildlife), ‘to ensure that proper and sufficient measures are taken to protect the park ... from injury by fire’ (Section 18, National Parks Act 1975).

The Forests (Part I - Fire Protection) Regulations and National Parks Regulations deal with various matters of importance in fire protection, including campfires.

Strategic protection requirements are identified in the Department's Benalla Region Draft Fire Protection Plan (CFL 1989a).

In most years in Barmah Forest, high fire danger conditions occur throughout summer. Between 1972-73 and 1986-87, 67 fires burnt a total area 1195 ha in the forest. The largest fire in this period burnt about 200 ha, and 50 of the fires covered 10 ha or less. Eighty-one percent of fires occurred between November and April. The sources, agents and locations of these fires are shown in Table 11.

### TABLE 11 SOURCES, AGENTS AND LOCATIONS OF FIRES, 1972-73 TO 1986-87

<table>
<thead>
<tr>
<th>Sources (% of fires)</th>
<th>Agents (% of fires)</th>
<th>Location of fires (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightning</td>
<td>14</td>
<td>Lightning 14</td>
</tr>
<tr>
<td>Cig./match</td>
<td>20</td>
<td>Recreationists 52</td>
</tr>
<tr>
<td>Campfire/BBQ</td>
<td>28</td>
<td>Other 21</td>
</tr>
<tr>
<td>Escape burns</td>
<td>6</td>
<td>Unknown 9</td>
</tr>
<tr>
<td>Deliberate</td>
<td>10</td>
<td>East Park 22</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>Rest of forest 48</td>
</tr>
<tr>
<td>Unknown</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

Fire suppression methods are well established for the area, and most fires are quickly put out. Existing facilities and personnel are generally adequate, but it is important that staff and equipment levels are maintained so that prompt and effective fire suppression can be carried out.

Existing fire prevention measures are:

- maintenance of access to water supplies (there is sufficient water in the forest to obviate the need for fire dams)
- maintaining access tracks
- construction and maintenance of perimeter firebreaks
- slashing of picnic and camping areas
- maintenance of fireplaces
- grazing by stock to reduce fuel load
- enforcement of fire regulations
management for forest protection

- public education through ranger patrols
- small-scale prescribed burns.

Prescribed burning is the use of fire to achieve specific management objectives, such as the reduction of fuel for protection purposes, and the maintenance of particular habitat or successional stages of vegetation. Since River Red Gum (*Eucalyptus camaldulensis*) is sensitive to fire, widespread fuel reduction burning is not appropriate in the forest. However small scale burns can be used to protect areas such as Barmah township.

Liaison with the Country Fire Authority (CFA) has been of great assistance to fire management in the forest. The Regional Fire Prevention Plan (CFA 1986) outlines strategies for fire prevention and suppression on private land in North Central Victoria. The CFA has identified un-irrigated private land adjacent to the forest as a moderate fire hazard in the State-wide context, and a high fire hazard in the local context. Irrigated farmland further to the south is of low fire hazard. Linear firebreaks and safe areas established under the CFA Plan are shown in Figure 7.

Campers and other forest visitors in the central and western parts of the forest are difficult to evacuate in the event of a major fire. It is important to establish safety procedures to provide for visitor safety in such an event.

**Aims and actions**

**To protect life, property and forest values from fire**

**To protect neighbouring land from fires originating in the forest, in accordance with the Benalla Region Fire Protection Plan**

**To maintain vehicle tracks for fire management purposes**

**To liaise with relevant organisations regarding fire management**

**To control wildfires by means which cause the least damage to forest values and which confine the wildfires to the minimum area as rapidly as is possible, with due regard to economy**

**To minimize the adverse effects of fire suppression activities on important natural features**

Ongoing Maintain a perimeter fire break (Figure 7).

Ongoing Minimise accumulation of flammable debris along roadsides during maintenance or upgrade.

Ongoing Maintain access to permanent water along creeks, lakes and billabongs.

Ongoing Inform visitors of fire danger levels and the requirements of the Forests (Part I - Fire Protection) Regulations 1978 and National Parks Regulations through ranger patrols, and where necessary enforce regulations.

Ongoing Continue liaison with the Country Fire Authority.

Ongoing Use strategies outlined in the Draft Benalla Region Fire Protection Plan (CFL 1989a), Large Fire Organisation (CFL 1988c) and Displan (Government of Victoria 1987e) as a basis for managing visitor safety and fire suppression during major fires.

As needed Maintain slashed areas in and around picnic and camping areas shown in Figure 5.

As needed Clear flood debris away from fence lines or other locations where it may constitute a fire hazard.
As needed  Minimise fuel accumulation in the forest adjoining Barmah township (Figure 7) by prescribed burning in the accordance with the Benalla Region Fire Protection Plan.

As needed/ High  During a major fire, direct campers to stay in the vicinity of their camp sites, unless there is ample time to evacuate the forest. Inform campers of safety procedures through ranger patrols and the Recreation Guide (Chapter 10).

As needed  Control all wildfires within natural or artificial control lines determined by the officer in charge of suppression operations in order to restrict wildfires to a reasonable minimum area, with due economy and a minimum of disturbance, as rapidly as possible following detection. As far as possible avoid suppression activities in Reference Areas (Section 5.5), sites of species indicated in Tables 3 and 5, and Aboriginal sites, except when required to protect the feature.

As needed  Rehabilitate areas of the forest disturbed by control lines and other fire control activities. In particular, prevent vehicular use of new control lines, and restore the natural surface configuration and drainage, provided this does not cause additional long-term damage.

11.2 PEST PLANTS

Some introduced plants have the potential to spread through the forest, competing with and disturbing indigenous vegetation. The distribution of pest plants (weeds) has not been mapped in detail, but they are widespread and locally common. Appendix I of DCE (1990) includes introduced plants found in the forest.

Spraying is the most common method of control, using either a 900 litre tank mounted on a truck for concentrated and major infestations, or 5 litre spray packs for more dispersed weeds. Some species are also controlled by hand-pulling.

The Department has obligations under the Vermin and Noxious Weeds Act 1958 and the National Parks Act 1975 to eradicate or control introduced plants. The National Parks Act 1975 requires permission from the Director of NPW before introduced species, including biological control agents, are used in a Park.

Box ridges contain a wide variety of weeds and a large number of significant native species (Section 5.2). Many of the weeds are scattered throughout the ridges and cannot be readily eradicated using conventional methods. The labour intensive Bradley Method, which involves repeated manual removal to gradually expand a weed-free area, may offer the best chance of controlling weeds in these areas.

Aims and actions

To monitor, control and as far as possible eradicate introduced plants

To minimise further establishment of introduced plants

Medium  Investigate the opportunities of using the Bradley Method to remove weeds from box ridges, possibly in association with a 'Friends' group (Section 13.3).

Ongoing  Control weed populations, with priority given to species indicated in Table 12.
Ongoing Favor non-chemical means of control particularly at sites of botanical significance. If chemical means are necessary, employ methods to minimise effects on non-target species.

Ongoing Monitor and record weed populations and the effectiveness of control methods.

Ongoing Monitor the introduction of new pest plants to the forest and control them rapidly, before spread can commence.

As needed Director of NPW to authorise use of the biological control agents indicated in Table 12 within the State Park.

**TABLE 12 MANAGEMENT ACTIONS FOR PEST PLANTS**

<table>
<thead>
<tr>
<th>Pest plant</th>
<th>Location</th>
<th>Priority</th>
<th>Management action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paterson's Curse</td>
<td>Heavy infestations in the Yielima and Ulupna Island sections of the Park, and scattered outbreaks elsewhere</td>
<td>High</td>
<td>Trial a biological control agent, use chemical spray as necessary.</td>
</tr>
<tr>
<td>(Exhume plantagineum)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caltrop</td>
<td>Localised infestations</td>
<td>High</td>
<td>Eradicate with sprays.</td>
</tr>
<tr>
<td>(Tribulus terrestris)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golden Dodder</td>
<td>Heavy infestations along the river at the Gulf, Bunny Digger, Glue Pot, the Cutting and Ulupna Island</td>
<td>High</td>
<td>Spray Dodder and host, prevent encroachment into wetlands.</td>
</tr>
<tr>
<td>(Cuscuta tasmanica)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Johns Wort</td>
<td>In State Forest, especially in the vicinity of Tram Is., Muster Paddock, Grinters Ridge and Four Mile</td>
<td>High</td>
<td>Control using chemical sprays and biological methods.</td>
</tr>
<tr>
<td>(Hypericum perforatum)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blackberry</td>
<td>Localised infestations near Boals and Top Island. Significant areas along the river have been killed recently</td>
<td>High</td>
<td>Continue control by chemical spraying, and if possible eradicate.</td>
</tr>
<tr>
<td>(Rubus spp.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horehound</td>
<td>Patches occur on dry ridges. Spread by stock and other animals.</td>
<td>High</td>
<td>Manually remove solitary plants, control large areas with sprays.</td>
</tr>
<tr>
<td>(Marrubium vulgare)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bathurst Burr</td>
<td>Localised infestations, especially on higher ground and Aboriginal sites.</td>
<td>High</td>
<td>Manually remove, use sprays if necessary.</td>
</tr>
<tr>
<td>(Xanthium spinosum)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiny Burr-grass</td>
<td>Occurs along the Sand Ridge near the Dharnya Centre</td>
<td>High</td>
<td>Eradicate with chemical sprays.</td>
</tr>
<tr>
<td>(Cenchrus longispinus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willow</td>
<td>Localised occurrences along the river and effluent creeks</td>
<td>High</td>
<td>Physically remove and ensure effluent channels are clear of debris, trial stem injection poisoning.</td>
</tr>
<tr>
<td>(Salix spp.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 12 (cont.)

<table>
<thead>
<tr>
<th>Pest plant</th>
<th>Location</th>
<th>Priority</th>
<th>Management action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honey Locust (<em>Gleditschia</em> sp.)</td>
<td>Opposite Picnic Point</td>
<td>High</td>
<td>Remove and monitor to prevent re-infestation.</td>
</tr>
<tr>
<td>Fennel (<em>Foeniculum vulgare</em>)</td>
<td>Small outbreaks beside track near Black Engine Creek and on Top Island by the river</td>
<td>High</td>
<td>Manually remove, monitor.</td>
</tr>
<tr>
<td>Spear, Slender and other thistles</td>
<td>Widely distributed</td>
<td>Medium</td>
<td>Where possible remove manually before seeding. Spray if necessary.</td>
</tr>
<tr>
<td>Noogoora Burr (<em>Xanthium strumarium</em>)</td>
<td>Heavy infestations along the river at the Gulf, the Cutting, Ulupna Island and swampy areas</td>
<td>Medium</td>
<td>Pull by hand and burn. Use sprays if necessary.</td>
</tr>
<tr>
<td>Sweet Briar (<em>Rosa rubiginosa</em>)</td>
<td>Mainly found along the Murray</td>
<td>Medium</td>
<td>Eradicate with chemical sprays. Remove and destroy seed pods.</td>
</tr>
<tr>
<td>Various fruit and other introduced trees</td>
<td>Isolated trees, especially along the river and at Morgans Beach</td>
<td>Low</td>
<td>Remove</td>
</tr>
<tr>
<td>Saffron Thistle (<em>Carthamus lanatus</em>)</td>
<td>Extensive occurrence in Goose Swamp</td>
<td>Low</td>
<td>Control with sprays.</td>
</tr>
<tr>
<td>Skeleton Weed (<em>Chondrilla juncea</em>)</td>
<td>Infestations in the drier parts of the forest, at Yielima and Sand Ridge</td>
<td>Low</td>
<td>Use biological controls, spray if necessary.</td>
</tr>
</tbody>
</table>

11.3 PEST ANIMALS

The Department has obligations under the Vermin and Noxious Weeds Act 1958 and the National Parks Act 1975 to exterminate or control introduced animals in the forest. Section 32G of the National Parks Act enables the Director of NPW to issue permits to licensed shooters for the hunting of feral animals in the Park.

Grazing animals

Grazing by the introduced European Rabbit (*Oryctolagus cuniculus*), Brown Hare (*Lepus capensis*), Horse (*Equus caballus*), agisted cattle, and the native Eastern Grey Kangaroo (*Macropus giganteus*) can exert considerable pressure on the flora of the forest. Grazing pressure is greatest during periods of drought or extended flooding. Flooding of the forest causes grazing animals to concentrate on high ground, particularly box ridges, where many significant plant species occur (Section 5.2).

Rabbits have had a major impact on the forest flora, affecting River Red Gum and shrub regeneration, reducing populations of herbs and grasses, and contributing to the establishment of introduced species (Chesterfield *et al.* 1984). Rabbits selectively graze the more nutritious grasses and herbs, which can result in changes to the composition of vegetation communities (Strahan 1983).
Following the first local sightings in about 1883, rabbit populations expanded rapidly and had reached plague proportions by the 1920s. During the following two decades they caused substantial damage to native vegetation in the forest. The droughts of the 1940s further increased pressure on the remaining forage, and during this time large numbers of rabbits died of starvation (Chesterfield et al. 1984). Following control by myxomatosis in the 1950s, populations have remained at relatively low levels. Rabbits are now controlled by fumigation, usually with Phostoxin tablets placed down burrows.

Horses, because of their habit of cropping vegetation to the ground, can also have a dramatic effect on palatable native species. They also cause soil disturbance and damage roads. About 200 wild horses are present in the forest. Wild horses have been controlled either by using a mare to lure horses into a private paddock or by ‘running’ horses in the forest. The latter practice has been discontinued because of disturbance to cattle and distress to the horses. The former practice only takes horses from a limited area. As alien animals they are undesirable in the forest. Under Departmental policy, wild horses are not to be shot or poisoned in Parks.

Cattle management, and research into the environmental effects of cattle and other grazing animals, is discussed in Section 8.2.

**Wild pigs**

The Pig (*Sus scrofa*) population in the forest is estimated to be 200-300, but no accurate figures are available. Pigs cause localised soil disruption, muddy waterholes and disturb understory vegetation. It is desirable that they be eliminated from the forest. Present control measures are to trap and shoot. Culling is also carried out by private shooters who sometimes use hunting dogs (Section 9.2.10).

**Foxes**

Foxes (*Vulpes vulpes*) are widespread throughout the forest. The fox is an opportunistic predator on various animals, including rabbits, Yellow-footed Antechinus (*Antechinus flavipes*) and reptiles. Fox predation, together with disturbance by cattle, may have contributed to the disappearance of the Western Barred Bandicoot (*Parameles bougainville*) and Rufous Bettong (*Aepyprymnus rufescens*) from the area, and they probably compete with Tiger Quoll (*Dasyurus maculatus*) for food (Strahan 1983). There is a remote possibility that the latter two species still occur in the forest (Section 15.6.1 of CFL 1990).

Foxes also feed on tortoise eggs, and since these animals are long-lived, the impact of this predation may not be noticed until there is a sudden population decline (Turner pers. comm.). A study in South Australia found that 93 per cent of Murray Turtle (*Emydura macquarii*) nests were destroyed by foxes and a further 3.5 per cent by native predators (Thompson 1983). At present DCE has no organised programs aimed at controlling foxes. Private culling is dependent on current prices for fox pelts, which are strongly depressed. Buried baits poisoned with 1080 are the most effective control method. Approval is required from the Director of NPW before 1080 can be used in the State Park.

**Cats**

Cats (*Felis catus*) are opportunistic predators on small terrestrial and arboreal mammals. Lizards and ground nesting birds are also important prey, particularly in summer (Jones and Coman 1981). Low numbers of these predators are present in the forest.

**Carp**

Large numbers of carp are present in waterways throughout the forest. No effective control measures are available at present.
Aims and actions

To monitor, eradicate or establish effective control of introduced animals, especially those declared as vermin

To cooperate with adjoining landowners in the control of vermin and other introduced animals

To prevent over-grazing during drought or flood

General

High  Develop strategies to minimise damage to native flora from over-grazing during periods of drought or extended flooding.

High  Commence a fox control program using buried poison baits placed along the river bank in sandy locations during the nesting season of tortoises. Director of NPW to authorise the use of 1080 baits in the State Park. Monitor the impact of the program on non-target species.

Medium  Remove all wild horses from the forest by the most practicable and humane method.

Medium  Liaise with NSW authorities to ensure control of wild pig and wild horse populations is practiced on both sides of the river.

Medium  Determine the size of the forest's pig population.

Ongoing  Control rabbits, using methods such as myxomatosis, warren destruction and fumigation. Eradicate the rabbit infestation adjacent to Top Island Reference Area.

Ongoing  Monitor populations of all pest animals.

As needed  Continue to employ a trapper to control wild pigs.

As needed  In addition to the above baiting program, adopt additional control measures such as shooting and cage trapping against foxes and feral cats. If an unidentified small macropod or Tiger Quoll (Section 5.3) are found in the forest, assess if additional baiting programs or other measures are required.

State Forest

Ongoing  Allow licensed shooters to hunt feral animals in accordance with Section 9.2.7.

Ongoing  Encourage hunting of feral animals by members of groups such as the Victorian Field and Game Association.

State Park

As needed  Director of NPW may issue permits to licensed shooters for hunting of feral animals (Section 9.2.7).
11.4 INVERTEBRATE PESTS AND OTHER THREATS

Gum-leaf Skeletoniser

The Gum-leaf Skeletoniser (*Uraba lugens*) is a major defoliator of River Red Gum in the mid-Murray area. Twelve outbreaks have been recorded since 1969, with up to 40,000 ha defoliated on at least two occasions. The infestations occur when the absence of flooding in the forest coincides with the larval stage of the insect.

Floodwaters provide humid conditions favourable for the spread of fungi which kill the larvae, but only if floods occur between spring and mid-summer or March to June. During these times the insect's eggs, early and final instar larvae and pupae are located close to the forest floor. Defoliation rarely if ever results in tree mortality, but growth is temporarily retarded (Von Mueller Institute 1986). Appropriate flood regimes are the key to controlling this moth.

Mistletoe

Various species of this native parasite are distributed throughout the forest. The extent of infestation seems to vary from year to year, but in recent times the number of trees affected has apparently increased. Mistletoe weakens the host tree, reduces growth potential, and can sometimes kill the tree. Mistletoe is also an important component of the native flora and a valuable food source for native fauna.

Cinnamon Fungus

This fungus (*Phytophthora cinnamomi*) has not been detected in the forest, but recent dieback on some trees should be investigated.

Aim and actions

To protect the forest against pests and diseases

Ongoing Monitor activity of the Gum-leaf Skeletoniser moth.

Ongoing Monitor mistletoe infestation of River Red Gum in State Forest.

As needed Conduct tests for the presence of Cinnamon Fungus in the forest and implement appropriate measures if the disease is detected.
12 BOUNDARIES

12.1 STATE BOUNDARY

The boundary of Victoria follows the top of the southern bank of the Murray River. This means that the river and the area between the top of the bank and the water (when the river is less than bank-full) is legally in NSW. A section of Ulupna Island is also in NSW because of a natural alteration to the bed of the Murray since the border was determined (Figure 1). This 43 ha river bend is part of the Thornley State Forest managed by the NSW Forestry Commission. It is classified 'Preserved State Forest' and grazing, hunting and timber production are not permitted.

The location of the State border therefore creates a number of difficulties for land management agencies on both sides of the river. Management of access, camping, boat launching, lighting of fires, control of erosion and enforcement of Park regulations are some of the potential problems for DCE.

Section 19D of the National Parks Act 1975 allows the Minister, where necessary or convenient to ensure cooperation in carrying out the purposes of the Act, to enter into an agreement for the management of land with a Minister of the Crown of another State or the Commonwealth, or with any authority constituted under the law of any other State or the Commonwealth. The Forests Act 1958 and the Crown Land (Reserves) Act 1978 do not contain similar provisions with respect to State Forest or Crown Land Reserves.

Aims and actions

To rationalise management along the border between NSW and Victoria

To liaise and cooperate with NSW public land management authorities

To ensure management of adjoining NSW land is compatible with this Plan

High Liaise with the NSW Lands Department and NSW Forestry Commission to formulate an agreement under Section 19D of the National Parks Act which would enable DCE to effectively manage:

- those areas adjacent to Barmah State Park between the high bank of the Murray River and the water level (when the river is less than bank full)
- the river bend on Ulupna Island which is within NSW.

High Liaise with the NSW Lands Department to investigate establishing an agreement which would enable DCE to effectively manage those areas adjacent to the Murray River Reserve between the high bank of the Murray River and the water level (when the river is less than bank full). This may include enforcement issues.

Ongoing Maintain contact with relevant NSW authorities and seek their participation in land management planning for areas along the river.

Ongoing Provide input into planning and development of NSW land adjoining the forest.

12.2 STATE PARK BOUNDARY

The Certified Plans which define the boundaries of the eastern section of Barmah State Park according to the National Parks Act 1975 are of insufficient detail to indicate the exact location of the southern boundary with respect to the adjoining levee and Road Reserves.

This Plan assumes that the levee is within the Park and that the Road Reserve is excluded, except in two instances where the Park crosses the Reserve in the vicinity of Morgans Beach and Ulupna Creek.
However, the exclusion or otherwise of the Road Reserve from the Park has implications for access to both the Park and neighbouring private property. In some places the existence of the Road Reserve also conflicts with need to rationalise the track network (Figures 4 and 5) in order to protect landscape and vegetation values. At present large sections of the Road Reserve are not being used as a road.

**Aim and action**

**To clarify the location of the southern boundary of the Park**

High Review the location of the southern boundary of the eastern section of the Park, to determine whether the Road Reserve is contained within the Park. If the Road Reserve is outside the Park, assess the desirability of adding sections of the Reserve to the Park (thereby cancelling the Reserve), to enable better management of access into the area. If required, institute proceedings to amend the Park boundaries.

12.3 **ENCLAVES AND SURROUNDING LAND USE**

Actions and developments on private property in the vicinity of the forest have the potential to impact upon:

- landscape values
- quality of water entering the forest
- animals which utilise areas both within and adjacent to the forest
- intensity and patterns of recreational use.

Liaison with neighbouring landholders and planning authorities is therefore an important component of managing the forest.

Most of the southern boundary of the forest abuts onto cleared private land. The Shires of Nathalia and Numurkah control and plan for residential, industrial or tourist developments on private property adjoining the forest (Section 2.2). To ensure such developments do not have an adverse impact on the forest, it is desirable that relevant planning applications are referred to DCE for comment. The Planning and Environment Act 1987 has provision for establishment of Referral Authorities, who must be consulted before approval is given for specified types of planning permits.

The Yielima P.R. is a 260 ha freehold enclave surrounded by State Forest (Figure 1). The land is used for growing crops and grazing cattle, and is predominantly cleared. Two sections of freehold land adjoining the State Park boundary near Ulupna Creek are at present unfenced.

Kangaroos can occasionally cause problems for farmers neighbouring the forest, competing with stock for feed and damaging crops.

A caravan park on Crown Land adjoining the south end of Barmah Island is managed by the Shire of Nathalia. The township of Barmah is also adjacent to the forest at this point. A horse riding business and caravan park, Hideaway Caravan Park, is located on freehold land adjoining the forest (Figure 6). An enclave of private land at Picnic Point in the Millewa State Forest (NSW) is run as a caravan and camping park.

Road Reserves are located in Goose Swamp (Figure 6) and follow most of the southern perimeter of the forest. These Road Reserves may conflict with need to rationalise the track network (Figures 4 and 5) in order to protect landscape and vegetation values. The declaration of the State Park has cancelled Road Reserves passing through the Park (see also Section 12.2).

Roadside Reserves outside the forest and remnant vegetation on farmland provide important habitat for species such as Superb Parrot (*Polytelis swainsonii*) and Grey-crowned Babbler (*Pomatostomus temporalis*). Roadside in particular contain valuable remnants of box forest.
Streamside Reserves adjoin the forest at Broken Creek and Ulupna Creek. The 60 m wide Murray River Reserve abuts the eastern extremity of the forest. LCC (1985) recommendations concerning public land water frontages are included in the actions below.

**Aims and actions**

To minimise conflicts between forest management and surrounding land use

To cooperate with landholders adjacent to the forest in the protection of both private property and public land from fire, pests and other hazards

To cancel unnecessary Road Reserves

To protect habitat of significant species on roadsides and private property in the vicinity of the forest

To implement LCC recommendations regarding management of adjacent public land water frontages

<table>
<thead>
<tr>
<th>Level</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Institute proceedings to have DCE made a Referral Authority under the Planning and Environment Act 1987 for planning permits in the Shires of Numurkah and Nathalia which have relevance to management of the forest.</td>
</tr>
<tr>
<td>High</td>
<td>Require the relevant landholders to fence the State Park boundary along Ulupna Creek to exclude stock.</td>
</tr>
<tr>
<td>Medium</td>
<td>Instigate proceedings to cancel the Road Reserve in Goose Swamp and investigate cancelling any portions of the Road Reserve along the southern perimeter of the forest not required for access to private property (see also Section 12.2).</td>
</tr>
<tr>
<td>Low</td>
<td>Investigate the future inclusion of Morgans Beach into the Park.</td>
</tr>
</tbody>
</table>

Ongoing Liaise with the Nathalia Shire to achieve management of the Barmah Caravan Park in keeping with management of the adjacent forest.

Ongoing Liaise with the managers of the Hideaway Caravan Park and the Picnic Point camping area to avoid conflicts with the management of the neighbouring State Park.

Ongoing Encourage the retention of remnant native vegetation and preservation of habitat for Superb Parrot and Grey-crowned Babbler on roadsides and private property in the vicinity of the forest.

Ongoing Manage Streamside Reserves adjoining the forest so that they:

- protect adjoining land from erosion by the maintenance of adequate vegetation cover
- provide for flood mitigation
- maintain the character and quality of the landscape
- conserve flora and fauna
- provide opportunities for low intensity recreation
- allow access to water and for grazing of stock by adjoining landholders under licence where appropriate (LCC 1985).
Ongoing Liaise with the Shires of Nathalia and Numurkah to ensure developments on neighbouring freehold land do not have an adverse effect on Barmah State Park or Barmah State Forest.

Ongoing Maintain liaison with local community groups and farmers and involve them in the planning and management of the forest.

Ongoing Continue to provide access to Yielima P.R. via the tracks available for public use (Figure 4). Do not permit location of an overhead SEC power line through the forest to the property.

As needed If Yielima P.R. is offered for sale, consider purchasing the property for inclusion in the State Forest.

As needed When necessary to protect neighbouring farmland, the Regional Manager may issue destruction permits for kangaroos on private property. If and when appropriate and consistent with the Departmental policy on use of wildlife for Aboriginal cultural purposes (Section 6.1), allow a member of the Yorta Yorta MGRC to carry out the hunting.
13 MANAGEMENT RESOURCE REQUIREMENTS

Resources available for management of the forest, including staff, buildings, facilities and equipment, are primarily located at Nathalia and the Dharnya Centre. Various advisory bodies, community groups and individuals also make an important contribution to forest management.

13.1 STAFF

It is difficult to define the total number of staff working in the forest, as all staff have multi-functional responsibilities and perform a variety of tasks across different areas. Benalla and Melbourne-based staff administer and plan the forest from Regional and State-wide perspectives. Specialist staff such as landscape planners, biologists and interpretations officers provide essential information and expertise. Local staff (Table 13) are responsible for day-to-day forest management.

Staff levels generally match the current workload. However, existing local staff could not effectively implement all the actions outlined in this Plan to the standard required by the Government and expected by the community. Actions which cannot be carried under existing staff arrangements are the research and monitoring proposals marked with an asterisk in Chapter 14.

Actions which require expert assistance from within DCE include:

- site design and landscaping (Sections 5.6, 9.2.2)
- tourist promotions (Chapter 10)
- publications (Chapter 10).

The DCE Aboriginal Employment and Training Strategy (CFL 1989c) outlines measures to address the disadvantages faced by Aboriginal people in the Australian labour market. An initiative of relevance to this Plan is the establishment of an Aboriginal Contract Fund, which will finance contacts between DCE Regions and Aboriginals. Works related to cultural heritage matters and cultural site protection and interpretation (Section 6.1) are particularly suitable for funding.

Ongoing training of technical and planning staff is an integral component of effective and efficient management. Relevant staff will also be trained and authorised under relevant Acts and Regulations. A training program for Aboriginal rangers and cultural officers is currently being developed by DCE.

Aims and actions

To ensure DCE Benalla Region has sufficient staff to implement this Plan

To ensure relevant staff are trained in appropriate management skills

To enable selected staff to enforce the various regulations pertaining to the forest

Ongoing Continue development of a training program for Aboriginal rangers and cultural officers.

As needed Benalla Region to take steps to acquire additional staff and/or utilise specialist staff from within DCE Divisions to implement this Plan. In particular, science staff will be employed to conduct and coordinate a research and monitoring program covering the topics indicated in Chapter 14, and submissions will be made to the Aboriginal Contract Fund to employ Aboriginals to carry out works proposed in Section 6.1.
As needed In addition to the Department’s general training program for staff and on-the-job training acquired in the normal management of the forest, provide selected staff with formal training in:

- legislation and enforcement
- basic search and rescue
- fire management
- first aid
- education and interpretation
- identification of Aboriginal sites and cultural resource management
- monitoring techniques for flora and fauna
- identifying and monitoring weed species
- silviculture.

<table>
<thead>
<tr>
<th>TABLE 13 LOCAL STAFF AVAILABLE FOR IMPLEMENTATION OF PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
</tr>
<tr>
<td>Dharnya</td>
</tr>
<tr>
<td>Barmah Ranger-in-Charge (TO1)</td>
</tr>
<tr>
<td>Dharnya Site Ranger (TA2)</td>
</tr>
<tr>
<td>Cultural Officer (CO2)</td>
</tr>
<tr>
<td>Cultural Officer (CO1)</td>
</tr>
<tr>
<td>Education Officer (seconded)</td>
</tr>
<tr>
<td>Aboriginal Trainee (TA1)</td>
</tr>
<tr>
<td>Nathalia</td>
</tr>
<tr>
<td>Area Supervisor (TO5)</td>
</tr>
<tr>
<td>Ranger (TO2)</td>
</tr>
<tr>
<td>Ranger (TA2)</td>
</tr>
<tr>
<td>Forest Officer (TO2)</td>
</tr>
<tr>
<td>Herdsman/Ranger (TA2)</td>
</tr>
<tr>
<td>Land Protection Officer (TO1)</td>
</tr>
<tr>
<td>Clerical Officer (CO2)</td>
</tr>
<tr>
<td>Word Processing Operator (WPO 1)</td>
</tr>
<tr>
<td>Works Crew</td>
</tr>
<tr>
<td>Summer (temporary) Firefighters</td>
</tr>
</tbody>
</table>

13.2 EQUIPMENT AND BUILDINGS

Machinery and vehicles currently used in the Nathalia works area include:

- two-wheel drive tractors (2)
- aluminium boats and motors (2)
- 3 tonne trucks (2)
- four-wheel drive vehicles (6)
- two-wheel drive vehicle (1)
- four-wheel drive fire tanker (1).

These resources are generally adequate for work being carried out at present. It is desirable that a new first-attack tractor for fire suppression be acquired over the next five years.

Buildings for visitor and management use are generally well established and satisfactory. The Dharnya Centre, including the Bunkhouse, Kitchen/Dining Hall and Interpretations Centre will be maintained as the main information and interpretation centre for the forest. Existing staff accommodation at Dharnya (1 house) will be maintained as a residence for the Dharnya Site Ranger.
Further buildings may be required in the future to provide storage space or enhance the interpretations capability of the centre.

**Aim and actions**

To ensure staff have suitable and sufficient equipment to carry out their work

- **High** Purchase a new first-attack fire suppression tractor to ensure suitable and sufficient fire suppression equipment is available.

- **As needed** In liaison with the Dharnya Advisory Committee and DCE Landscape Services Section, construct further buildings within the Zone 3 area at Dharnya, ensuring any developments are in keeping with the functions and design of the centre.

**13.3 ADVISORY BODIES AND PUBLIC PARTICIPATION**

A wide range of groups and individuals have an ongoing interest in management of the forest.

Advisory bodies are of particular importance in providing guidance to DCE and facilitating regular contact between DCE and various interest groups. Advisory bodies currently assisting with forest management and planning are the Barmah Advisory Committee, Barmah Forest Grazing Advisory Committee and the Regional Land Protection Advisory Committee.

This Plan also recommends that the Yorta Yorta MGRC establish a liaison committee to enable coordination of Aboriginal site management between Victoria and NSW, and to deal with other issues of importance to the Yorta Yorta people (Section 6.1).

The Victorian National Parks Association have been instrumental in establishing 'Friends' groups who give voluntary assistance to the conservation, maintenance and development of Parks throughout the State. There is potential for such a group to be established for Barmah State Park.

**Aim and Actions**

To involve a wide range of interest groups and individuals in the management of the forest

- **Medium** Encourage and give support to any suitable proposals for the formation of a Friends of Barmah group.

- **Ongoing** Convene regular meetings of the Barmah Advisory Committee, Barmah Forest Grazing Advisory Committee, and the Regional Land Protection Advisory Committee.

- **Ongoing** Maintain liaison with community groups and individuals through meetings, items in the local media, provision of educational and information material (Chapter 10) and other means as appropriate.
14 FURTHER STUDIES

This section summarises the various recommendations for further study, including research, monitoring and planning, outlined in previous sections of this Plan. They are listed together here for ease of reference.

Section 13.1 indicated that scientific staff are required to coordinate and carry out research into various aspects of forest ecology and utilisation. Topics which may be included in this work are marked with an asterisk. Work planned or conducted by an organisation apart from DCE is included.

Water and wetlands

High Experiment with small barriers across drainage channels to aid spread and retention of water in Boals Deadwoods

*High Develop and maintain a record of the location and extent of each major wetland type and species, with priority given to the key wetlands at Top Island, Boals Deadwoods, Reedy Lakes and War Plain.

*High Establish procedures for monitoring, reporting and recording water quality and depth, changes in distribution of wetland flora, and the types, numbers and breeding success of water birds.

High Using funds provided by the Murray Darling Basin Commission, monitor water quality and depth, wetland productivity, wetland flora and fauna, and fish populations. Coordinate this monitoring with other monitoring and research proposed in this Plan.

High Assist the investigation funded by the Murray Darling Basin Commission to determine the most appropriate method(s) of overcoming the adverse effects of altered water regimes. Incorporate the results of this study into a supplement to this Management Plan

Medium Liaise with the Murray Darling Freshwater Research Centre, Murray Darling Basin Commission, NSW Maritime Services Board and NSW Department of Lands to investigate bank erosion along the Murray River.

Medium Encourage research into the rate and mechanisms of sediment deposition in the forest.

Medium Examine the feasibility and desirability of undertaking localised excavations in wetlands to improve diversity of habitat for waterbirds.

Ongoing Continue to keep a map record of the extent of flooding in the forest.

Ongoing Liaise with Rural Water Commission and Melbourne University to monitor groundwater levels and movements in and around the forest.

Flora

*High Determine specific locations and population sizes of all significant species and maintain a register of this information.

*High Determine distribution and conservation status of Upright Sunray (*Helipterum strictum*), Rush (*Juncus* sp. ‘O’), and Fairy Spectacles (*Menkea crassa*).
*Medium Prepare improved management prescriptions for significant plants based on detailed ecological study.

*Ongoing Monitor populations of rare plants at Machonies and Tongalong Ridges, and if necessary institute conservation measures.

*Ongoing Monitor populations of significant plants in Goose Swamp.

*Ongoing Monitor vegetation communities in depressions and floodways and determine the effect of the proposals outlined in Section 5.1

*Ongoing Monitor encroachment of Moira Grass plains (Psuedoraphis spinescens) by rushes and River Red Gum (Eucalyptus camaldulensis).

*Ongoing Monitor the extent of Cumbungi (Typha orientalis), Common reed (Phragmites australis) and Giant Rush (Juncus ingens).

*Ongoing Monitor populations of significant plant species (Table 3), especially with respect to grazing and water regimes (where relevant).

*As needed Develop appropriate management actions for any further species identified, through further survey or taxonomic revision, as rare and endangered.

**Fauna**

High Conduct surveys to determine whether the Tiger Quoll (Dasyurus maculatus) and an unidentified small macropod are present in the forest.

*High Determine locations of nest trees of Superb Parrot (Polytelis swainsonii) and determine the importance of box ridges to the species.

Medium Encourage systematic survey of reptiles in the forest, and determine the distribution of the Hooded Scaly-foot (Pygopus nigriceps) and Carpet Python (Python spilota variegata) and whether the Curl Snake (Suta Suta) and Bandy Bandy (Vermicella annulata) are present in the forest.

Medium Undertake surveys to determine the importance of Barmah Forest for native fish, and investigate favoured water regimes.

Low Assess status of Regent Honeyeater (Xanthomyza phyrgia) and Bush Thick-knee (Burhinus magnirostris) in the forest.

Low Encourage further general surveys of fauna, including invertebrates, and research into the biology and habitat requirements of fauna.

*Ongoing Monitor populations of the Squirrel Glider (Petaurus norfolcensis), Tuan (Phascogale tapoatafa), Koala (Phascolarctos cinereus), Superb Parrot and Eastern Grey Kangaroo (Macropus giganteus).

**Geomorphology**

Medium Assess the significance of the geomorphological features in the forest.

Low Examine the processes involved in the formation and erosion of the digitate delta and assess the impact of river regulation on these processes.

Ongoing Monitor the condition of the sand lunette and source-bordering dunes.
Reference Areas

*High Undertake a comprehensive survey of the flora and fauna in the Reference Areas and establish an ongoing monitoring program.

Medium Prepare Reference Area Management Plans for Top Island and Top End Reference Areas.

Aboriginal heritage

High Encourage completion of the archaeological survey of the forest.

High Liaise with the Yorta Yorta MGRC and Victoria Archaeological Survey to develop and maintain a register and map record of all known Aboriginal sites in the forest.

Medium Encourage studies examining fenced and unfenced sites to determine the effect of cattle, horses and uncontrolled access on Aboriginal sites.

Ongoing Develop and maintain an inventory of Aboriginal artefacts associated with the forest.

European history

High Establish a register and map record of European sites and historical artifacts in the forest.

Medium Encourage compilation and publication of an inventory of place names and their origins.

Ongoing Monitor visitor use of historic sites.

Timber

Medium Encourage further silvicultural research on topics such as thinning, regeneration, culling unmerchantable trees, and harvesting techniques.

Medium Encourage research into the effects of timber harvesting on native flora and fauna, and improve management prescriptions as further information becomes available.

Grazing

*High Undertake a research project to assess:

  . the effects of cattle on wetlands, native plants, especially those on box ridges, weeds, and fuel load
  . the effects of winter grazing.

*Ongoing Monitor the effects of cattle on significant plant species.

Apiculture

Ongoing Encourage research into the effects of introduced bees on native flora and fauna.
## Recreation

<table>
<thead>
<tr>
<th>Level</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Prepare and maintain a Signs Plan for the forest.</td>
</tr>
<tr>
<td>High</td>
<td>Draw up detailed site plans to control the number and location of campsites, traffic movement and facilities at Barmah Lakes, the Gulf and Morgans Beach.</td>
</tr>
<tr>
<td>High</td>
<td>Investigate regulations to enable prohibition of grubbing in those parts of Zones 1 and 3 within State Forest.</td>
</tr>
<tr>
<td>High</td>
<td>Develop regulations to prohibit shooting in those parts of Zones 2 and 3 within State Forest, and to limit firearm use in those parts of Zones 1 and 4 in State Forest to shotguns.</td>
</tr>
<tr>
<td>Medium</td>
<td>Include in the investigation into bank erosion an assessment of the impact of power boats.</td>
</tr>
<tr>
<td>Medium</td>
<td>Develop guidelines for use of hunting dogs in State Forest.</td>
</tr>
<tr>
<td>Medium</td>
<td>Conduct visitor surveys, construct a visitor profile and determine the degree to which recreation objectives are being achieved.</td>
</tr>
<tr>
<td>Medium</td>
<td>Investigate establishment of a Melbourne-based agent for bookings and inquiries for the Dharnya Centre.</td>
</tr>
<tr>
<td>Medium</td>
<td>Investigate the establishment of cultural and significant plant gardens at Dharnya.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor the use and impact of power boats on wetlands within the forest.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor the effectiveness of restrictions and regulations in minimising visitor impact on forest values.</td>
</tr>
</tbody>
</table>

## Pests and other threats

<table>
<thead>
<tr>
<th>Level</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Investigate the opportunities for using the Bradley Method to eradicate introduced species from box ridges.</td>
</tr>
<tr>
<td>Medium</td>
<td>Develop strategies to minimise damage to native flora from over-grazing during periods of drought or extended flooding.</td>
</tr>
<tr>
<td>Medium</td>
<td>Determine the size of the forest's pig population.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor weed populations and the effectiveness of control measures.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor populations of pest animals.</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor activity of the Gum-leaf Skeletoniser (<em>Uraba lugens</em>).</td>
</tr>
<tr>
<td>Ongoing</td>
<td>Monitor mistletoe infestation of River Red Gum in State Forest.</td>
</tr>
<tr>
<td>As needed</td>
<td>Conduct tests for Cinnamon Fungus (<em>Phytophthora cinnamomi</em>).</td>
</tr>
</tbody>
</table>
REFERENCES


CFL (1988b) Rare or threatened plant species. Department of Conservation, Forests and Lands, Melbourne (unpublished list).


Fisheries and Wildlife Division (1983) First submission to the Land Conservation Council’s investigation into the Murray Valley Study Area. Ministry for Conservation, Victoria (unpubl.).


References


National Parks Service (1983) First submission to the Land Conservation Council's investigation into the Murray Valley Study Area. Ministry for Conservation, Victoria (unpubl.).


References


PERSONAL COMMUNICATIONS

Davidson, I. (1989) Zoologist, DCE, Benalla
Loyn, R. (1989) Zoologist, DCE, Melbourne
Wilson, K. (1989) Botanist, Picola
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**Head Office**
Jim O'May, Tony Varcoe, Richard Gijsbers,

acknowledge the valuable assistance of the following people:

John Arnold, DCE, Nathalia Howie Marshall, Nathalia
John Atkinson, Museum of Victoria Max Moor, Picola
Terry Bonhomme, Victoria Archaeological Survey Monica Morgan, Yorta Yorta Tribal
Council
David Bennett, DCE, Benalla Gary Nelson, Victoria Archaeological
Survey
Leon Bren, Melbourne University Peter Newman, Nathalia
John Bye, DCE, ex-Nathalia Rod Power, Tongala
Evan Chesterfield, DCE, Melbourne Kim Pridmore, DCE, Nathalia
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Jack Hutchinson, DCE, Nathalia Tom Sloan, DCE, Benalla
Jack Killminster, Picola Enoch Trickey, Picola
Russell Killminster, Picola Kelvin Trickey, Picola
Colin Leitch, DCE, Benalla Colin Walker, Yorta Yorta Tribal
Council
Richard Loyin, DCE, Melbourne Karen Wilson, Picola
Tim Mannion, Waaia Clive Woollard, DCE, Dharnya

numerous DCE staff who commented on drafts, prepared maps and artwork for the Plan

and in particular, members of the Barmah Advisory Committee:

Wayne Atkinson Yorta Yorta MGRC
Jenny Barnett Victorian National Parks Association
Stan Brown Nathalia Shire Council
Shube Cobledick Victoria Field and Game Association
Judith Frankenberg Australian Conservation Foundation
Phil Hawkey Country Fire Authority
Elizabeth Hoffman Yorta Yorta MGRC
Joan Theyers Victorian Sawmillers Association
Stan Vale Victorian Farmers Federation

PHOTOGRAPHIC CREDITS

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