Dryandra Woodland

Management Plan
1995-2005

Management Plan No 30

Department of Conservation
and Land Management

National Parks and Nature
Conservation Authority

Lands and Forests
Commission

DRYANDRA WOODLAND

MANAGEMENT PLAN

1995 - 2005

PLANNING TEAM:

Tony Friend
Tim Bowra
Steve Gorton
Dennis Hilder
David Mitchell
Daryl Moncrieff (Final Plan Co-ordinator)
Anthony Sutton (Draft Plan Co-ordinator)

Produced by the
Department of Conservation and Land Management
for the
Lands and Forest Commission
Perth, Western Australia.

PREFACE

Management plans set out the strategies and guidelines for the management of an area for ten years. Plans are the responsibility of the Lands and Forest Commission (LFC) for State forest and timber reserves, and of the National Parks and Nature Conservation Authority (NPNCA) for nature reserves, national parks and conservation parks. The Department of Conservation and Land Management prepares plans on behalf of these bodies.

The CALM Act (1984) specifies that management plans shall contain:

a) a statement of the policies or guidelines proposed to be followed; and
b) a summary of operations proposed to be undertaken.

A draft management plan for the Dryandra Woodland, incorporating State forests 51 (Lol Gray), 52 (Highbury) and 53 (Montague) was prepared by CALM and issued by the LFC for public comment. Forty submissions were received, and were considered in the preparation of this final plan prior to its approval by the LFC and NPNCA[1].

The principal objectives of the Management Plan are:

- in the case of areas to remain as State forest[2], to achieve the purposes of conservation, recreation and timber production. In the long term (70-100 years), it is intended that the timber production role will be one of research and development, with timber production being maintained by plantations on private property;

- in the case of areas designated as national park, to fulfil as much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna, and the preservation of any feature of archaeological, historic or scientific interest; and

- in the case of areas to be designated as nature reserves, to maintain and restore the natural environment, and to protect, care for, and promote the appreciation and study of, indigenous flora and fauna, and to preserve any feature of archaeological, historic or scientific interest.

ACKNOWLEDGEMENTS

The planning team responsible for the preparartion of this Management Plan consisted of Anthony Sutton (Draft Plan co-ordinator), Daryl Moncrieff (Final Plan co-ordinator), David Mitchell, Tony Friend, Steve Gorton, Dennis Hilder and Tim Bowra.

Many individuals and organisations contributed to the Plan, and their assistance is acknowledged. In particular, Anne Coates provided information on flora management issues; Noel Nannup and the Narrogin Noongar TAFE students helped prepare the Aboriginal Heritage section; CALM's Land Information Branch compiled the maps; Ken Wallace, Roger Underwood and the Narrogin District CALM staff commented on early drafts of the Plan; the Lions Club assisted with the visitor survey; and many people completed visitor surveys or made written submissions. Jim Williamson edited the Plan.

The cover photograph of Powderbark Wandoo woodlands is by Allan Padgett.

[1]This Plan recommends changes to the land tenure of Dryandra, including the creation of areas of national park and nature reserve vested in the NPNCA.

[2]The mallet plantations are considered indigenous State forests, not State forest planted with exotic species as defined under Section 56 of the CALM Act 1984

A VISION FOR DRYANDRA WOODLAND

Land clearing in the wheatbelt, particularly in the last 40 years, has reduced the area of native bushland to isolated remnants.

Of these, Dryandra Woodland is one of the largest and most diverse bushland areas, supporting a range of local plant and animal species, including the State's mammal emblem, the Numbat.

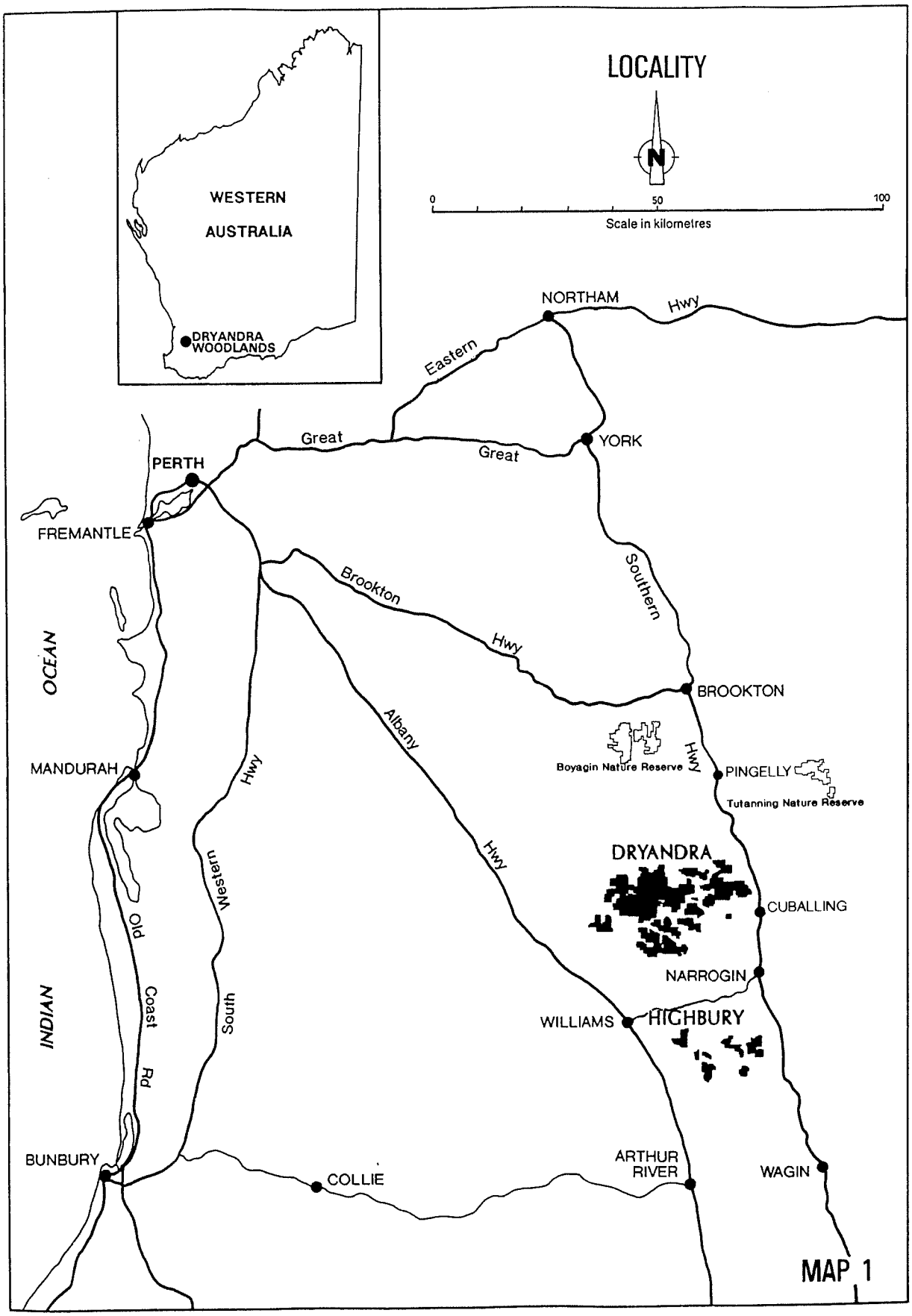
With continued degradation of bushland and agricultural lands through a range of factors including salinisation, waterlogging, erosion, and clearing, the importance of Dryandra will increase even further.

The continued survival of Dryandra's plant and animal species is dependent not only on the protection of this area, but also on the partial revegetation of the surrounding farmland.

The local timber industry is uniquely placed to help develop revegetation which combines commercial production, land conservation and nature conservation objectives.

The long term (100 year) vision promoted in this Management Plan is for some agricultural lands in the Dryandra area to be revegetated with belts of perennial woody vegetation. This will not only extend the woodland environment and help combat farmland degradation, but will also provide an ongoing resource for local timber-based industries.

Map 1 Locality



PLAN OVERVIEW

THE WOODLAND

The Dryandra Woodland (Lol Gray, Highbury and Montague State forests) lies about 160 km south-east of Perth in the Wheatbelt Region of the Department of Conservation and Land Management (see Map 1). It comprises 17 discrete blocks scattered over a north-south distance of approximately 50 km and separated by areas of agricultural land. The total area is 28 066 ha, with blocks ranging in size from 87 ha to 12 283 ha.

VALUES OF DRYANDRA WOODLAND

Western Australia's wheatbelt supports an extremely diverse flora and fauna. This is largely attributable to its transitional location between the arid zone and the more mesic environment to the west and south-west. The diversity and distribution of species has been greatly reduced, however, due to extensive clearing for agriculture, and the introduction of exotic animals, plants and diseases. The remnant blocks within the Dryandra Woodland are amongst the largest and most diverse of the central western wheatbelt, and are thus of major conservation significance.

Twelve distinct vegetation associations, comprising over 800 native plant species, have been identified within the Woodland. This includes 20 priority species and two species declared as rare[1]. Dryandra also supports seven threatened species of fauna, and a further three in need of special protection[2].

The Woodland provides a range of recreation sites and a variety of experiences for tourists and visitors. It is extensively used by university, school and naturalist groups as a venue for ecological field studies, the attractions being the biological diversity of the woodland, the Irabina Study Centre and the area's close proximity to Perth. The cottages within the original forestry settlement, which are managed by the Lions Club, also provide low cost, basic accommodation for overnight visitors. Use of the accommodation tends to be seasonal, with the Settlement heavily booked on weekends from May to November.

The mallet plantations within the Woodland are a valuable timber resource for the local community. In the first part of this century the bark of Brown Mallet (a source of tannins) was a major export commodity and a resource for local leather tanneries. Naturally occurring mallet was heavily exploited during this period, leading to the establishment of mallet plantations in Dryandra between 1925 and 1962. These plantations now extend over approximately 30% (8316ha) of Dryandra.

Timber harvested from Dryandra Woodland supports a number of local enterprises. These include a tool handle manufacturer who produces approximately 100 000 handles each year, a small industry for the treatment and supply of fencing materials, one licensed operator who cuts firewood and fencing material, and two licensed operators who cut firewood only. The ongoing requirements of the industry present a unique opportunity to aid in the development of economically and environmentally sustainable land management practices on agricultural land in the wheatbelt. CALM intends to be a lead player in the future development of this industry by continuing to allow commercial operations in Dryandra over the next 100 years (during which time CALM will promote plantation development on private property), and maintaining a 200 ha plantation to research and demonstrate plantation management.

Although little is known of the past use of the area by Aboriginal people, evidence of their occupation and links to the area survive in the form of archaeological sites and the ever-growing interest of local Noongars in re-establishing cultural ties to the land. The Department of Aboriginal Sites has recorded five sites within the Woodland, including an ochre quarry, stone arrangements, artefact scatters and a scarred tree. Dryandra has not been comprehensively surveyed for Aboriginal sites, and it is likely that others exist.

MANAGEMENT GOALS FOR THE WOODLAND

The Plan outlines the goals, objectives, and strategies for the management of Dryandra for the next ten years. Based on the recognition that nature conservation is the highest priority, the following management goals for Dryandra are proposed:

- **Conserve biological, physical, cultural and landscape values.**
- **Facilitate public enjoyment of Dryandra in a manner compatible with the conservation goal.**
- **Manage commercial uses in a manner that minimises the impact on other values.**

---

[1] *'Rare flora' refers to taxa declared under Section 23F(1) of the Wildlife Conservation Act (1950) as rare, likely to become extinct or in need of special protection. 'Priority species' are taxa that are under consideration for declaration under the Act.*

[2] *'Threatened' fauna taxa are those that are declared under Section 14(2)(ba) of the Wildlife Conservation Act (1950) as being likely to become extinct or rare—'specially protected' taxa includes fauna that is otherwise in need of special protection.*

SUMMARY OF KEY ISSUES AND MANAGEMENT STRATEGIES

Land Tenure

State forests 51 (Lol Gray), 52 (Highbury) and 53 (Montague), are vested in the Lands and Forest Commission (LFC) for the purpose of multiple use. Currently, conservation of flora and fauna is the primary use, with mallet timber production and recreation as secondary uses. In order to achieve the management goals listed above, it is proposed that some areas will become nature reserve, some will become national park, and others will remain as State forest (see Section 2. Land Tenure and Map 3[a] and [b]).

The area will be collectively known as 'Dryandra Woodland'. This name change takes into account the structural differences between it and the taller, denser forests of the Darling Range (see Section 7. Vegetation and Flora), recognition of the Highbury blocks as being part of the planning unit, and future marketing opportunities.

Flora and Fauna

As a result of past clearing of the fertile valley floors for agriculture, some of the original vegetation associations of the central western wheatbelt are absent from or poorly represented in Dryandra. In this Plan, management will be aimed at ensuring the continued persistence of the existing range of vegetation associations within Dryandra (see Section 2. Land Tenure and Section 7. Vegetation and Flora).

The persistence of many species of flora and fauna of high conservation significance is indicative of Dryandra's important role in conserving the biological diversity of the wheatbelt and the State. In this Plan, it is proposed to maintain viable populations of all native species, to re-introduce native animals that were once found in Dryandra, to provide opportunities for Dryandra to be used as a source of native animals for re-introduction into other areas, and to maximise the value of Dryandra to mobile elements of the native fauna by increasing vegetated links between remnants (see Section 8. Fauna).

Aboriginal Heritage

Local Aboriginal (Noongar) people have expressed a strong desire for areas to be set aside where they can legally engage in cultural activities, including hunting. The feasibility of permitting such activities on various categories of CALM-managed land within the south-west of the State, including Dryandra, is currently being investigated. If permitted, cultural activities within Dryandra will be managed on a sustainable basis whilst ensuring that other values are not compromised (see Section 9. Aboriginal Heritage).

Recreation and Tourism

Annual visits to the Woodland in 1990-91 were estimated to be 29 000, including 5000 overnight visits at the Settlement. Visitation levels are expected to increase once the national park is declared, and the area is promoted by the tourism industry. Dryandra will be marketed to attract a clientele that is appreciative of the natural environment. Main target audiences will include the local community, schools and universities, naturalists, nature-based tourists, and others seeking passive recreation in a natural setting.

Tourism and recreation uses have been accommodated in this Plan, with improved access, better provision of information, the redesign of many recreation sites, and the expansion of recreation opportunities in some areas (see Section 14. Tourism and Commercial Visitor Services).

A range of access will continue to be provided to meet visitor and management demands. Strategies include upgrading and maintaining selected vehicular tracks leading to features of interest, whilst closing to public vehicular traffic some minor tracks associated with past industry uses. The use of selected minor tracks by pedestrians and cyclists will be encouraged (see Section 11. Access).

Areas degraded by present use will be redesigned or rehabilitated (see Section 12. Recreation Areas and Section 13. Recreation Activities).

Timber Production

The long term (100 year) vision is for commercial timber production from Dryandra to be phased out in favour of production from revegetated agricultural lands. These new plantings of local tree species would support local industries (contributing to the local economy and employing local people), as well as providing for land and nature conservation values. Eventually, the production role in Dryandra would be one of research and development for the local timber industry, with only small areas of mallet plantation being retained to demonstrate silvicultural techniques and resultant products. The remaining areas of plantation in Dryandra would be regenerated with the original native species, restoring a woodland in which nature conservation, passive recreation and eco-education will be the priority values. The steps and time frame to achieve this vision are outlined in Section 15. Timber Production.

In working towards the 100 year vision, it is proposed over the next ten years to:

- commence the conversion of poor quality mallet plantations to a woodland of original species;

- manage good quality mallet plantations for mallet timber products, consistent with the maintenance of conservation values;
- further develop research on the silviculture of mallet and on the properties and uses of mallet;
- investigate means of encouraging the establishment of suitable trees (especially local species) on private property as a future resource for local industries and to assist with land and nature conservation; and
- continue silvicultural studies of sandalwood.

Disease

Plant diseases, caused by *Phytophthora* species and *Armillaria luteobubalina,* are important concerns in Dryandra. Management will include surveys to identify diseased areas, and the application of hygiene practices in all relevant operations (see Section 18. Disease).

Fire

The management of fire in Dryandra will need to be flexible to achieve the multiple objectives of management. During the term of this Plan there will be an on-going requirement for the protection of life, property, and the Brown Mallet plantations, and an increasing emphasis upon the maintenance of habitat and species diversity. It is proposed that effective fire protection be achieved by a combination of fuel reduced buffers, the maintenance of efficient detection and suppression systems, and regular and constructive liaison with farmers, visitors and the general public (see Section 19. Fire and Map 5[a] and [b]).

Weeds

Major weed threats in Dryandra are cape tulip, Guildford Grass, Cape Weed, clover, soursob, and grasses such as wild oats, Perennial Veldt Grass and African Love Grass. The Plan aims to control or eradicate, where possible, these and other weeds that have potential to cause major environmental problems (see Section 20. Weeds).

Introduced Animals

Introduced animals, such as foxes, have a detrimental effect on native plants and animals. Dryandra is one of the areas where successful fox control methods were researched and developed. The fox baiting program will continue, as will research on effective and efficient control of foxes and other feral animals (see Section 21. Introduced Animals).

Education, Information and Interpretation

Recent growth in visitor numbers has increased opportunities for community education, information and interpretation. Programs based on the theme that 'biodiversity is essential to sustain each individual's quality of life' will be developed. Promotion of this theme will involve the development of an interpretive drive trail within the Woodland, improving education opportunities at the Settlement, Dryandra Arboretum and the Irabina Study Centre, and targeting audiences such as the local communities, schools and universities, naturalists and nature-based tourists (see Section 25. Education, Information and Interpretation).

TABLE OF CONTENTS

PRINCIPAL MANAGEMENT DIRECTIONS

1. POLICIES AND GOALS

Policies

This Plan is based on CALM policies current at the time of publication. These policies are developed from legislation, principally the CALM Act (1984) and associated regulations. Policies are published and distributed throughout CALM as policy statements. They are available to the public on request. The Plan is also consistent with NPNCA policies.

Goals

The Plan outlines the goals, objectives, and strategies for the management of Dryandra for the next ten years. Based on the recognition that nature conservation is the highest priority, the following management goals for Dryandra are proposed:

- **Conserve biological, physical, cultural and landscape values.**

- **Facilitate public enjoyment of Dryandra in a manner compatible with the conservation goal.**

- **Manage commercial uses in a manner that minimises the impact on other values.**

Management Context

Dryandra is situated between the 500 mm and 600 mm isohyets, receiving significantly less rainfall than the Darling Range to the west. The structure and composition of the vegetation reflects this: forests of Jarrah (*Eucalyptus marginata*) have been replaced by woodlands with a more open canopy, typically comprising Wandoo (*E. wandoo*) and Powderbark Wandoo (*E. accedens*). In recognising this fundamental difference, management principles within this Plan are more closely aligned to those of other woodland communities within the wheatbelt than the Darling Range forests.

Land clearing in the wheatbelt has reduced the area of native bushland to isolated remnants. In the Dryandra area, clearing has been comparatively recent, mainly occurring in the last forty years (see Map 2). As late as 1962, Dryandra was connected to the main forest belt of the Darling Range, and other large areas of native bush existed to the east. With the continued clearing of private property, the blocks of Dryandra have eventually become separated from these other areas and each other. The impacts associated with habitat fragmentation are still likely to be affecting the biota of Dryandra. For example, Saunders (1989), predicts further losses of bird species from wheatbelt reserves, depending on the extent of removal of native vegetation and the length of time since clearing occurred.

Despite Dryandra's overall large size in comparison with other reserves of the central western wheatbelt, it is subject to similar problems to those of other fragmented areas of native vegetation. These include:

- susceptibility to hydrological changes;
- inward drift of fertilisers and weeds from agricultural land;
- restrictions on fauna movement; and
- vulnerability to single catastrophic events, such as a wildfire that burns a large proportion of a block. Re-colonisation by plants and animals may be very slow, or may not occur at all. Such events could therefore lead to local extinctions. The continued survival of Dryandra's flora and fauna is dependent not only on the protection of CALM-managed land, but also on the partial revegetation of the surrounding farmland.

A primary value of Dryandra is its role in conserving a representative sample of the plants and animals of the central western wheatbelt. The area also makes an important contribution to maintaining biodiversity on an international scale by providing habitat for seven threatened species of fauna. In recognition of these attributes part of Dryandra Woodland is listed by the Australian Heritage Commission on the Register of the National Estate.

Overall, Dryandra Woodland has the potential to cater for a range of land uses, including nature conservation, recreation, education, timber production and Aboriginal cultural activities. These uses, together with its location within cleared farmland, provide opportunities to demonstrate how the integration of management across crown land and private property boundaries can contribute to ecologically sustainable land-use.

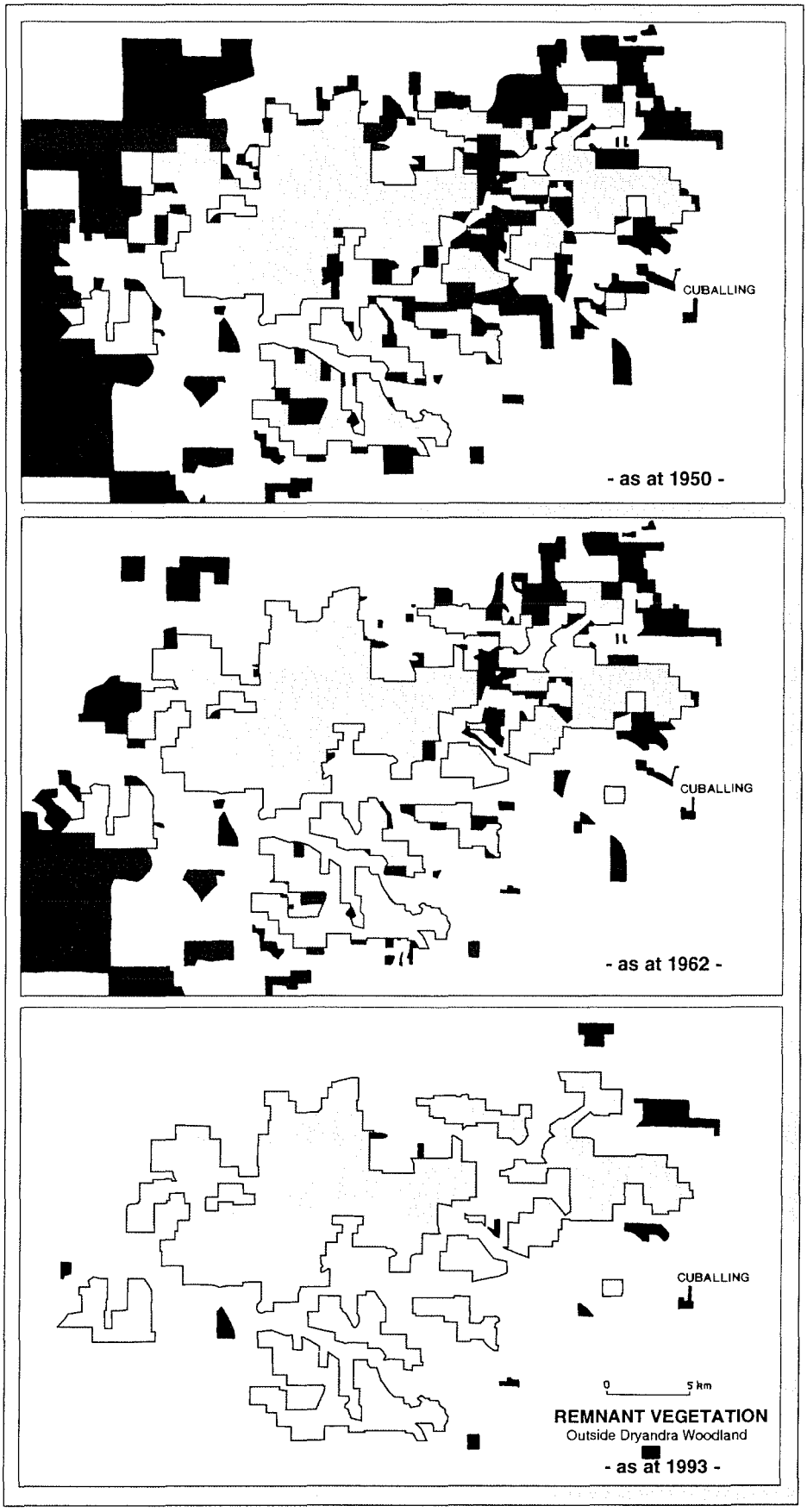
2. LAND TENURE

BACKGROUND

Current Tenure

Dryandra Woodland refers to State forests 51 (Lol Gray), 52 (Highbury), and 53 (Montague): they have a combined area of 28 066 ha and are vested in the Lands and Forest Commission for the purpose of multiple use. Conservation of flora and fauna is currently the primary use, with mallet timber production and recreation as secondary uses. State

Map 2. Remnant Vegetation outside Dryandra Woodland



MAP 2

forest 52 lies south of Narrogin, while State forests 51 and 53 (formerly known as 'Dryandra forest') are both north of Narrogin.

EPA Recommendations

In 1962, a subcommittee of the Australian Academy of Science (WA) made a series of recommendations with respect to National Parks and Nature Reserves within the State. These recommendations were reviewed in 1972 by the Conservation Through Reserves Committee at the request of the EPA (EPA 1976). The Committee, upon assessing State Forests 51 and 53 (the recommendations did not extend to include State forest 52), made the following comments and recommendations:

> 'The Committee emphasises the outstanding value of the Dryandra area as wildlife habitat. This is due largely to the protection and management which the area has hitherto received from the Forests Department. In view of both the current specialised staff and the knowledge of forestry management possessed by the Forests Department, the Committee recommends:
>
> 1. that State forests 51 and 53 remain dedicated to that purpose;
>
> 2. that the following reserves be included in the State forest:

Reserve	Purpose	Vesting
16201	Water Supply	Min. for Water Supply
18856	Timber (Mallet)	not vested
25768	Timber (Mallet)	not vested
31670	Prot. of Native Fauna	not vested
26643	Cons. of Flora & Fauna	WA Wildlife Authority
31378	Cons. of Flora & Fauna	not vested

> 3. that no further portions of Dryandra Forest be planted with pines or other exotic species;
>
> 4. that if any of the mallet plantations are felled they be regenerated to natural bush; and
>
> 5. that the area be managed by the Forests Department as though it were a fauna and flora reserve and that if at any time the area is relinquished by the Forests Department it be made a Class 'A' reserve for the Conservation of Flora and Fauna, vested in the WA Wildlife Authority' (CTRC 1974).

These recommendations were supported by the EPA and later endorsed by State Cabinet in 1976.

Under the former Forests Department's General Working Plans Nos 86 and 87 (Forests Department 1977, 1982) and more recently CALM's policies, recommendations 1, 2 and 3 have been implemented. Recommendation 5 has been largely implemented as the majority of State forest 51 (Lol Gray) is managed for habitat protection.

Changes in Use and Management

Since 1976 there have been changes in the use of Dryandra Woodland that directly impact upon the above comments and recommendations. These include:

- mallet timber production. Although timber has been harvested from Dryandra for many decades, local forest industries have expanded to the stage where a range of mallet products are produced, such as tool handles, fence posts and firewood. These industries are important in providing local employment and economic benefit, and demonstrating unequivocally to landholders that a sustainable timber industry can exist in the <600 mm rainfall zone. The establishment of plantations of local species on private property would serve the dual purpose of providing a cash crop, as well as providing shelter for stock and improving farmland condition by lowering water tables on salt-affected land;
- recreation. Dryandra Woodland, with approximately 29 000 visitors annually, has become a popular recreational area. Education groups favour the area because of the unique environment and the provision of accommodation and a study centre; and
- Aboriginal cultural activities. Local Aboriginal people have requested permission to conduct cultural activities, including hunting, in Quinns block (see Map 3[b]).

In addition, during this period the Forests Department, National Parks Authority, and the Wildlife section of the Fisheries and Wildlife Department merged to form the Department of Conservation and Land Management. Dryandra is situated within CALM's Narrogin District, which is responsible for the administative and operational management of the Woodland.

The premises upon which the EPA's recommendations were based have changed. While Dryandra still has outstanding value as wildlife habitat, there is now a need to consider other uses such as timber production, Aboriginal cultural activities, and increasing recreation demands. Furthermore, the management knowledge of the Forests Department is now complemented by staff from the other merging agencies, giving CALM a wide range of expertise in land management. CALM, unlike the previous Forests Department, has the legislative backup and the expertise to manage Dryandra as national park, nature reserve or State forest, or any combination of these.

Tenure Options

Under the CALM Act (1984) there are six possible land categories to which all or part of Dryandra Woodland could be assigned. These are: nature reserve, national park, conservation park, State forest, timber reserve and miscellaneous reserve (areas managed under section 5[g] of the CALM Act).

In 1992, the Lands and Forest Commission (LFC) in conjunction with the National Parks and Nature Conservation Authority (NPNCA) considered the future tenure for Dryandra Woodland. Both bodies agreed that plantations supporting the mallet industry should remain as State forest, whilst the remainder of the area should become either national park or nature reserve with vesting in the NPNCA.

ISSUES

- The land tenure of the blocks comprising Dryandra should reflect the conservation, recreation and production values of each area.
- Complex land tenure boundaries may be difficult to locate accurately in the field, leading to management and user problems.
- Due to the fragmented nature of Dryandra Woodland, the various statutory land tenures proposed (nature reserve, national park and State forest), and estimated visitor numbers and uses over the next ten years, further zoning of the Woodland into management units could unnecessarily complicate management.
- As a result of past clearing for agriculture, many of the original vegetation associations of the central western wheatbelt are poorly represented in or absent from Dryandra. Surrounding areas of remnant vegetation on private and Crown land enhance the conservation value of Dryandra.
- The high boundary-to-area ratio of Dryandra increases management concerns in relation to fire protection, introduction of weeds, fertiliser drift, access to and from the area, domestic animals entering Dryandra, and native animals damaging crops and fences. The purchase of key properties, should they come up for sale, would help to reduce the length and complexity of the boundary.
- Local Aboriginal people have requested permission to use Quinns Block for cultural activities (see Section 9. Aboriginal Heritage, strategy no. 1).
- The term 'Dryandra forest' has previously referred only to the blocks north of Narrogin. For this reason, and the fact that the vegetation structure is actually 'woodland', not 'forest' (see Section 7. Vegetation and Flora), the term is considered inappropriate . The name for the area should take into account the addition of Highbury into the management unit, and future marketing opportunities.

OBJECTIVE

- *Ensure land tenure reflects the high conservation value of Dryandra Woodland, and takes into consideration recreation and production values.*

Given Dryandra's high biological values and their need for protection, and the current recreation, production and cultural demands, it is proposed to separate the areas comprising Dryandra Woodland into the following land categories:

national park - for larger, contiguous areas of natural bush with high nature conservation and recreation values, and for which no timber production is proposed (see Map 3[a]). Areas of natural bush in the central block of Dryandra and some of the larger blocks satisfy these criteria. The total area proposed as national park is 16 337 ha (approximately 58% of the total area).

nature reserve - for isolated areas of natural bush with high nature conservation value, and limited recreation potential (see Maps 3[a] and [b]). Much of Highbury, and the smaller, isolated blocks of natural bush north of Narrogin satisfy these criteria. While logistically it would be easier to make all natural bush areas national park, the classification of the smaller areas as nature reserve is consistent with the tenure of similar areas within the vicinity of Dryandra. The total area of proposed nature reserve is 3294 ha (approximately 12% of the total area). This area may increase depending on the outcome of the review of Aboriginal cultural use of CALM-managed land in the south-west (see below).

State forest - for the mallet plantations, the Sandalwood plots on Gura Rd, and Quinns Block (see Maps 3[a] and [b]). The plantation areas are primarily important for sustainable mallet timber production, but have simultaneous value for nature and cultural conservation, recreation, and water catchment protection. Quinns Block, although not containing areas of mallet plantation, will remain State forest at least until the use of such areas for Aboriginal cultural activities are determined. (If cultural activities are deemed inappropriate, then the area would become nature reserve.) Mallet plantations that are regenerated back to the original natural vegetation during the life of this Plan, ie. 'poor quality' plantations, will remain as State forest at least until the Plan is reviewed in 2005. The total area to remain as State forest at this stage is 8316 ha (approximately 30% of the total area).

The overall proposal is that State forests 51 (Lol Gray), 53 (Montague) and 52 (Highbury) will now be known collectively as the Dryandra Woodland, and within this entity will be areas of nature reserve and national park vested in the NPNCA, and State forest vested in the LFC. All areas will be managed by CALM according to the principles established in this Management Plan.

STRATEGIES

1. Implement the proposed tenure changes shown on Map 3(a) and (b).
2. Ensure changes to land tenure boundaries are easily located in the field.
3. When private properties adjoining Dryandra are for sale, investigate purchasing those areas which have potential conservation, recreation or production value, or management benefits. Acquisition must also consider surrounding land uses and the views of the local community.
4. Actively pursue the incorporation of nearby Crown Land as additions to Dryandra Woodland.

Zoning

5. Whilst the Plan has been prepared using current visitor use and growth patterns, and predicted changes over the next ten years, it is possible that future public use of Dryandra far exceeds expectations. If such circumstances lead to management problems, consider a zoning scheme for the Woodland that minimises conflicts but maintains current public expectations wherever possible.

MANAGEMENT

PHYSICAL RESOURCES

3. CLIMATE AND WEATHER

BACKGROUND

The Dryandra Woodland experiences a Mediterranean climate with warm to hot, dry summers and mild, wet winters (McArthur *et al.* 1977). Seasonal changes in temperature, rainfall and wind direction are marked and more extreme than coastal areas of the south-west.

While fire is normally cited as the main disturbance event leading to changes in vegetation structure, other events such as windstorms, drought, summer rainfall and thunderstorms may all significantly affect the native plants and animals of the wheatbelt. Examples in Dryandra Woodland where extreme weather events have impacted upon the biota include the loss of mallet canopy as a result of a windstorm and more recently the collapse of some Dryandra thickets following drought or extreme and prolonged heat.

Less obvious weather events may also affect the biota; for example, the survival of regenerating seedlings may depend on an adequate amount and spread of rain over the first year or two.

ISSUES

- In autumn and spring, the mild to warm temperatures and regular rain are conditions conducive to the spread of plant diseases (see Section 18. Disease).
- Severe weather events, together with other natural events, may have a synergistic impact on the environment (Main 1987).

OBJECTIVE

- *Take into account the effects of climate and weather on Dryandra in management planning.*

STRATEGY

1. Monitor weather data for use in the management of Dryandra, particularly severe events, rainfall, wind speed and direction, frosts, and times of high fire risk.

4. GEOLOGY, LANDFORMS AND SOILS

BACKGROUND

The Dryandra Woodland lies within the South-western Province of the Yilgarn Block, an ancient plateau composed mainly of granite, with intrusions of dolerite, and capped with laterite. Past weathering of the plateau in the Dryandra area has produced a gently undulating countryside featuring distinct breakaway slopes, that can be partitioned into three broad landform units: Norrine (lateritic uplands), Noombling (valley slopes) and Biberkine (valley floors) (McArthur *et al.* 1977). The vegetation associations of Dryandra are closely linked to these landform units (see Table 2).

ISSUES

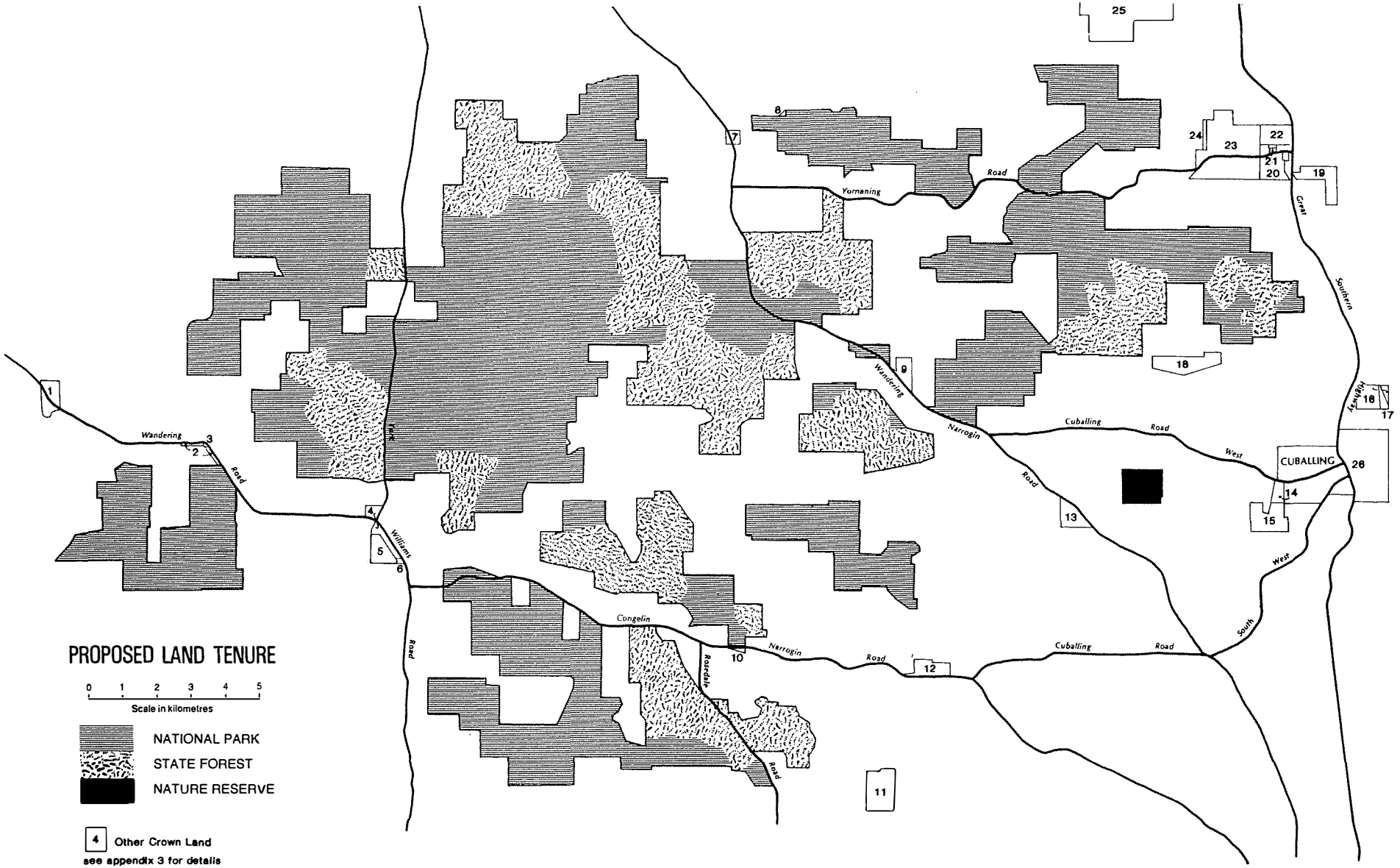
- The soils of the Dryandra Woodland are generally not prone to erosion although gullying may occur on steeper slopes and where there is a change in the penetrability of the soil profile, eg. duplex soils (Dames and Moore 1985).
- Granite outcrops and valley floors, and their associated plant communities, are sensitive to disturbance.
- As a result of past clearing of these relatively fertile valley floors for agriculture, the Biberkine landform unit is poorly represented in Dryandra.

OBJECTIVE

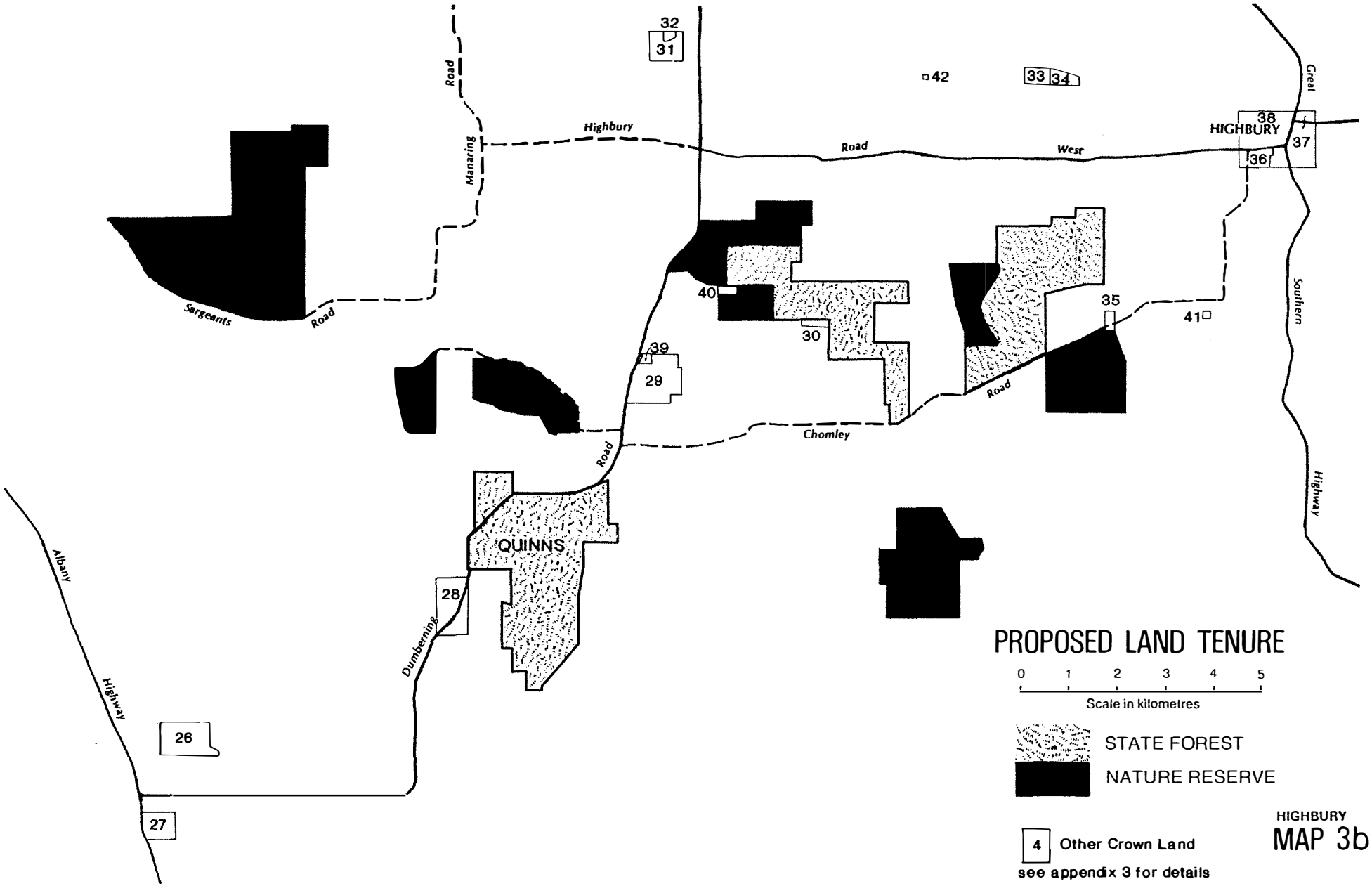
- *Protect all landforms, soils and geological features, and the processes that sustain them.*

STRATEGIES

1. Minimise access and management activities in areas prone to erosion and disturbance, for example, on breakaway slopes, soils subject to waterlogging, valley floors and granite outcrops.
2. Consider for acquisition, by purchase or exchange when available, private property enclaves and Crown lands adjoining Dryandra that contain the Biberkine landform unit.
3. Provide interpretive information on the relationship between the geology, landforms and soils, and the distribution of plant and animal communities.
4. Monitor the effectiveness of erosion control techniques and incorporate new practices where appropriate.



DRYANDRA
MAP 3a


Road
Manaring
Highbury
Road
West
Great
Southern
Highway
Sargeants
Road
Chomley
Road
Road
Dumberning
Albany
Highway
QUINNS
HIGHBURY
32
31
42
33
34
38
37
36
40
30
39
29
35
41
28
26
27
PROPOSED LAND TENURE
0 1 2 3 4 5
Scale in kilometres
STATE FOREST
NATURE RESERVE
4 Other Crown Land
see appendix 3 for details
HIGHBURY
MAP 3b

5. HYDROLOGY

BACKGROUND

Catchments

Dryandra Woodland is within the upper reaches of the Murray River and Blackwood River catchments. Areas of the Woodland to the north of Narrogin are located between the Williams and Hotham rivers, which drain into the Murray River. Woodland areas to the south-west of Narrogin, are located on the catchment boundary between the Murray and Blackwood catchments. The north-western most blocks drain into the Williams River, whilst the remaining blocks in the Highbury area feed into the Arthur River, a tributary of the Blackwood.

Dryandra Woodland is within the Cuballing, Narrogin and Williams land conservation districts.

Water Quality

There is a trend of increasing water salinity from west to east within the Murray and Blackwood rivers. This reflects an increasing concentration of salts within the soil profile with diminishing rainfall (Mc Arthur *et al.* 1977). The surface water within Dryandra Woodland, although a blend of surface run-off and saline ground water, is considered fresh (J. Davis pers comm.).

Water Supplies

Several dams exist within Dryandra Woodland, including:

- Congelin Dam, which previously serviced steam trains;
- the Old Mill Dam, which was associated with a sawmill;
- the Montague Dam; and
- two dams within the Settlement area, one of which supplies the domestic water. In addition, water tanks are located at the old Lol Gray and Contine homestead sites.

Hydrological Processes

The water cycle in the south-west forests and woodlands consists of a series of four interrelated processes: precipitation, evapotranspiration, soil water storage and movement, and streamflow. Changes in land use which alter these processes and, thus, change the water balance, have the potential to cause environmental problems.

ISSUES

- Land uses within the immediate catchments have the potential to influence the water quality and quantity in the tributaries and dams in the Woodland and on surrounding farmland.
- The water stored in a number of small dams in Dryandra is used for recreation, fire control, and as habitat for aquatic flora and fauna.
- The supply of domestic quality water to the Settlement needs to be maintained.
- Liquid wastes from the Settlement and recreation sites have the potential to pollute streams and dams.
- Increasing soil salinity, as a result of rising groundwater, is a problem on agricultural lands surrounding Dryandra. Baseline data on the level and pressure of the groundwater in the Woodland is required to detect potential salinity problems.

OBJECTIVE

- *Manage water resources to ensure the protection of conservation, recreation and production values of Dryandra and the surrounding catchments.*

STRATEGIES

1. Manage the Woodland's water resources on a catchment basis.
2. Liaise with the Department of Agriculture, Land Conservation District Committees and landowners to encourage land use practices that improve the water quality.
3. Ensure hydrological processes are considered during planning for all management activities, particularly timber production.
4. Maintain a potable water supply for the Settlement by protecting the catchment area of the Settlement Dam.
5. Maintain Congelin Dam and the Old Mill Dam and their catchments for fire control purposes.
6. Ensure that liquid wastes from the Settlement and recreation sites do not pollute streams and dams.
7. Monitor the level and pressure of the groundwater in Dryandra and the surrounding area in order to detect potential soil salinity problems.

6. LANDSCAPE

BACKGROUND

Landscape[3]

Every landscape has an identifiable visual character determined by its geology, hydrology, soils, vegetation and land use history. According to these features the State has been divided into 38 Visual Character Types (Stuart-Street and Kirkpatrick 1994). The Dryandra Woodland is within the Dryandra Uplands, which is a component of the Wheatbelt Plateau Visual Character Type.

Dryandra's landscape is characterised by its diversity in vegetation (open woodland to closed heath) and

[3] *The term landscape in this context refers to the scenery or visual expression of the environment. Other non-visual components of the landscape, such as smell and sound, have not been assessed.*

landform (gentle valley slopes to abrupt breakaway areas), and its historic built components (the Settlement and homestead sites). The visual quality of this landscape is a resource in its own right and should be considered concurrently with other values when management decisions are made.

Landscape Management
Landscape management is concerned with the management of land, vegetation and water resources so as to maintain or improve their visual quality.

Changes to the landscape continually occur. Whether visual changes are perceived as positive or negative depends on numerous factors, including the viewer's perception and position, view duration, view distance, landform, soils, aspect and type of landscape alteration. The ability of landscapes to absorb change without loss of scenic value also varies and depends on slope, soils and vegetation cover. Landscape management thus involves extensive broad scale and on-site analysis of these factors, project impact evaluation, and sensitive site planning, design and construction methods.

ISSUES

- Sites or management activities currently requiring improved visual management include:
  - existing gravel pits;
  - recreation sites where there is undefined car parking and damage to vegetation from site associated use;
  - timber production operations in visually sensitive areas, such as along some roadsides;
  - additions to the Settlement buildings where the scale, form, colours, materials and patterns do not effectively borrow or blend with the historical characteristics of the site;
  - the exotic plant species along Tomingley Road;
  - groups of unrelated signs which create visual clutter; and
  - clearing for line-of-sight from survey trig points.
- Alterations to natural landscapes often have an undesirable visual impact that can be avoided or minimised. Management operations within Dryandra, should conform to the desired visual quality standards outlined in CALM's Policy 34 Visual Resource Management on Lands and Waters Managed by CALM.

OBJECTIVE

- *Ensure that all uses and management activities are planned and implemented to complement rather than detract from the visual qualities of Dryandra's landscapes.*

STRATEGIES

1. Assess and map the visual resource values of the Dryandra Woodland as time and resources permit.
2. Ensure sites or activities currently requiring visual management (see Issues) are managed according to the guidelines outlined in Table 1.
3. Ensure government agencies, statutory authorities, lessees and CALM contractors recognise the importance of visual resource management.
4. Encourage sensitive siting of facilities and signs, selection of site compatible materials and colours, revegetation with local native species, and careful planning and siting of utilities.
5. Develop all signs in accordance with CALM's Sign Manual and encourage the sensitive use of signs in areas adjacent to the Woodland. Interpretive and explanatory signs should be utilised before and during operations that alter the visual landscape.

BIOLOGICAL RESOURCES

7. VEGETATION AND FLORA

BACKGROUND

Regional Context
Dryandra Woodland lies on the boundary between the Darling and the Avon botanical districts of the South-west Botanical Province (Beard 1980). This boundary approximates the replacement of Jarrah (*Eucalyptus marginata*) by Powderbark Wandoo (*E. accedens*) and Brown Mallet (*E. astringens*) on lateritic residual soils, the retirement of Marri (*E. calophylla*) from the mid slope, and the appearance of York Gum (*E. loxophleba*) on the lower slopes (Beard 1980). As a result, Dryandra's flora is transitional between that of the moister Jarrah forest and the semi-arid wheatbelt. The structure of the vegetation also changes, assuming a more open form typical of woodlands, where canopies are clearly separated (McDonald *et al.* 1984).

The central western wheatbelt (400-600 mm rainfall), although originally supporting woodlands similar to that found in Dryandra, is now largely cleared. The remaining areas of natural vegetation, particularly the larger remnants such as Dryandra Woodland and the Boyagin and Tutanning Nature Reserves (Map 1), are thus of major conservation significance.

Vegetation Communities
One of the features of Dryandra Woodland is the contrast in vegetation structure between tall, open

Table 1. Visual Management Guidelines.

VISUAL MANAGEMENT GUIDELINES
• Alterations to the natural landscape should be subtle, remaining subordinate to natural elements by borrowing extensively from form, line, colour, texture and scale found commonly in the surrounding landscape.
• Site-specific visual resource factors should be carefully identified and evaluated before any management activities are undertaken.
• Facilities and activities that utilise and yet disturb little of the natural environment should be encouraged, for example, walking tracks and small picnic sites.
• Degraded landscapes, eg. gravel pits, should be rehabilitated after use.
• Where structures are required they should be sympathetic in design, materials and colour to complement surrounding landscape elements and be carefully sited away from major natural focal points, out of viewer sight-lines and where vegetation or landform screening can be utilised.
• Prescribed burning operations should incorporate prescriptions and techniques that minimise the visual impact.

woodlands of Wandoo and Powderbark Wandoo, and low, dense heathlands. A recent vegetation survey (Coates 1993) identified 12 vegetation communities in Dryandra. These communities are closely linked to landform and soil, and can be rated for management purposes according to the incidence of priority plant species, and weed invasion and dieback disease hazard (Table 2).

Flora

With 816 identified native plant species, Dryandra Woodland has a relatively rich flora that includes species from both the more moist Jarrah forest and the semi-arid wheatbelt. In comparison, the nearby nature reserve of Tutanning contains 697 recorded species (A. Hopkins pers comm.), and the south coast national parks of Fitzgerald River and Walpole-Nornalup contain 1748 species and 698 species respectively (CALM 1992a, CALM 1991a).

The greatest floristic diversity can be found in the Lateritic Plateau Woodlands, Dryandra/Petrophile Shrublands, Low Kwongan, Marri Woodlands and Lithic Complexes. These communities make up only a small proportion of the total area of Dryandra. At a community level, Wandoo and Powderbark Wandoo woodlands occupy nearly 50% of the area of Dryandra, yet have only approximately 25% of the recorded native flora species. The major families represented are Myrtaceae (76 species), Proteaceae (75), Papilionaceae (73), Asteraceae (72), Orchidaceae (65), Mimosaceae (37), Poaceae (32), Anthericaceae (29) and Cyperaceae (26).

Threatened and Priority Flora

All native flora are protected under the Wildlife Conservation Act (1950), but declared rare flora (DRF) are given special protection. The DRF list is reviewed annually and published in the Government Gazette. Currently there is two DRF species within the Dryandra Woodland (see Appendix 1). In addition, CALM maintains a priority species list for flora that are poorly known and in need of further survey, or are adequately surveyed but in need of monitoring. Twenty priority species have been recorded in Dryandra, most of which require further survey to adequately assess their conservation status (see Appendix 1).

Fungi, Mosses and Liverworts

In addition to the diverse array of vascular plants, there are many species of fungi, mosses, liverworts and lichens. While only limited surveys of these groups have been conducted, to date more than 100 species of 'larger fungi' have been recorded in Dryandra. Many of the 'larger fungi' are hypogean (underground) species, an integral part of the Woylie's (*Bettongia penicillata*) diet (Christensen 1980). Most species of hypogean fungi are also mycorrhizal, growing within or on the outside of plant roots. This symbiotic relationship assists nutrient uptake by plants.

Keystone Species

A keystone species is one which, if removed, would precipitate significant losses of other species (Gilbert 1980). Structurally dominant species that fruit, flower or seed outside the normal peaks in community production, or that produce high levels of a reliable resource, may be important in

maintaining community cohesion. Possible keystone species include the hypogean fungi of the Woodland.

Disturbance Cycles

Plant communities and populations may be severely disrupted by disturbances such as windstorms, flood, fire and drought. Depending on factors such as season, species, and frequency of disturbance, plants may temporarily disappear or be reduced in numbers. Often these disturbance events act as 'reset mechanisms', returning a plant community to an earlier seral stage. Rock Sheoak (*Allocasuarina huegeliana*) and Brown Mallet forests are both vegetation associations that can regenerate as single-aged stands following a disturbance event such as fire (see also Section 19. Fire).

ISSUES

- The Jam Low Forests, which include stands of Sandalwood (*Santalum spicatum*), and York Gum Woodlands are poorly represented within Dryandra (see Table 2). Other vegetation associations of the Narrogin area, such as Salmon Gum Woodlands, do not occur in Dryandra Woodland but as isolated stands on surrounding private property. Management strategies should aim at ensuring the continued persistence of the full range of plant communities within the vicinity of Dryandra.
- There are two rare and 20 priority species occurring in Dryandra. The incidence of these species is highest in vegetation types 1, 9 and 10 (see Table 2). Many of the priority species require further survey or taxonomic study to assess adequately their conservation status.
- Vegetation types 10, 11, and 12, which are associated with moist, fertile soils, are highly susceptible to weed invasion (see Table 2).
- Dryandra is within the known distribution of dieback, a plant disease caused by fungi of the *Phytophthora* genus. An infection of *P. citricola* has been recorded within the Woodland. Vegetation types 1, 2 and 3 have a high proportion of susceptible species, while type 10 is associated with moisture gaining sites, increasing the disease hazard (see Table 2).
- *Armillaria luteobubalina* has been recorded at two locations within Dryandra, with vegetation types 5, 6 and 7 (susceptible species), and type 10 (moisture gaining sites) appearing to be the most susceptible (see Table 2). While it is difficult to control the spread of this naturally occurring fungus, monitoring plays an important role in the management of infected sites.
- In the absence of natural disturbance events, it may be necessary to use management tools (eg. prescribed burning) to maintain the full range of physiological ages of some plant communities .
- The role of many ecological factors in Dryandra (such as keystone species, mycorrhizal fungi, pollinators and 'natural' episodic disturbance cycles) is poorly understood.

OBJECTIVES

- *Maintain viable populations of all species of plants which occur in Dryandra.*
- *Develop and implement management strategies that will ensure continued persistence of the full range of plant communities within Dryandra.*

STRATEGIES

1. Protect Dryandra's plant communities from plant diseases and weeds by implementing strategies in Section 18. Disease and 20. Weeds.
2. Protect threatened and priority species, especially those susceptible to plant fungal diseases, weed invasion and frequent fire. Develop and implement management strategies for their conservation.
3. Ensure that a record of the location of threatened and priority flora species is readily accessible at CALM's Narrogin District Office. Ensure that these records are consulted before development or management actions are undertaken.
4. Through appropriate management, ensure that a range of physiological ages of plant communities are represented in Dryandra.
5. Ensure the continued persistence of the full range of plant communities within Dryandra Woodland and the surrounding areas by:
   - liaising with neighbouring private property owners to protect areas of remnant vegetation, especially those types not well represented on CALM managed land;
   - providing advice to landowners on species suitable for planting in vegetation corridors;
   - giving existing areas of Jam Low Forests (including stands of Sandalwood) and York Gum Woodlands management priority, eg. for weed control and plant re-establishment;
   - incorporating areas of Crown Land into Dryandra Woodland within the vicinity of the Woodland.

Research and Monitoring

6. Carry out research into management regimes (especially fire) required to maintain vegetation communities.
7. Research the: response to disturbance (such as plant disease, fire, weeds and erosion); reproductive biology, taxonomy; and ago to maturity of all threatened and priority flora.
8. Record and describe the frequency, intensity and impact of severe disturbances (natural and human) on plant communities. As far as practicable, also describe recovery.
9. Identify keystone species and vegetation communities of critical conservation importance.

Table 2. Vegetation associations of Dryandra Woodland.

Vegetation Association Types	Landform	Occurrence of vegetation associations	Incidence of priority plants	Weed invasion hazard	Fungal disease hazard
1. Lateritic Plateau Woodlands	Norrine (lateritic uplands)	Common, but covers only small areas	***	*	P *** (susceptible species) A*
2. *Dryandra/Petrophile* Shrubland	Norrine (lateritic uplands)	Uncommon, but covers only small areas	**	*	P *** (susceptible species) A*
3. Low Kwongan	Noombling (upper valley slopes)	Common, but covers only small areas	**	*	P *** (susceptible species) A*
4. Brown Mallet Forest	Noombling (upper valley slopes)	Common, but covers only small areas in the natural bushland		*	P * A*(susceptible species)
5. Powderbark Wandoo Woodland	Noombling (upper valley slopes)	Common, covers extensive areas	*	*	P* A*** (susceptible species)
6. Wandoo Woodland	Noombling (mid–lower valley slopes)	Common, covers extensive areas		*	P* A*** (susceptible species)
7. Wandoo/Sheoak Forest	Noombling (mid–lower valley slopes)	Common, but covers only small areas		*	P* A*** (susceptible species)
8. Marri Woodland	Noombling (mid–lower valley slopes)	Uncommon, covers only small areas		** (sandy soils)	P* A** (susceptible species)
9. Sheoak Low Forest	Noombling (valley slopes)	Common, but covers only small areas	***	*	P* A* (moist site)
10. Lithic Complex (granite)	Noombling (valley slopes)	Common, but covers only small areas	***	*** (moist site)	P** A** (moist site)
11. York Gum Woodland	Biberkine (valley floor)	Occasional, covers only small areas		*** (moist site)	P* A*
12. Jam Low Forest	Biberkine (valley floor)	Occasional, covers only small areas		*** (moist site)	P* A*

* Low ** Medium *** High

Note: The ratings were developed in consultation with A. Coates, G. Keighery and B. Shearer.

P = *Phytophthora* species
A = *Armillaria luteobubalina*

10. Keep abreast of new information on the flora and ecology of Dryandra. Utilise this new knowledge to modify management where appropriate, using specialist assistance.

8. FAUNA

BACKGROUND

Regional Context

Dryandra supports a rich faunal assemblage that reflects the transitional nature of the vegetation: most wheatbelt species have distributions that also encompass either the arid inland or the more mesic environments to the west and south-west. For example, of the mammal species, only the Western Mouse (*Pseudomys occidentalis*) and the now extinct Broad-toothed Potoroo (*Potorous platyops*) were historically restricted to the wheatbelt (Sanders and Harold 1991).

Following extensive clearing of the bush for agriculture and the subsequent introduction of exotic animals, plants and disease, both the number of species and the area inhabited by them has been greatly reduced. Only a few isolated pockets of bushland now remain which are large and varied enough to continue to provide a habitat for the remaining species (Burbidge 1977). Of these, Dryandra Woodland is one of the larger and more diverse areas, retaining 24 of the 46 species of native mammals which remain in the wheatbelt.

The persistence of several threatened species of mammal and two species of birds means Dryandra plays a number of important roles in conserving the fauna of the wheatbelt and the State. Firstly, the Dryandra populations provide some measure of security for each of these species, eg. the Numbat (*Myrmecobius fasciatus*) population represents nearly half of the total number of the species. Secondly, fox baiting in Dryandra has allowed these populations to increase to the point where a proportion of the numbers can be translocated to other areas where populations have become extinct. Individuals from the Dryandra populations of both the Woylie and the Numbat have formed the basis of re-introductions of populations in other areas. The natural dispersal of threatened species from Dryandra along vegetated corridors to nearby remnant bush has also occurred (J. A. Friend pers comm.).

An additional way in which Dryandra may contribute to the conservation of threatened fauna is by providing secure habitat for the re-introduction of fauna once found in the area but now locally extinct. The Southern Brown Bandicoot (*Isoodon obesulus*) is an example of a threatened species that may be re-introduced into Dryandra in the future. Eventually, re-introduced populations may increase to the level where they in turn can be re-introduced to other areas.

Vertebrates

The number of mammal species found in the Wheatbelt Region of CALM has declined considerably since European settlement, with six species no longer found in this area and three species presumed extinct (Strahan 1983). This decline has been attributed primarily to land clearing, however, other factors such as changing fire regimes, and the introduction of competitors, predators and diseases, have caused significant losses.

Twenty-four species of native mammal are found in the Woodland, including five – the Numbat, Woylie, Tammar Wallaby (*Macropus eugenii*), Chuditch (*Dasyurus geoffroii*) and Red-tailed Phascogale – which are threatened (Table 3). The Southern Brown Bandicoot was last recorded in Dryandra in 1971 (Burbidge 1977). The Woodland also has populations of rarely seen species such as Honey Possums (*Tarsipes rostratus*), Western Pygmy Possums (*Cercartetus concinnus*), and Mardos (*Antechinus flavipes*).

CALM prepares and implements recovery plans and wildlife management programs for threatened fauna according to priorities laid down by CALM, in consultation with the National Parks and Nature Conservation Authority and relevant consultative committees. Recovery Plans for the Numbat and Woylie have recently been completed and are being implemented.

Ninety-eight species of birds are recorded from Dryandra Woodland, including two species that are threatened and two others that are gazetted as specially protected (Table 3). Overall, the diversity of birds is probably a reflection of the wide range of habitats found in the Woodland.

Of the 51 species of reptiles recorded at Dryandra only one, the Carpet Python (*Morelia spilota imbricata*), is gazetted as specially protected (Table 3).

There are eight frog species recorded from Dryandra Woodland, including the Golden-flecked Burrowing Frog (*Heleioporus barycragus*) which is largely restricted to the western Darling Range (Burbidge 1977). Dams and drainage lines support the greatest number of frog species.

Further vertebrate surveys of Dryandra are likely to record additional species of reptiles and frogs.

Invertebrates

Little is known of the invertebrates of the Woodland; studies have been restricted to termites (J. A. Friend pers comm.), litter and ground-surface arthropods (Majer 1985), and arboreal spider communities (L. Thomas pers comm.).

Termites are an important component of the fauna of Dryandra, performing a crucial role in nutrient cycling and maintaining soil structure. Termites comprise the whole diet of Numbats and one species, *Coptotermes acinaciformis raffrayi*, is the only species of termite that forms hollows in Wandoo and Powderbark Wandoo and, as such, may be considered a keystone species.

Mallet Plantations

The use of mallet plantations by at least native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet, and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of natural regrowth eucalypts support a greater diversity than young, uniform stands.

Disturbance Cycles

Animal communities and populations are severely disrupted by disturbances such as fire, flood and drought. Depending on factors such as season, the species, and intensity of disturbance, animals may temporarily disappear or be reduced in numbers. Recovery is by re-invasion from nearby undisturbed areas and expansion of resident populations as the vegetation returns (CALM 1992b).

The diversity of animal communities and populations in Dryandra reflects not only the variation in climate, soils, topography and vegetation, but past natural and human disturbances.

Corridors

Dryandra Woodland comprises 17 vegetation 'islands' within a largely cleared landscape. However, in some cases, corridors of uncleared vegetation remain (for example, road reserves), linking the Woodland's remnants. In addition, some local landowners have revegetated areas to form corridors between remnants. For many animals, movement between blocks is necessary on a daily, seasonal or intermittent basis, to enable them to find food, shelter, breeding sites or partners (Hussey *et al.* 1991). Additional benefits of vegetation corridors include:

- provision of habitat for plants and animals;
- representation of the vegetation communities which were present prior to clearing;
- a prominent and accessible education resource;
- an improvement in landscape quality; and
- potential increased farm productivity through prevention of erosion, control of salinity, and provision of shade and shelter for stock.

There is no formal program in place to monitor the use of corridors by native animals at Dryandra.

ISSUES

- Five mammal, four bird and one reptile species are threatened or in need of special protection. Specific management strategies are required to maintain species' habitats and control predators.
- Dryandra Woodland is a source of species for translocation to other reserves and a possible location for future releases.

Table 3. Threatened and Specially Protected fauna

Status	Common name	Scientific name
Threatened	Red-tailed Phascogale	*Phascogale calura*
	Numbat	*Myrmecobius fasciatus*
	Chuditch	*Dasyurus geoffroii*
	Woylie	*Bettongia penicillata*
	Tammar Wallaby	*Macropus eugenii*
	Malleefowl	*Leipoa ocellata*
	Crested Shrike-tit	*Falcunculus frontatus*
Specially Protected	Peregrine Falcon	*Falco peregrinus*
	Carnaby's Black Cockatoo	*Calyptorhynchus funereus latirostris*
	Carpet Python	*Morelia spilota imbricata*

- The populations of some native mammal species have increased in Dryandra over recent years. This increase has primarily been due to the control of foxes.
- Native fauna, especially Numbats, Woylies and Malleefowl are of major interest to visitors (see Section 14. Tourism and Commercial Visitor Services).
- Owing to their limited capacity to survive in saline water, all frogs in the wheatbelt are considered to be at risk (Sanders and Harold 1991).
- Little is known of the invertebrate fauna (including aquatic fauna) of Dryandra or of their role in nutrient cycling and other ecosystem processes of the Woodland.
- Local Aboriginal people have requested permission to conduct cultural activities, including hunting, in Quinns Block (see Section 9. Aboriginal Heritage).
- The movement of biota between isolated blocks of remnant vegetation in Dryandra is restricted by fenced and cleared farmland. Vegetated corridors linking these blocks will aid in the dispersal of biota, as well as providing additional habitat and improving landscape quality. Existing corridors are not currently monitored.
- The use of mallet plantations by native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of regrowth original eucalypts, such as Wandoo and Powderbark Wandoo, support a greater diversity than young, uniform stands.

OBJECTIVES

- *Maintain viable populations of all the species of native animals presently in Dryandra.*
- *Maximise the value of Dryandra to mobile elements of the native fauna by increasing vegetated links between remnants.*
- *Re-introduce native animals that were once found in Dryandra.*

STRATEGIES

General

1. Continue to control, and if practicable eradicate, introduced species that are damaging or could potentially damage native fauna (see Section 21. Introduced Animals).
2. Protect habitats from plant disease (see Section 18. Disease), introduced plants (see Section 20. Weeds), inappropriate fire regimes (see Section 19. Fire) and human activities (see Section 13. Recreation Activities and Section 15. Timber Production).
3. Facilitate support for fauna conservation by encouraging and promoting the use of Dryandra for nature-based tourism purposes (see Section 13.1 Nature Study and Appreciation).

Threatened Species

4. Implement recovery plans, in conjunction with nominated recovery teams, for threatened species which occur or once occurred in Dryandra. The plans may include recommendations to re-introduce native animals that were once found in Dryandra and to use Dryandra as a source of native animals for re-introduction into other areas.
5. Where a fauna species thought to be at risk in Dryandra is not covered by a specific recovery plan, determine and implement management required to maintain or enhance populations using the results of current research and monitoring, and where appropriate, using specialist assistance.

Corridors

6. In consultation with neighbours, Land Conservation District Committees and local authorities, seek to establish and protect vegetation corridors between Woodland remnants.
7. Provide information to the public, particularly the farming community, on the values of vegetation corridors and remnant vegetation to both sustainable agriculture and native biota.

Research and Monitoring

8. Encourage and carry out general research on fauna ecology in Dryandra, with particular emphasis on threatened and specially protected species, and those species thought to be at risk (eg. frogs).
9. Encourage and carry out research on the abundance, diversity and ecology of invertebrate fauna and on the impact of present management activities upon invertebrate fauna.
10. Record and describe the frequency, intensity, and impact of severe disturbances (natural and human) affecting animal communities. As far as practicable, also describe recovery of populations following disturbance.
11. Encourage and carry out research on the use of corridors in the Dryandra area.

CULTURAL RESOURCES

9. ABORIGINAL HERITAGE

BACKGROUND

There is sufficient archaeological evidence to indicate that Aboriginal people have occupied the south-west

of Western Australia almost certainly for 40 000 years (Merrilees *et al.* 1973, Hallam 1975) and, possibly, for as long as 50 000 years (Hallam 1981).

There were thought to be at least 13 different Aboriginal clans in the south-west region: collectively the people are known as Noongars. The word Noongar, or its linguistic equivalent, is identifiable as the word for Aboriginal (or person) in many of the vocabularies in this region. The people from the Narrogin district belonged to the Wiilman Clan.

The south-west of Western Australia was the first region of the state affected by European settlement. Within about 50 years of the founding of the Swan River Colony in 1829, the local traditional Aboriginal lifestyle had all but disappeared as the new dominant culture set about transforming most of this region into an agricultural-based economy. As a result of agricultural activities most of the original vegetation was cleared, leaving isolated areas of native vegetation.

Little is known of Aboriginal use of the Dryandra area. However, evidence of Aboriginal occupation and links to the area survive in the form of archaeological sites and the ever-growing interest of local Noongars in re-establishing cultural ties to the land. The Department of Aboriginal Sites has recorded five such sites within the Woodland. These sites include an ochre quarry, artefact scatters, stone arrangements, and a scarred tree. Dryandra has not been comprehensively surveyed for Aboriginal sites and it is likely that others exist.

There has been a significant resurgence of interest in Noongar culture in recent years. Many Aboriginal people in the south-west are seeking a more active and cooperative relationship with CALM concerning management and use of the conservation estate and other natural bushlands. Although most Noongar concerns centre around the preservation of sites within Dryandra, other interests include the use of Dryandra for cultural activities, maintaining the Aboriginal knowledge of Dryandra's plants and animals, and conducting guided tours (Noongar TAFE students pers comm.).

Local Noongar people have expressed a strong desire for areas to be set aside where they can legally engage in cultural activities, including hunting (CALM 1991b). The feasibility of permitting such activities on various categories of CALM-managed land within the south-west of the State, including Dryandra, is currently being investigated.

Section 23 of the Wildlife Conservation Act provides for a person of Aboriginal descent to take sufficient food for himself and his family from Crown land, excluding nature reserves or wildlife sanctuaries, with the permission of the occupier[4]. Permission is generally not needed to hunt on unvested reserves or vacant Crown land, although these occupy only a very small proportion of land in the central wheatbelt area. Approximately 80% of CALM-managed land in the Narrogin District is nature reserve or proposed to become so, and is thus excluded from any future hunting proposals. The remainder mostly comprises State forest within the Dryandra Woodland, of which a further 58% is proposed to become national park .

Quinns Block, within Highbury State forest, was identified by local aboriginal people as a favoured location for future cultural activities, including hunting, camping, and passing on cultural knowledge (ie. 'the Noongar way') to the younger generation. It is also the largest of the Highbury blocks and receives relatively little recreation use compared to those areas of Dryandra north of Narrogin. If cultural activities are approved, they will need to be carefully monitored to ensure they are sustainable and do not adversely affect other users, including neighbours.

ISSUES

- There are potential benefits for the protection of the biological diversity and for Aboriginal people if there is close liaison between CALM and local Noongars.
- Within Dryandra, there is potential for local Aboriginal people to explain and demonstrate their culture in community education programs and on commercial tours.
- All Aboriginal sites are protected under the Aboriginal Heritage Act (1972).
- Local Aboriginal people have requested permission to use Quinns Block for cultural activities, including hunting (see Map 3b) (CALM 1991a). If approved, the sustainability of such activities would require compliance with management prescriptions, and careful monitoring.

OBJECTIVES

- *Protect the Aboriginal cultural heritage[5] of Dryandra.*
- *Involve Aboriginal people in the management of the Aboriginal cultural heritage of Dryandra.*
- *Encourage greater understanding and appreciation of the Aboriginal cultural heritage of Dryandra.*

---

[4] *The 'occupier' of each tenure category is the associated vesting or managing authority.*

[5] *Within this context the term 'Aboriginal cultural heritage' refers to the lifestyles, attachments, beliefs and values of Aboriginal people in the past, present and future.*

STRATEGIES

1. Identify Noongar people having cultural links and on-going interests in Dryandra. In consultation with these people:
   - implement recommendations of the current review. If cultural activities, including hunting, are identified as being compatible with CALM objectives, permit such activities in Quinns Block. Consult with local Noongars, reserve neighbours and other relevant interest groups to determine the sustainability, safety considerations and monitoring requirements of any activities; and
   - provide opportunities for involvement in the management of Dryandra. For example, local Aboriginal people could be involved in:
     - assessing the condition of existing Aboriginal cultural sites and taking appropriate action to preserve them;
     - developing interpretive displays, community education programs and commercial tours incorporating the cultural history of the area;
     - researching past and contemporary Aboriginal use of Dryandra; and
     - anthropological and archaeological surveys of Dryandra.
2. Consult with the Department of Aboriginal Sites prior to all major development proposals to ensure Aboriginal sites are protected.

10. EUROPEAN HERITAGE

BACKGROUND

European occupation in the Williams – Narrogin area was first recorded in the 1860s with the issuing of pastoral leases to early settlers. Sandalwood cutters, mallet bark strippers, and kangaroo and possum hunters also visited this area prior to the closer settlement associated with tillage leases (Pustkuchen 1981).

During the earliest years of this century mallet forests were heavily utilised for tannins. The settlers needed capital to develop their farms and saw mallet as a means of supplementing their income.

Mallet bark worth 859 pounds was exported from Western Australia in 1903. In 1905 a scientist, Dr Johannes Passler, delivered a lecture to the German Leather Industry in which he concluded '...that we have in Malletto Bark a tanning agent which in regard to tanning property, equals those hitherto known as the richest tanning substances such as Mangrove bark...' The bark became well sought after by countries with limited tanning sources. However, there were already concerns by the importers and the Western Australian Government that the '...tanning material will be exhausted.' (Paton 1988).

After 1905, there was a steady decline in the volume of bark exports and by 1907 areas within payable distance of the Great Southern Railway were virtually cut out and harvesting had spread throughout the Great Southern District. The real danger of the species being cut out completely was reported as early as 1908 in the Annual Report of the Woods and Forests Department (Germantse 1987). By the mid 1920s, the shortage of mallet was acute whilst world demand for vegetable tannins remained high (Paton 1988).

Following extensive surveys of land west of Cuballing, the first portions of Dryandra were reserved by the Forests Department in 1924 for the purpose of protecting natural mallet stands and establishing plantations. A house for a resident overseer and stables were erected at Lol Gray in 1925 and preparatory work for the establishment of mallet plantations commenced in 1926 (Forests Department 1926).

During the depression years extensive areas of Dryandra were sown to mallet with the aid of sustenance workers. Forest Department staff were located at the Dryandra Settlement and additional outstations at Contine, Congelin, Montague and Highbury. The outstations were strategically located on the highest hills overlooking the mallet plantations and each had a fire tower. The overseer's wives performed the tower work, informing the staff at the Settlement of any fires within the vicinity of Dryandra. The fire tower at Lol Gray was restored by the WA Division of the Institute of Foresters of Australia in 1986.

After 1959, the amount of mallet bark produced declined rapidly. A glut on the world market, increased royalty and production costs, and increased competition from synthetic products eventually led to the collapse of the industry in the early 1960s (Paton 1988).

In 1967, a tool handle business was established near Narrogin after tests had demonstrated the potential of mallet for this purpose. An earlier tool handle enterprise had closed in 1944. Plantations mallet is now used for tool handles, fencing materials and firewood.

Since 1972 the Settlement has been leased to the Lions Dryandra Village (Inc.) for the purpose of providing visitor accommodation.

Heritage Sites

The Burra Charter, adopted by the Australian International Council on Monuments and Sites in 1979, provides the basis for management by CALM of places of cultural significance. It defines conservation principles, processes and practices for application to places of cultural significance.

The main European sites of interest in Dryandra are:

- the Settlement area, including the Arboretum, Old Mill shed and dam;
- two survey markers erected by John Forrest in the 1870s as part of a route survey between Perth and Albany;
- house sites and fire towers associated with the early mallet industry;
- Congelin railway siding and associated structures and formations; and
- the old school site at Lol Gray.

ISSUES

- There is a need to assess the condition of the existing European sites and take action as necessary to preserve them.
- Some sites are being degraded through visitor mis-use, eg. it is suspected that timbers from the horse yards at Congelin have previously been used for firewood by visitors.
- There is a need to develop interpretive and educational opportunities incorporating the European heritage of the area.

OBJECTIVES

- *Protect the European cultural heritage of Dryandra.*
- *Encourage greater understanding and appreciation of the European cultural heritage of Dryandra.*

STRATEGIES

1. Ensure that all management decisions concerning the conservation and restoration of places of historic interest within Dryandra adhere to the principles of the Burra Charter.
2. Assess the condition of existing European sites and take action as necessary to preserve them.
3. Develop interpretive and education opportunities incorporating the European history of the area.

Research and Monitoring

4. Research past and contemporary European use of Dryandra.

RECREATION AND TOURISM

The primary attractions of Dryandra are the naturalness, peacefulness and scenic quality of its open woodlands. These features provide Dryandra with a unique ambience that is becoming increasingly scarce in our ever developing world. Many people see access to such places as essential for human health, and it is therefore considered essential that these precious qualities are protected for future generations. Management prescriptions for recreation and tourism management and development in Dryandra will ensure that these qualities will be maintened in perpetuity.

The Recreation Opportunity Spectrum (ROS) is a planning tool that enables managers to provide for the greatest possible range of opportunities in a given area, while limiting unintended incremental development (Stankey and Wood 1982). It does this by identifing a range of recreation classes, and the types of experiences, activities and opportunities that are appropriate in each class. Major factors that determine different classes include:

- the level and extent of access;
- the presence or absence of facilities and services;
- the opportunity for social interaction; and
- the degree of management and visitor impacts.

The principles of the ROS have been considered in establishing the various recreation opportunities and activities in Dryandra. While specific areas will be developed to facilitate access by the public—providing an important avenue for discovering parts of the Woodland—much of Dryandra will remain substantially unchanged. Recreation and tourism management in Dryandra will aim to encourage non-disruptive, passive uses that are reliant on the special environmental qualities of the Woodland. Consistent with this principle:

- activities such as sightseeing and bushwalking will be promoted, while events with potentially high impacts, such as competitive car rallies, will be restricted to areas outside the Woodland that can sustain such use; and
- Dryandra will be managed to attract a clientele that is appreciative of the natural environment. Main target audiences will include the local community, schools and universities, naturalists, nature-based tourists, and others seeking passive recreation in a natural setting.

Approximately 17% of visitors to the Woodland presently stay more than one day, based on accommmodation figures at the Settlement. This figure does not account for those visitors staying in other accommodation in the vicinity of the Woodland, and is expected to rise as the area is promoted as a tourist destination. An increased level of use has been accommodated in the Plan with improved access, better provision of information, the

redesign of most recreation areas, and the expansion of recreation opportunities at key areas.

11. ACCESS

BACKGROUND

Access to the Dryandra Woodland is mainly by the Wandering – Narrogin Road for blocks north of Narrogin, and from the Dumberning Road for blocks in the Highbury area (see Maps 4[a] and [b]). These and other gazetted roads that traverse the Woodland are maintained by the local shires. Within the Woodland there is also an extensive network of tracks and firebreaks which have evolved with past land uses, such as Wandoo timber production and mallet plantation management. The most frequently used tracks are Kawana Road and Tomingley Road, the latter recording 24 000 visits over a 12 month period in 1990-91. These tracks are maintained by CALM, and not only provide access for visitors, but for management activities such as fire, feral animal and weed control; maintenance of recreation areas; and scientific research.

ISSUES

- Plant fungal diseases can be spread by vehicles (including bicycles), horses and walkers.
- Vehicles leaving defined roads can cause soil compaction, damage vegetation, and spread diseases.
- The provision and maintenance of all weather, 2WD vehicle access is expensive.
- Many tracks in Dryandra, especially those associated with prior timber harvesting operations, are rarely used by the public, but are important for management purposes, eg. fire control.
- Roads, tracks and parking areas will need to sustain greater use as the numbers of visitors to Dryandra increases.
- Adjoining landowners have traditionally used tracks within the Woodland for the movement of stock, vehicles and machinery.
- Vehicles are responsible for an increasing number of native animal deaths.

OBJECTIVES

- *Provide and maintain a range of visitor opportunities within Dryandra, including 2WD touring, cycling, horse riding and walking, while ensuring that environmental values are not adversely affected.*
- *Ensure that all forms of access are constructed and maintained to an appropriate standard that supports current and future levels of use.*
- *Maintain access for management and emergency purposes.*

A range of access will continue to be provided to meet visitor and management demands. Access for bushwalking and cycling, as well as horse riding is covered in Section 13. Recreation Activities. The strategy for vehicle access is to upgrade and maintain selected tracks that lead to existing features of interest, while closing some minor tracks to public vehicles. The rationale for this strategy is to increase the number of recreation opportunities available in the Woodland, reduce the risk of spreading dieback, and reduce maintenance costs. Many tracks within Dryandra lead to the same destination, and closures are likely to cause minimal inconvenience. All vehicle access to private property will be retained.

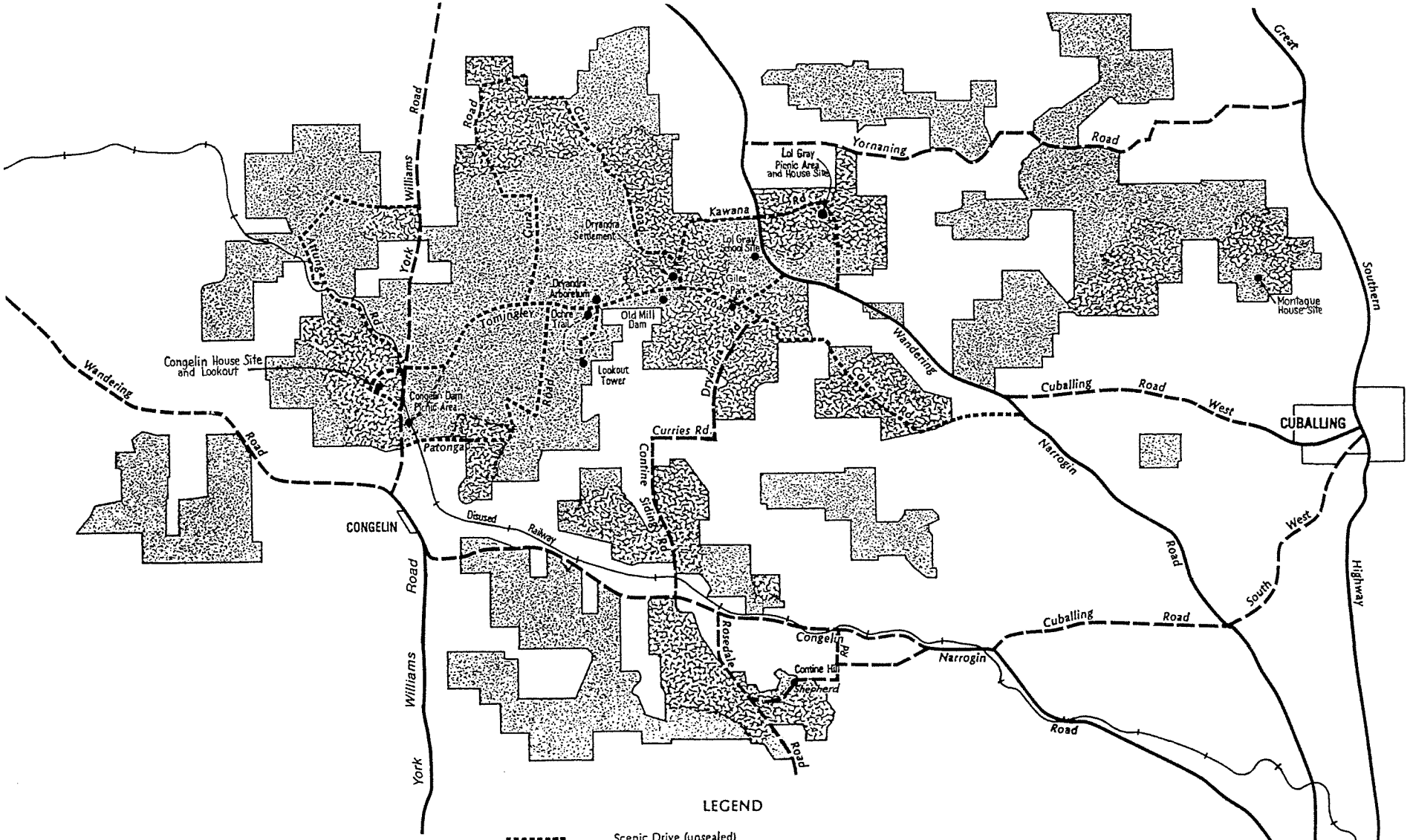
STRATEGIES

General Access

1. Maintain and, where necessary, upgrade the vehicle access network shown on Maps 4(a) and (b) to a standard that provides for all-weather two wheeled drive vehicle access.
2. Maintain access for tourist coaches and caravans along Tomingley Road and Kawana Road.
3. Improve visitor safety by providing vehicle stopping points along main routes and advisory traffic signs where necessary.
4. Close minor tracks to public vehicles that:
   - are associated with past timber harvesting and have minimal public use;
   - otherwise prevent additional recreation opportunities (according to ROS principles):
   - are causing erosion problems or a loss of other values; and
   - are impassable due to seasonal conditions or pose a high dieback risk.
5. Make some minor tracks closed to public vehicles available for bushwalking and cycling (see Section 13.4 Bushwalking and Cycling).
6. Promote responsible driving practices throughout the Woodland to minimise native animal road kills. Install advisory signs as appropriate.
7. Carry out road maintenance according to dieback disease hygiene measures and visual resource management principles.
8. Negotiate alternative routes or options for adjoining landowners needing to transfer stock through the Woodland.
9. Avoid the construction of any other tracks for management purposes except when values of a high priority are threatened, eg. by a wildfire (see Section 19. Fire).
10. Retain all vehicle access to private property.

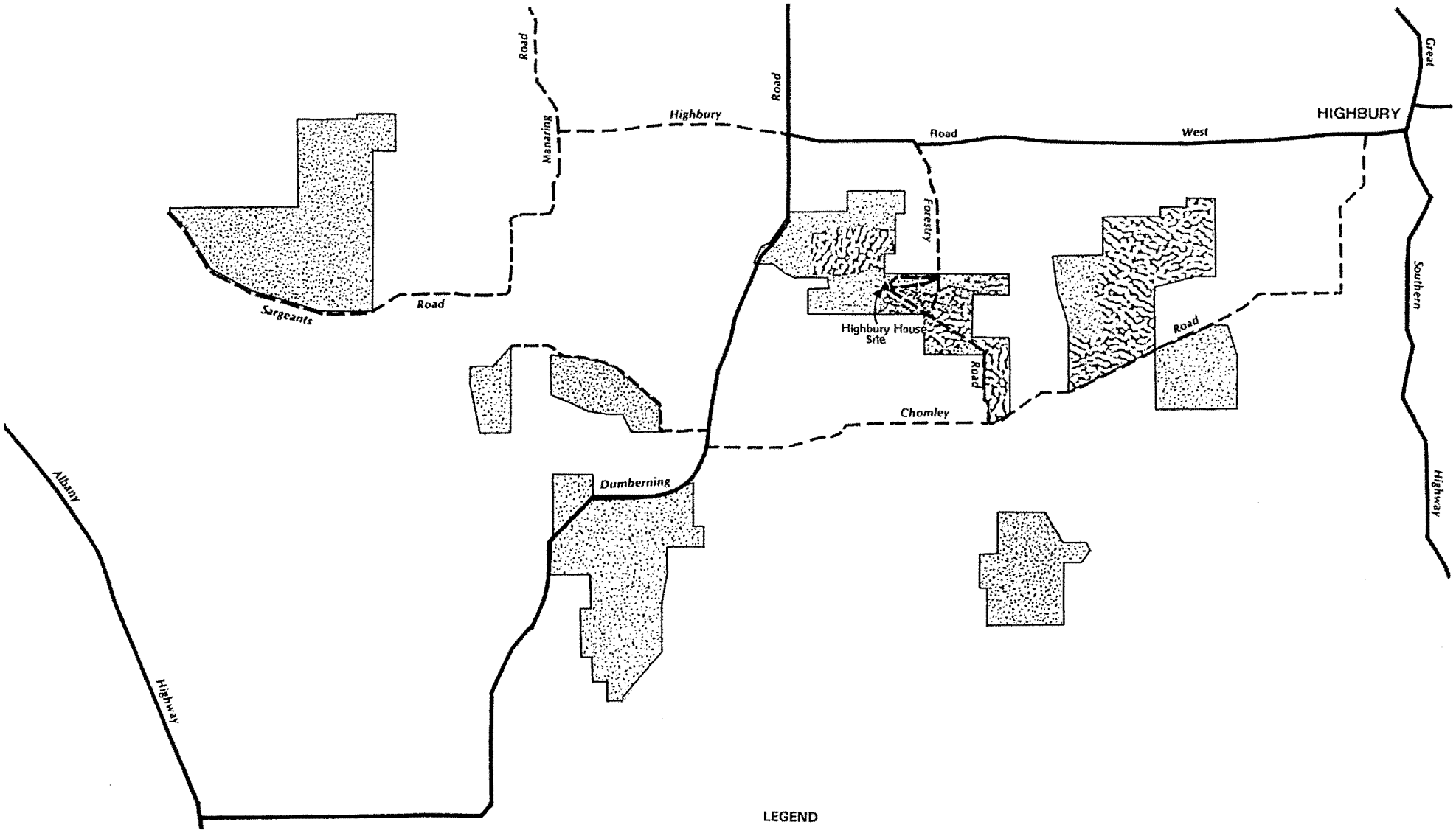
Research and Monitoring

11. Monitor the use of public access routes in Dryandra to establish long-term trends in visitor numbers.



DRYANDRA

MAP 4a PROPOSED ACCESS



LEGEND

Sealed Road

Unsealed Road

Mallet Plantation

Natural Vegetation

Note: (i) All other woodland tracks maintained to management standard only.
(ii) All access to private property is retained.

0 1 2 3 4 5

Scale in kilometres

HIGHBURY

MAP 4b PROPOSED ACCESS

12. Monitor the condition of the access network in the Woodland, including vehicular and pedestrian access, and take appropriate management action where necessary..

12. RECREATION AREAS

12.1 RECREATION AREAS AND FACILITIES

BACKGROUND

The major recreation opportunities available in Dryandra Woodland are outlined in Table 4. There are approximately 29 000 visitors to the Woodland annually (based on the most recent reliable data), of which approximately 5000 visitor nights were spent at the Settlement.

ISSUES

- Not all recreation sites are in accordance with landscape design or minimum impact principles.
- Recreation opportunities are strongly influenced by the type of facilities provided. The level of development at different sites should vary to maximise the range of opportunities available.
- Currently, not all recreation areas and facilities are capable of sustaining increased use.
- Maintenance of recreation areas and facilities is costly to CALM.

OBJECTIVES

- *Provide a range of recreation areas and facilities that:*
  - *are high quality;*
  - *aesthetically harmonious;*
  - *have minimal ecological impacts;*
  - *are in accordance with CALM standards;*
  - *facilitate use by disabled visitors;*
  - *enable a variety of recreation experiences;*
  - *are capable of sustaining increased use; and*
  - *are low maintenance.*

The strategy for recreation site development and management is to provide a range of of visitor facilities and opportunites in accordance with ROS principles. Site facilities will range from 'developed', where there are large numbers of people and site-hardening is necessary, to 'primitive', where facilities and signposting are minimal, and visitor contact with others is low. Opportunities for 'remote' recreation (ie. no vehicular access, facilities or signposting, and contact with other visitors is unlikely) are provided in the larger blocks.

The current level of recreation development is sufficient to meet existing visitors needs (CALM 1992c). Management proposals outlined in Table 4 aim to ensure all recreation areas are capable of sustaining increased use and that future public expectations are met. Priorities in Table 4 reflect current visitor and management requirements and, therefore, may change according to future monitoring of the patterns and levels of visitor use.

STRATEGIES

1. Redesign, modify and manage recreation areas and facilities as outlined in Table 4. Prepare site development plans for all major proposals.
2. Ensure all facilities are developed in accordance with Departmental standards.
3. Base all recreation development plans on an up-to-date plant disease hygiene plan and hygiene evaluation (see Section 18. Disease). Ensure no threatened flora or fauna are adversely affected.
4. Design all facilities and access tracks to require only minimum maintenance.
5. Encourage users to help reduce maintenance (for example, take home rubbish).
6. Provide facilities for disabled access at key areas, including Old Mill Dam and Congelin Dam.
7. Minimise conflict between users by careful site location and design.
8. Design recreation areas and facilities to minimise safety hazards.

Research and Monitoring

9. Monitor changes in the patterns and levels of visitor use, and predicted trends. Alter recreation and tourrism management.

12.2 DRYANDRA SETTLEMENT ACCOMMODATION COMPLEX

BACKGROUND

In 1990-1991 there were approximately 29 000 visitors to Dryandra Woodland (CALM 1991c), of which approximately 5000 visitor nights were spent at the Settlement. The Settlement accommodation complex comprises eight self-contained weatherboard houses and a self-contained Nissen hut. These buildings and the immediate surrounds are leased to the Lions Club to manage as low-cost accommodation. Other built facilities on the site include a study centre, a workshop, and a government employee's house: these are managed by CALM and are excluded from the Lions lease area.

Lease

The Settlement accommodation was leased to the Lions Club of WA between 1972 and 1991 for a nominal annual rental fee. In return the Lions were to restore, alter and develop the lease area as a camp for underprivileged children, youth organisations, scientific bodies and other groups. A condition of the lease was that all revenue was to be spent on the

Table 4 Recommended recreation site development

Location*	Feature	Present facilities	Proposed site development (priority)
Dryandra Settlement and Old Mill Dam.	Accommodation complex, open field, dam	Overnight accommodation and day visitor area. Self-contained accommodation, study centre, sports field, toilets, BBQs, picnic shelter	Developed. Create day visitor focal point at Dam by installing picnic tables, toilets, gas BBQs and information shelter. Provide facilities for disabled visitors. Trail head for walking track network. Improve signposting. See also Section 12.2 Dryandra Settlement Accommodation Complex.
Congelin Dam	Dam, historical features associated with railway.	BBQs, picnic tables	Semi-developed. Redesign for day use at dam and overnight camping near railway siding . Provide toilets and gas BBQ suitable for disabled visitors, information and walk path.
Contine Hill	Lookout point, tower site, house site	BBQs, picnic tables	Semi-developed. Re-design site to reduce impact of carpark, upgrade day-use facilities, improve views and minimise erosion. Provide toilet as visitor numbers increase.
Dryandra Arboretum	Native plant arboretum	BBQs, picnic tables, labelled trees, interpretive walk	Primitive. Maintain basic picnic facilities. Remove BBQs. Upgrade information and maintain arboretum. Restrict vehicle access along Ochre Trail.
Giles Park	Shaded picnic area under a canopy of pines.	BBQ, picnic tables	Primitive. Maintain basic picnic facilities. Remove BBQs.
Lol Gray	Historic tower and house site.	BBQs, picnic tables	Primitive. Maintain basic picnic facilities and tower. Construct a loop walk that traverses the breakaways, mallet plantations and heathlands.
Lol Gray School site	Site of former Lol Gray school, commemorated by a monument.	N/A	No on-site development. Sign post and show location on Woodland brochures and main information board at Settlement.
Congelin House site	Historic tower and house site.	N/A	As for Lol Gray School site. Part of drive trail.
Montague House site	Historic house site. Paddock and dam.	N/A	As for Lol Gray School site.
Highbury	Historic house site.	N/A	As for Lol Gray School site.

*see Map 4(a) and (b) for site locations.

development, management, care and maintenance of the leased premises and environment.

Lions Dryandra have recently been re-issued with a ten year lease. The lease conditions enable further development of the leasehold area but only with the consent of the Executive Director of CALM.

Other accommodation
The Dryandra area is well serviced by farm-stay accommodation. At present there are eight operators in the immediate vicinity of Dryandra, including both the Highbury area and the main blocks north of Narrogin. Caravan facilities are available at Popanyinning, approximately 15 km north of Cuballing, and in the townships of Williams, Pingelly and Narrogin. Motel/hotel accommodation is also available in the latter three and at Cuballing.

ISSUES

- The Settlement buildings are approximately 50-60 years old and, hence, require continuous maintenance.
- Alternative accommodation options, such as farm-stays and caravan parks, are provided by private enterprise in the surrounding area.
- Nineteen percent of the people interviewed in the user survey indicated that Dryandra Woodland could be improved by upgrading the Settlement facilities (CALM 1992c).
- Other accommodation options are catered for off-site, eg. camping at Congelin Dam, farmstays on nearby private property.
- There are currently no accommodation facilities suitable for disabled visitors.
- The Settlement area provides further opportunity to promote the general interpretive theme for the Woodland - 'biodiversity is essential to sustain each individual's quality of life' (see Section 25. Education, Information and Interpretation).

OBJECTIVES

- *Restore and maintain the historical style and character of the Dryandra Settlement.*
- *Provide accommodation facilities suitable for disabled visitors.*
- *Manage Dryandra Settlement so that it:*
  - *has a high standard of amenity and service;*
  - *has a minimal impact on the surrounding environment; and*
  - *promotes the theme that 'biodversity is essential to sustain each individual's quality of life'.*

The overall strategy for achieving the above objectives is for the Lions Club, in conjunction with CALM, to manage and promote the Settlement accommodation complex. Co-ordination will be the responsibility of the District Manager on a day to day basis, and overall by a joint CALM/Lions committee.

STRATEGY

1. Ensure all buildings, erections, improvements, fixtures or fittings erected or installed during the term of the lease are in harmony with the historical style and character of the Dryandra Settlement (see Section 6. Landscape).
2. Ensure, where appropriate, new buildings or constructions are in accordance with Australian standards for access for the disabled.
3. Promote the theme that 'biodiversity is essential to sustain each individual's quality of life' by encouraging Lions Dryandra to practice conservation principles through their daily management.
4. Encourage the development of alternative accommodation options on private property.

13. RECREATION ACTIVITIES

13.1 NATURE STUDY AND APPRECIATION

BACKGROUND

The human desire to explore, experience and study nature first hand is fundamental to the notion of setting aside relatively undisturbed areas in parks and reserves. Dryandra, as a remnant of the wheatbelt landscape, affords many opportunities for a range of nature study and appreciation activities such as bird watching, photography, wildflower viewing and spotlighting nocturnal animals. In particular, Dryandra is a focal point for the study and observation of threatened mammals, such as the Numbat and Woylie.

Visitor survey results (CALM 1992c) show that of the people interviewed, the most popular activities were scenery appreciation (75%), enjoying the peaceful atmosphere (71%) and wildlife appreciation (71%). However, 40% of respondents also believed their experience in Dryandra could have been improved with the provision of additional ecological and cultural information.

ISSUES

- The study of nature is compatible with the recreation goal for Dryandra as it allows for the appreciation of the Woodland in a peaceful, relatively non-impacting manner.
- Many visitors do not realise the value or significance of Dryandra's environment. There are opportunities to show visitors these aspects of Dryandra.

OBJECTIVE

- *Encourage all visitors to appreciate and increase their understanding of Dryandra's natural and cultural environment.*
- *Provide opportunities for viewing wildlife in a manner compatible with conservation objectives.*

STRATEGIES

1. Promote opportunities for viewing wildlife in their natural environment, provided this can be done safely and without undue disturbance to the species being observed or their habitats.
2. Develop nature walks, such as the Ochre Trail, to provide controlled access through interesting or sensitive environments (see Section 13.2 Bushwalking and Cycling, and Table 4).
3. Obtain necessary CALM and external approvals before identifying and interpreting sensitive features, such as threatened flora and fauna, or Aboriginal sites.
4. Implement those strategies in Section 25. Education, Information and Interpretation that relate to nature study and appreciation.

13.2 PLEASURE DRIVING AND SIGHTSEEING

BACKGROUND

Pleasure driving and sightseeing are two of the more popular activities in Dryandra (CALM 1992c). Many of the roads and tracks provide either open views across a wide, sweeping landscape of forested hills and farmland, or enclosed views within the wandoo woodlands. Look-outs, such as Contine Hill, provide an important opportunity to facilitate sightseeing with minimal impact on the environment.

In recognition of the popularity of pleasure driving and sightseeing, CALM has secured funding under the auspices of the Forest Ecotourism Program to develop an interpretive drive trail in the Dryandra Woodland.

ISSUES

- Currently there are no defined pleasure driving routes or adequate maps.
- There is a need to provide sufficient roadside look-outs at scenic vantage points, or near features of environmental or historical interest.
- Vehicles are responsible for an increasing number of native animal deaths.

OBJECTIVES

- *Provide a variety of opportunities to view Dryandra's different features and landscapes.*
- *Foster an appreciation of Dryandra's environment by sightseers.*

STRATEGIES

1. Develop an interpretive drive trail in Dryandra Woodland that incorporates the interpretive theme 'biodiversity is essential to sustain each individual's quality of life' (see Section 25. Education, Information and Interpretation).
2. Promote and manage Tomingley, Gura, Attunga, Patonga and Kawana roads as scenic drives. Liaise with local shires and the Western Australia Tourist Commission (WATC) to ensure a uniform tourist drive classification is achieved.
3. Promote responsible driving practices throughout the Woodland to minimise native animal road kills. Install advisory signs as appropriate.
4. Install speed humps (or similar traffic-pacifying devices) to slow traffic within the Settlement area if deemed necessary in the future.
5. Ensure roads promoted for pleasure driving are maintained to a suitable standard and are sign posted appropriately.
6. Provide appropriate facilities, such as roadside pullover bays, for drivers to stop and enjoy the environment.
7. Ensure all works associated with roads and their viewsheds (for example, verge clearing, fuel reduction burning and timber harvesting) are in accordance with visual resource management (see Section 6. Landscape) and ecological management principles.
8. Promote and maintain views at Contine Hill, Lol Gray Hill and other look-outs by removing obstructing vegetation where necessary.
9. Provide information on the main features seen from selected look-outs, including nearby attractions, vegetation, landforms and fauna (see Section 25. Education, Information and Interpretation).

13.3 PICNICKING AND BARBECUING

BACKGROUND

The bush picnic or barbecue is an opportunity to relax and enjoy the bush with family or friends, whilst also providing the central focus for other nature-based leisure activities, such as sightseeing, bushwalking and pleasure driving.

Within Dryandra, picnic and barbecue facilities currently exist at Lol Gray, Dryandra Settlement, the Old Mill Dam, the Arboretum, Giles Park, Congelin Dam and Contine Hill. Future proposals for these areas are outlined in Table 4. In addition, there are plans by the Shire of Cuballing to re-establish a

recreation area at Yornaning Dam (sited east of Dryandra).

ISSUES

- Picnic and barbecue areas require regular maintenance by CALM staff, particularly at peak times.
- Facilities and recreation experiences are duplicated at various recreation areas within the Woodland. For example, barbecue facilities are available at four locations along Tomingley Road. There is a need to determine for each recreation area appropriate uses and the level of development.
- Fire escapes from open barbecues can cause wildfires.
- Uncontrolled collecting of wood for barbecues damages fauna habitat.

OBJECTIVE

- *Provide a range of high quality, well-designed picnic and barbecue areas that blend with the natural environment and have a minimal impact.*

STRATEGIES

1. Redesign, modify and manage picnic and barbecue areas as outlined in Table 4. Prepare site development plans for all major proposals.
2. Design all facilities to have minimum environmental impact and low maintenance requirements.
3. Encourage users to help reduce maintenance (eg. take home rubbish).
4. Provide facilities for disabled access at key picnic and barbecue areas, such as Old Mill Dam and Congelin Dam.
5. Progressively phase in gas barbecues. Provide firewood at barbecue sites in the interim period.

13.4 BUSHWALKING AND CYCLING

BACKGROUND

Bushwalking, either as a long hike or a short wander through the bush, is becoming increasingly popular. About 75% percent of Woodland users participate in bushwalking (CALM 1992c). Dryandra, with its diversity of landform and vegetation, provides many and varied opportunities to explore by foot. Bushwalking is compatible with the recreation goal for Dryandra as it allows for the appreciation of the Woodland in a peaceful, low-impact manner.

Currently, the only walking track in Dryandra is the Ochre Trail. Potential exists to provide many more opportunities to experience the Woodland on foot by constructing new tracks or using existing access associated with past management activities.

Cycling in natural areas has become an increasingly popular activity with the advent of mountain bikes. While there is little use of Dryandra Woodland for cycling at present, it is envisaged that it is an activity likely to increase.

ISSUES

- The Settlement area (including Old Mill Dam) is a major focus for visitors. A variety of bushwalking opportunities needs to be provided from this point, including a walking track designed to accommodate disabled and elderly persons.
- Walking and cycling tracks require regular maintenance, particularly in steep terrain, and resources are required to maintain the number of tracks that will be provided.
- Areas suitable for cycling need to be identified and promoted as demand increases. Conflict between cyclists, pedestrians and motorists could occur in some areas.
- Bushwalking and cycling can spread plant diseases.

OBJECTIVES

- *Provide a variety of bushwalking opportunities in Dryandra, ranging from short, interpretive walking tracks to extended ones of several hours duration.*
- *Ensure that walking and cycling tracks are located on alignments that are capable of sustaining use, where maintenance is feasible, and where Dryandra's values will not be adversely affected.*
- *Provide cyclists with opportunities to experience Dryandra's many landscapes in areas able to sustain such use.*
- *Ensure conflicts between user groups are avoided.*

A number of opportunities to explore the Woodland on foot will be developed incorporating a range of experiences, landscapes and length of walks. Most paths will link with others thus providing many options for bushwalkers. Major starting points will be at the Old Mill Dam, the Settlement, and Lol Gray.

Cycling tracks will be designated, and shared or linked with walk paths.

STRATEGIES

1. Progressively develop, in consultation with the Lions Club and the local community, a range of walking tracks that enable visitors to explore the Woodland by foot. Major starting points will be at the Old Mill Dam, the Settlement and Lol Gray.

2. Develop walking and cycle tracks according to the guidelines in Table 5.
3. Monitor levels of use and, where conflict arises, consider closing some vehicle tracks to favour bushwalking.
4. Develop self-guiding, interpretive walks which help enrich visitor appreciation and understanding of Dryandra.
5. Promote minimum impact bushwalking and cycling.
6. Provide comprehensive information on bushwalking and cycling opportunities available in the area (see Section 25. Education, Information and Interpretation). Information on walking and cycling tracks should include:
   - distance;
   - level of fitness required;
   - completion time; and
   - special features.
7. Designate, in consultation with the community, suitable cycling tracks, incorporating:
   - management tracks;
   - a variety of landscapes; and
   - a variety of lengths and difficulty of routes.
8. Prohibit cycling off roads and on pedestrian walks where there is a clear conflict between users.
9. Develop a walking and cycle track management plan.

13.5 CAMPING

BACKGROUND

Some overnight visitors to the Dryandra Woodland are seeking an overnight outdoor experience that is not catered for at the Settlement accommodation complex (CALM 1992c). Although no area has been formally designated, camping does occur within Dryandra.

Camping can be broadly categorised into vehicle-based camping at designated locations, and that associated with backpacking. Vehicle-based camping areas are usually established at selected locations and site-hardened to sustain the increased level of use. Backpacking is associated with walk tracks and routes, and usually only involves an overnight stay in any one area. Such camping is not allowed within the vicinity of designated recreation areas or major roads, and fires are not permitted.

ISSUES

- Camping areas need to be sheltered from the elements preferably with suitable trees, on flat, stable soils. They also need to be of sufficient size to cater for increasing future demand.
- Campfires are an integral part of many visitors' camping experience, but increase the risk of wildfire and cause damage to vegetation and fauna habitat through uncontrolled collecting of wood.

Table 5. Walking and Cycle Track development guidelines

WALKING AND CYCLE TRACK DEVELOPMENT GUIDELINES
• Walking and cycle tracks should provide views and be placed in a position in the landscape where this can be achieved without jeopardising Dryandra's values, particularly by creating plant disease risks or impacts on the landscape.
• Walking and cycle tracks should be linked, where appropriate, with recreation and camping areas in Dryandra, and with paths in adjoining areas.
• Starting points should be relatively accessible to vehicles and provide information on the associated path.
• Promote the development of loop or circuit walking and cycle tracks which permit one-way use and avoid the need to retrace the same route while allowing access to a number of points of interest in the same area.
• Longer walking and cycle tracks should enable the walker to experience the more remote and pristine areas of Dryandra.
• Existing walking and cycle tracks should be used where practicable.
• All walking and cycle tracks should be designed to minimise maintenance requirements and to cater for increasing future use.
• At least one walking track should be designed to accommodate disabled and elderly persons.

- Camping areas require regular maintenance by CALM staff, particularly at peak period times. It is CALM policy to recover the costs of providing facilities and services to the public from users.
- Generators can disturb wildlife and disrupt other visitors' camping experience.

OBJECTIVE

- *Provide opportunities for low-impact camping in areas able to sustain such use.*

Camping will be permitted in Dryandra at Congelin. Facilities such as tables, toilets, gas barbecues and parking will be designed and sited to minimise environmental and aesthetic impacts. Caravan sites will not be provided as it is considered that adequate facilities are provided in the surrounding district. No specific camping areas will be provided along walk routes; however, short-stay backpack camping will be allowed.

STRATEGIES

1. Establish a vehicle-based camping area at Congelin. Design campsites to cater for a range of group sizes, and for the effective separation of groups where practicable.
2. Seek to recover the costs of providing facilities and services to the public from the users by charging camping fees at Congelin.
3. Develop a voluntary campground host scheme to assist with the management of camping areas during peak periods.
4. Progressively phase in gas barbecues within the camping area. In the interim period, reduce the risk of wildfire and damage caused by firewood collection by:
   - educating the public as to the habitat value of fallen timber through interpretive material;
   - allowing fires in constructed fireplaces only;
   - ensuring that fuel levels in the surrounding area are maintained at less than 7-8 tonnes/ha; and
   - supplying mallet firewood as necessary.
5. Remove fire rings and ban the use of open campfires when gas barbecues are in place.
6. Inform visitors of the location of the designated camping area, the type of facilities present and the fees charged, through publications, information boards and sign posting.
7. Allow camping associated with backpacking on walk tracks and routes. Backpack camping will be restricted to a single overnight stay by individuals and small groups and will not be allowed within the vicinity of designated recreation areas or major roads. Restrict fires to portable fuel stoves.
8. Prohibit the use of generators by campers.

Research and Monitoring

9. Monitor changes in the patterns and level of camp ground use, vegetation cover, and predicted trends. Alter recreation management accordingly.

13.6 SWIMMING

BACKGROUND

The Congelin and Old Mill dams have historically been used for swimming during the hotter periods of the year. However, as there is no practical way of treating the water it is not possible to guarantee the safety of the dams for swimming. The Old Mill Dam also contains a small jetty or platform that may present legal problems if somebody is injured whilst using this structure.

ISSUES

- There are concerns about:
  - water quality, particularly the risk to health from amoebic meningitis;
  - the condition and safety of water access points and platforms;
  - submerged obstacles within the dams; and
  - the legal liability if somebody is injured whilst swimming.
- Pathogen levels can fluctuate rapidly, rendering periodic monitoring by chemical analysis ineffective.
- A ban on swimming in the dams in Dryandra would be extremely difficult to enforce.

OBJECTIVE

- *Minimise potential safety and health problems associated with swimming.*

STRATEGIES

1. Signpost dams informing the public of the potential safety and health problems associated with swimming, and discouraging such activities.
2. Maintain a visual monitoring system for blue-green algae. If blue-green algae is apparent, temporarily close dams to swimming.
3. Assess the condition and safety of water access points in the dams. In conjunction with Lions Dryandra Village (Inc.) maintain, replace or remove facilities as required. Record inspections and management actions.
4. Inspect the dams regularly for surface obstacles. Record all inspections and management actions.

5. Ensure that any site redevelopment at Congelin or Old Mill dams specifically address the issue of visitor safety, particularly with respect to children.
6. Maintain the fence surrounding the small dam adjacent to the Irabina Study Centre.

13.7 ORIENTEERING, ROGAINING AND CROSS COUNTRY RUNNING

BACKGROUND

Orienteering is an organised activity which requires participants to visit on foot a set number of control points in the bush in a given sequence in the shortest time. Orienteering events were first held in Dryandra in 1976. In 1979, an orienteering map of the Settlement area was produced. This map has been used annually in past years and has become a favourite of many members of the Orienteering Association of Western Australia. The combination of available accommodation, good access, complex gully systems and an established network of tracks makes Dryandra ideally suited for all levels of skill, fitness and enthusiasm.

Rogaining is a long distance cross country navigation event which generally involves greater use of roads and tracks than orienteering. Periods of several years may lapse between successive uses of the same area. Events, organised by the Western Australian Rogaining Association, were held in Dryandra Woodland and surrounding farmland in 1985 and 1989.

Cross country running is a foot race that occurs over a variety of surfaces along a single, marked course.

ISSUES

- The Orienteering Association of Western Australia has identified several other areas in Dryandra that have potential to provide future venues for orienteering. Each area is approximately 1500 ha in size.
- Limited studies on the impacts of orienteering on lichen-covered granite rocks and on Wandoo woodlands indicate that physical damage to vegetation is minimal and recovery is expected to be rapid (CALM and OAWA 1986). However, depending upon the number of participants, and the frequency and timing of events, orienteering, rogaining and cross country running have the potential to impact on the environment and disturb other visitors.

OBJECTIVE

- *Provide orienteering, rogaining and cross country running groups with an opportunity to experience Dryandra's many landscapes in areas able to sustain such use.*

STRATEGIES

1. Permit orienteering, rogaining and cross country running in areas of State forest and national park within Dryandra Woodland.
2. Ensure orienteering, rogaining and cross country running groups seek approval from the District Manager to stage events in Dryandra. Applications, including the event status (club, state or national), timing, and the number of competitors and observers expected, should be of sufficient detail to enable thorough evaluation of environmental and social issues, such as:
   - protection of flora and fauna;
   - potential to spread plant diseases;
   - susceptibility of soils to erosion;
   - potential conflict with other visitors; and
   - availability of suitable facilities, such as car parking areas, toilets, and BBQ areas.

Research and Monitoring

3. Ensure people involved with orienteering, rogaining and cross country running monitor the impacts of events in Dryandra. In conjunction with these groups, develop, monitoring criteria and standards.

13.8 HORSE RIDING

BACKGROUND

The use of horses in natural areas is part of the European cultural heritage of Australia, and is accepted as an appropriate means of appreciating and enjoying some areas of CALM managed land, provided environmental and social impacts are acceptable (NPNCA policy and CALM Policy No. 18. Recreation, Tourism and Visitor Services).

In the past horse riding activities have occurred in Dryandra, ranging from casual rides along defined tracks to organised trail and endurance events. Applications for other activities, including cross country riding and hunting from horseback, have been rejected in the past as they have potential to cause significant environmental impacts. Gymkhanas have occasionally been held in the Settlement paddock, however, the attraction of Dryandra for this event was more the availability of accommodation than the inherent natural values of this area. Currently, demand for horse riding in Dryandra appears to be very low (CALM 1992c). Potential horse riding impacts include:

- soil erosion;
- trampling and grazing of vegetation;

- introduction and spread of weeds and dieback disease;
- silting and fouling of watercourses; and
- the potential for conflict with other uses.

Consequently, horse riding is inappropriate in areas of Dryandra with high conservation value, or that are highly susceptible to the spread of weeds or plant fungal diseases (see Table 2). It is best suited to the Darling Range or areas proposed to remain as State forest within Dryandra, where it can be dispersed or directed to less sensitive areas.

ISSUES

- Horses can have a number of environmental and social impacts. However, many of these impacts can be minimised and effectively managed by confining horses to existing access tracks.
- Dryandra is predominantly an open woodland allowing for easy off-track access into bush areas, potentially leading to the impacts listed above, as well as increasing the likelihood of horses grazing on poisonous plants (eg. *Gastrolobium microcarpum*).
- There are no other CALM lands in the Wheatbelt Region where horse riding is permitted; however, there are many alternative sites on private and other lands. Farmstays adjacent to Dryandra offer horse riding activities.

OBJECTIVE

- *Provide horse riders with an opportunity to experience Dryandra's varied landscape, whilst protecting the Woodland environment from the impacts of horses.*

It is proposed to adopt a flexible approach to horse riding. While demand for horse riding in Dryandra is very low, recreational horse riding (including carts) will be limited to gazetted public roads that traverse Dryandra. These include:

- York - Williams Road;
- Contine Siding Road;
- Dryandra Road;
- Rosedale Road; and
- Shepherds Road.

However, demand for horse riding will be reassessed during the term of the Plan and, if need be, consideration will be given to designating a bridle trail.

STRATEGIES

1. Limit recreational horse riding (including carts) in Dryandra to gazetted public roads.
2. Reassess demand for horse riding in year five of the Plan and, if necessary, consider designating a bridle trail within State forest areas in Dryandra. The trail will follow existing tracks and be sited on stable surfaces where existing biological values can be satisfactorily protected and managed.
3. Exclude competitive horse riding events from Dryandra (eg. gymkhanas and cross country riding).

13.9 CAR AND MOTORBIKE EVENTS

BACKGROUND

Car and motorbike events may vary from casual, social outings to highly competitive events requiring expert driving and navigational skills and the use of specially equipped vehicles. Competitive motorbike trail-riding and car rallies have been permitted in the Woodlands in the past.

ISSUES

- Competitive events can damage roads, disturb other visitors, cause road deaths of wildlife, and lead to the deterioration of vegetation affected by dust along the roadsides. These impacts are inconsistent with the primary purpose of protecting Dryandra's conservation values.
- There are no other areas on CALM lands in the Wheatbelt Region where these activities are permitted; however, there are alternative sites on private and other lands.

OBJECTIVE

- *Protect the Dryandra Woodland environment from the impacts of competitive car rallies and other motor sports.*

STRATEGIES

1. Exclude competitive car rallies and other motor sports from Dryandra Woodland.
2. Encourage groups wishing to conduct social vehicle rallies to contact CALM for approval and planning of the event.
3. Direct social rallies away from areas of high conservation value, or popular recreation sites where there is a possibility of a nuisance being created to other visitors.

13.10 FISHING

BACKGROUND

Fishing for Redfin (*Perca fluviatillus*) and Yabbies (*Cherax destructor albidus*) are popular activities at both Old Mill Dam and Congelin Dam during the warmer months.

There is no size limit on Redfin, although a recreational fishing licence is required and a bag limit of 40 fish per angler per day applies. There are no size or bag limits on Yabbies, and a licence is not required.

ISSUES

- Fishing for Redfin and Yabbies is an established recreational activity in Old Mill Dam and Congelin Dam.

OBJECTIVE

- *Provide opportunities for recreational fishing of Redfin and Yabbies at Dryandra.*

STRATEGY

1. Allow recreational fishing for Redfin and Yabbies at Old Mill Dam and Congelin Dam in accordance with the relevant Fisheries Department regulations.

14. TOURISM AND COMMERCIAL VISITOR SERVICES

BACKGROUND

Tourism

Dryandra Woodland is one of the central wheatbelt's three tourist attractions. In 1990-1991 there were approximately 29 000 visitors to Dryandra Woodland (CALM 1991c), of which approximately 5000 visitor nights were spent at the Settlement. This compares with estimated annual visitor numbers of 117 000 at Wave Rock (Hibbs *et al.* 1994), 12 000 at Lake Dumbleyung, and 3000 at Boyagin Rock (CALM 1991c), all of which are located in the central wheatbelt.

Although the structure of the vegetation lacks the dimensions of the typical forest tourist attractions in the south-west of the State, Dryandra is still the key bushland resource in the central wheatbelt, and as such, provides the area with a substantial tourism product. The name 'Dryandra Woodland' gives this product a unique identity, distinguishing it from other forest tourist attractions.

Despite its natural attraction, close proximity to Wave Rock, and existing visitor levels, Dryandra currently receives comparatively little official recognition as a tourist destination in the central wheatbelt. This is mainly due to tourists' lack of awareness of its existence and the facilities and attractions that it offers.

Visitors to the central wheatbelt may be classified into three principal groups:

- the fully accommodated tour market, characterised by both domestic and overseas visitors, who are visiting Dryandra as part of a total tour package;
- the independent, self-drive market, characterised by both domestic and overseas visitors, who either visit Dryandra as part of an overall itinerary or as an end-destination; and
- day trippers, principally from the central wheatbelt and Perth Metropolitan Area, which consists of both coach and self-drive travellers, who do not stay overnight at Dryandra.

The largest potential markets for Dryandra are day trippers from the central wheatbelt and short-stay trippers from the Perth metropolitan area. Anecdotal information suggests that the future trends in tourism in Dryandra will be towards soft adventure (for example bushwalking) and nature-based tourism. Although these are quite different market segments, Dryandra should aim to cater for both audiences (B. Handcock pers comm.).

Infrastucture

Dryandra is accessible by sealed roads from all major population centres. Most of the roads and tracks within the blocks north of Narrogin are formed earth, and generally accessible to 2WD vehicles.

The Dryandra area is well serviced by a range of accommodation options. At present there are eight farm-stay operators in the immediate vicinity of Dryandra, including both the Highbury area and the main blocks north of Narrogin. Caravan facilities are available at Popanyinning, approximately 15 km north of Cuballing, and in the townships of Williams, Pingelly and Narrogin. Motel/hotel accommodation is available in these three townships and at Cuballing.

Other tourism service facilities, such as fuel and major food supplies, are available in Narrogin, Pingelly and Williams. Fuel and limited food supplies are also available at Cuballing.

Commercial Visitor Services

Commercial concessions may be granted on CALM lands to provide appropriate facilities and services for visitors. Proposals are carefully considered by CALM and may require the approval of the NPNCA or the LFC, and the Minister for the Environment.

Concessions must be consistent with the purposes of Dryandra Woodlands and this Management Plan.

Lease or licence arrangements can be mutually beneficial to CALM, the commercial operator and the public. CALM can assist operators by helping to develop information and on-site experiences for their clients. Conversely, commercial operators may be able to assist CALM with management tasks, enabling CALM staff to then perform additional tasks (eg. guided tours). However, CALM may be directly involved in those commercial activities which are environmentally or socially sensitive, or are of important educative or interpretive value to visitors.

Commercial visitor services within Dryandra currently include the Lions Dryandra Forest Village accommodation (see Section 12.2 Dryandra Settlement Accommodation Complex), the Dryandra Woodland Ecology Course and numerous wildlife tours.

ISSUES

- Dryandra Woodland has considerable potential for future tourism growth and commercial operators provided the following issues are addressed:
  - better access to Dryandra's natural environment and development of additional tourist attractions and activities. These factors are of prime importance to the area's potential to attract and retain visitors;
  - the provision of essential facilities and infrastructure, both public and private, which are required to adequately service existing tourists and sustain tourism growth; and
  - achievement of a balance between the provision of adequate access and preservation of Dryandra's natural environment, through implementation of appropriate management controls.
- It is CALM policy to recover the costs of providing facilities and services to the public from users.
- The proposed central theme of Dryandra's interpretive and educational programs—'biodiversity is essential to sustain each individual's quality of life'—could be incorporated into commercial tour operators' programs.

OBJECTIVES

- *Provide a range of nature-based tourism opportunities in Dryandra.*
- *Maintain the necessary infrastructure within Dryandra to cater for increased visitor numbers.*
- *Encourage and facilitate commercial interests in the development of facilities and services that complement those provided by CALM, and are consistent with the maintenance of Dryandra's values.*
- *Promote the interpretive theme 'biodiversity is essential to sustain each individual's quality of life' amongst tour operators.*
- *Ensure CALM's fees and charges for the provision of services to users, including commercial operators, maximise cost recovery*

CALM's role in tourism will be to complement private enterprise by managing and presenting natural assets, providing access and information, and interpreting the natural environment. Private enterprise has the role of marketing tour opportunities, and catering for the transportation, accommodation and comfort needs of visitors (Shea and Sharp 1992).

STRATEGIES

Tourism

1. Improve access for tourists to Dryandra's natural and cultural environment (see Section 11. Access and 13.2 Pleasure Driving and Sightseeing).
2. Develop a range of recreation opportunities to enhance tourists' experience of Dryandra (see Section 12.1 Recreation Areas and Facilities).
3. Upgrade the Settlement area, including the Old Mill Dam, and encourage caravan and 'farm stay' type accommodation adjacent to Dryandra to better service the needs of tourists.
4. Market Dryandra to attract a clientele that is appreciative of the natural environment. The main target audiences will include local communities, schools and universities, passive recreationists, naturalists and nature-based tourists and others seeking passive recreation in a natural setting.
5. Liaise with the Central South Tourism Association and the Western Australian Tourism Commission to ensure Dryandra is viewed and promoted as an integral part of regional tourism.
6. In consultation with the local community and tour operators, design and implement educational programs and activities that promote the theme that 'biodiversity is essential to sustain each individual's quality of life'.

Commercial Visitor Services

7. Develop guidelines, in consultation with operators, for groups and commercial tours, including:
   - maximum numbers of participants;
   - activities carried out in areas able to sustain such use; and
   - safety and environmental standards.
8. Approve only those commercial concessions that rely on the special environmental qualities of the Woodland.

9. Issue concessions (through leases and licences) to tour operators to supply appropriate visitor services. Where it is necessary to limit licences/leases, offer opportunities to operators according to criteria including experience, knowledge, willingness to contribute to to management, etc.
10. Encourage all tourism operators in Dryandra to attend CALM's Dryandra Woodland Ecology course (see Section 25. Education, Information and Interpretation).
11. Ensure CALM is directly involved in those commercial activities which:
    - are of particular environmental or social sensitivity;
    - are of important educative or interpretative value to visitors; and
    - are likely to cause an overall financial loss to CALM if conducted by concession.

    Ensure that fees and charges for the provision of these services to users at least cover costs.

Research and Monitoring

12. Monitor the impact of commercial tours on the Woodland environment. If Dryandra's values are being adversely affected take appropriate action, such as limiting the number of tours.

COMMERCIAL USE

15. TIMBER PRODUCTION

BACKGROUND

The current timber industry at Dryandra is based on plantation Brown Mallet, although there has been recent interest shown in Wandoo, Powderbark Wandoo and Rock Sheoak timbers. Recent trends indicate that during the term of this Plan it is likely that demand for timber from these, and other local native species, will increase.

Mallet

In the first part of this century the bark of Brown Mallet (a valuable source of tannins) was a major export commodity. Naturally occurring Brown Mallet was heavily exploited, until there was concern for both the future of the species and the industry. Consequently, Crown reserves were set aside to protect natural stands of the species, and to provide a secure resource for future industry needs.

Plantations of Brown Mallet were established in Dryandra between 1926 and 1962 and now cover 8316 ha (approximately 30% of Dryandra). Of this area, 3430 ha contains good quality mallet stands, 2812 ha are more open mallet stands with a limited range of understorey species, and mallet establishment failed over the remaining 2074 ha. The failed areas now carry mixed vegetation including areas of Wandoo, Powderbark Wandoo, Rock Sheoak, heath, and communities associated with rocky outcrops.

In Dryandra, natural mallet stands predominantly occur on the break-away slopes. The plantations were established on these sites and also on the broad valley slopes and floors. In the latter areas the original vegetation—generally Wandoo and Powderbark Wandoo woodlands—has mostly been displaced.

Wandoo and Powderbark Wandoo

Over two-thirds of Dryandra is natural bushland consisting primarily of Wandoo and Powderbark Wandoo woodlands. Since the early part of this century most woodland areas have been cut over for sawlogs, fencing material and firewood. Broadscale cutting of Wandoo initially declined in 1967 with the closing of the sawmill in Dryandra, and later ceased in 1977 when most areas of Dryandra were no longer able to sustain Wandoo timber production (Forests Department 1981). Since 1977 the Forests Department and then CALM have managed the Wandoo woodlands primarily for flora, fauna and landscape, although approximately 20 tonnes per year of Wandoo and Powderbark Wandoo were removed under licence between 1983 and 1989.

Currently, most local companies requiring Wandoo obtain supplies from State forests in the Mundaring and Jarrahdale districts, where the larger areas of forest can sustain the supply. However, pressure to harvest Wandoo from Dryandra still continues.

Under this Plan it is proposed that all future supplies of Wandoo for local companies will come from State forests in the Mundaring and Jarrahdale districts.

Minor Timber Species

There are a number of minor timber species in Dryandra that are likely to have been cut in the past, including Sandalwood, Rock Sheoak, Jarrah, Marri, Flooded Gum (*Eucalyptus rudis*), York Gum and Jam (*Acacia acuminata*). Commercial interest has recently been rekindled in some of these species, particularly Rock Sheoak.

Since 1931, 15 Sandalwood experimental plots have been established in the Dryandra Woodland. Many plants within these plots are still surviving and are a potential source of seed for future plantings. Recently CALM purchased a small area of private property in the Highbury area to demonstrate the commercial and land conservation benefits of establishing sandalwood on cleared farm land.

The Timber Industry

Currently, plantation mallet harvested from Dryandra Woodland supports a number of local industries. These include a tool handle manufacturer who produces approximately 100 000 handles each year, a

small industry for the treatment and supply of fencing materials, one licensed operator who cuts firewood and fencing material, and two licensed operators who cut firewood only.

In the 5 years to 1992, the following average annual quantities of mallet were removed under licence or contract from the plantations:

Tool Handles	500 tonnes of mallet per year (range 338-700)
Fencing materials:	700 tonnes of mallet per year (range 190-1046)
Domestic firewood:	850 tonnes of mallet per year (range 583-1284), including approximately 320 tonnes per year (range 217-347) collected by the public

The tool handle manufacturer has a contract to harvest up to 850 tonnes of plantation mallet annually, and selectively cuts an area of approximately 100 to 250 ha in any one year. Fencing and firewood products are salvaged from trees fallen for tool handles, or obtained by thinning stands to promote growth of tool handle quality trees: in effect, the firewood and fencepost trades are at present subsidiary industries that play an important value-adding role. This could change in future as poor quality plantations (ie. those unable to produce tool handle quality mallet within 35 years) are converted back to natural vegetation.

Whilst the Dryandra timber industry is small in the statewide context, it is an important part of the local economy and, potentially, has a key role to play in the future development of commercial tree crops on cleared farmland.

The Timber Resource

An inventory of the mallet resource in the plantations was conducted in the late 1980s. The total volume estimate for each product is as follows.

Tool handles:	21 000 tonnes
Fencing materials:	77 000 tonnes
Domestic firewood:	49 000 tonnes

The inventory did not account for the amount of product available in the tree crown. Limited analysis suggests that up to twice the volume may be available in the crown, mostly as firewood (S. Gorton pers comm.).

The inventory also revealed that many trees in the plantations were dying and that net growth rates were less than 2% volume growth per year due to overstocking. Chandler (1936) demonstrated that growth rates of 4.3% per year over a ten year period could be obtained in stands that had been thinned from 5160 to 640 stems per ha. Hewett (1993) obtained annual growth rates of 4.8%, 5.2% and 5.6% per year in plots thinned to 284, 280 and 104 stems per ha respectively.

At the current plantation growth rate the future annual demand for mallet products is likely to be greater than the annual sustainable yield of the plantations. Given this situation, there is a need to further research and improve the silvicultural management of mallet to increase sustainable yields, and encourage the establishment of commercial mallet plantations on private property as a resource for local industries.

Additional benefits of plantings on freehold land include:

- ameliorating land degradation;
- providing shelter for stock and crops;
- maintaining ecosystem processes;
- increasing aesthetic and recreational appeal; and
- producing other commercial or on-farm items (such as fence posts).

There is limited inventory data on Wandoo and Powderbark Wandoo, or any of the minor timber species.

ISSUES

- Contractors operating in the south-west forests were recently issued with ten year licences to coincide with the term of the Forest Management Plan (CALM 1994). The provision of ten year contracts provides the industry with sufficient resource security to allow investment in more efficient equipment, enabling improvements in log utilisation and increasing value-adding to forest products. Contractors in Dryandra currently operate under contracts with a five year tenure, most of which terminate during 1995. Greater resource security, improved industry management and integration with conservation objectives could be achieved by issuing licences for up to ten years to approximately coincide with the duration of the Management Plan.
- This Management Plan provides the broad framework for the future direction of the timber industry at Dryandra. However, operational and technical details need to be developed before the long-term vision (see below) can be fully effected..
- It is probable that the growth rates for plantation Brown Mallet can be increased by improved silvicultural treatment, but the cost-effectiveness of such treatment is unknown.
- The cost-effectiveness of cutting any species apart from Brown Mallet in Dryandra is questionable. For example, for each tree species to be harvested from Dryandra, CALM would need to determine the amount of timber

available for harvesting and the significance of the associated environment impacts. The costs of obtaining this information, together with the additional on-ground management expenses of supervising this operation, are likely to exceed the financial benefits gained by the Western Australian community. Other species are available from adjacent CALM districts immediately to the west.

- Public firewood collection is an established use at Dryandra. Off-road driving associated with public firewood collection can increase the risk of spreading plant diseases, lead to soil compaction, and damage understorey vegetation. There are also increased administrative and operational costs incurred by CALM in processing permits and policing field operations.
- To sustain the local timber industry at its current level of production will require the planting of suitable trees on farmland. The expansion of the timber resource onto farmland would enable the industry to further enlarge and diversify, improving its long term viability. The establishment of Sandalwood at Highbury and mallees for oil production at Lake Toolibin illustrate the diversity of resource that could be available in future years.
- In recent years a number of trends have emerged which indicate that this decade is the opportune time to establish local woody species on cleared farmland. These trends include:
  - an increasing awareness that woody perennial vegetation can ameliorate land degradation;
  - the need to diversify sources of farm income;
  - the increasing interest in using woody vegetation as a substitute for non-renewable or environmentally damaging substances; and
  - the increasing concern over the introduction of exotic, woody weeds.
- There is broad agreement that ecologically sustainable land-use is crucial to the long term viability of agriculture in the wheatbelt. To achieve this goal it is vital that extensive revegetation occur on cleared farmland to counteract land degradation. At the same time, it is clearly more attractive to property owners if revegetated areas can produce a direct cash return, eg. Sandalwood and oil mallees. Dryandra, which has the only West Australian sawlog-driven timber industry in the lower rainfall zone (< 600 mm annual rainfall), is uniquely placed to help develop revegetation techniques that combine commercial production, land conservation and nature conservation objectives. Although permanent vegetation approximating a natural composition and structure would be preferred, nature conservation objectives within the immediate surrounds of Dryandra could be further enhanced by linking the fragmented blocks of Dryandra with permanent or semi-permanent vegetation on private property that has a commercial use. Increasing the effective, available habitat at Dryandra may be crucial to the long term viability of the area's conservation values.
- Dryandra is of international significance for fauna conservation. Its values for recreation, education and tourism are also extremely high in a regional context, and are likely to increase given its relative isolation amongst agricultural land.
- The use of mallet plantations by native vertebrate animals is influenced by the age of the plantation, the amount of regrowth other than mallet and the inclusion of natural vegetation isolates or rocky outcrops (Ninox 1991). Older mallet stands with a relatively large number of regrowth original eucalypts, such as Wandoo and Powderbark Wandoo, support a greater diversity than young, uniform stands.

LONG TERM VISION

No bushland in agricultural areas east of the main forest region contains the full range of vertebrate species which existed there 200 years ago. Within the wheatbelt, only a few isolated pockets of bushland now remain which are large and varied enough to provide a habitat for the remaining species. Although highly fragmented, Dryandra Woodland is one of the largest and most diverse areas, thus assuming major conservation, education and recreation significance.

With continued degradation of remnant bushland and agricultural lands through a range of factors including salinisation, waterlogging, water and wind erosion, and clearing, the importance of Dryandra as a remnant of the wheatbelt's biota will increase even further.

To arrest these land degradation problems it is estimated that at least 10-20% of the cleared landscape needs to be revegetated (Lefroy *et al.* 1993). Locally this figure may be much higher as salinity problems exist in the Yornaning Dam catchment (adjoining Dryandra) despite approximately 70% native vegetation cover (Clark 1992). Revegetation will not only extend the woodland environment and help combat land degradation, it may also link the fragmented blocks of Dryandra.

The long term (100 year) vision promoted in this Management Plan is that some agricultural lands in the Dryandra area will be revegetated with belts of woody perennial tree species, including Brown Mallet and Sandalwood. These woodlots would support local industries, contribute to local economies and employ local people, as well as provide for nature conservation values and environmental protection. In this context, Dryandra Woodland would have a nature conservation,

recreation, and education role, and a limited timber production role based on research and development of the mallet and sandalwood industry—small areas of plantation in Dryandra would be used to demonstrate silvicultural techniques and resultant products.

The remaining areas of plantation would be regenerated with the original native species, eventually providing a woodland in which nature conservation, eco-education and passive recreation will be the priority values.

The steps and time frame to achieve this vision are outlined in Figure 1. Under this plan, no tree species other than mallet (except Sandalwood within research plots), would be harvested from State forest areas in Dryandra. The existing mallet plantations in Dryandra would support estimated mallet timber demands for at least the next 35 years based on current growth and harvesting rates.

The eventual transfer of the mallet resource on to agricultural land is considered essential in the long term given the extremely high conservation and recreation value of Dryandra, and the fact that its size and fragmentation make it difficult to manage because of the need to protect significant areas from disturbance, while at the same time maintaining a range of regeneration stages. Revegetation with woody perennial vegetation is critical to the long-term sustainability of agriculture in the wheatbelt: the synergistic relationship between agriculture and deep-rooted commercial tree crops make the establishment of a commercial timber resource on freehold land within the next seventy years both desirable and economically feasible. If this is not so, then the sustainability of both the timber industry and large areas of agricultural land would have to be questioned. In this context it may seem practical to phase out timber harvesting from Dryandra more rapidly. However, the industry is an important means of removing plantation mallet to make way for revegetation with natural species. Furthermore, the current plantations are essential for researching the commercial viability of mallet on agricultural land, an integral factor if the sustainable agriculture and nature conservation objectives previously discussed are to be achieved.

The net result of the 100 year vision is a mixture of ecologically sustainable land uses, including nature conservation, timber production and agriculture, across the landscape. In contrast with forests to the west, which are sufficiently large to be viewed as sustainable ecosystems within their own right, Dryandra is part of an ecosystem which includes the surrounding agricultural lands. Recognition and understanding of this amongst the wider community is crucial to the successful management of both.

OBJECTIVES

In working towards the 100 year vision, the objectives of management for the next ten years are to:

- *commence the conversion of poor quality mallet plantations to a woodland of original species;*
- *manage good quality mallet plantations for mallet timber products, consistent with the maintenance of conservation values;*
- *further develop research on the silviculture of mallet and on the properties and uses of mallet;*
- *encourage the establishment of suitable trees (especially local species) on private property as a future resource for local industries and to assist with land and nature conservation;*
- *provide resource security for contractors; and*
- *continue silvicultural studies of sandalwood.*

STRATEGIES

1. Issue licences for up to ten years to approximately coincide with the term of this Management Plan.
2. Produce a plan for the management of mallet plantation areas and the associated industries by December 1995. The plan will:
   - state the criteria for selecting which mallet plantations will be either returned to communities of original species or remain plantation for a further rotation;
   - determine which mallet plantations fall into the above categories;
   - maximise the efficient use of the resource by linking timber allocations for the fencepost and firewood industries to:
     - the estimated residue from the tool handle industry;
     - CALM's silvicultural requirements (eg. thinning); and
     - meeting the objectives of returning mallet plantations to natural vegetation.
   - contain timber management prescriptions that address silvicultural and nature conservation needs for all production operations (including domestic firewood);
   - outline revegetation prescriptions for plantation areas which are to be returned to communities of original species;
   - consider methods of encouraging the development of plantations on private property; and
   - be reviewed concurrently with the Management Plan in 2004.
3. Continue to prohibit the harvesting of Wandoo and Powderbark Wandoo in Dryandra Woodland. Identify, in conjunction with the local timber industry, alternative sources of these species as necessary, including CALM operations in the Darling Range forest belt.

Figure 1: Vision for mallet plantation management – 1995-2095

1st Rotation (approximately Year 0-35)	2nd Rotation (approximately Year 35-70)	3rd Rotation (approximately Year 70-100)
'Poor quality' mallet (approximately 4800 ha) Harvest stands for mallet products then convert to natural vegetation. If regeneration consists of dense mallet stands, commercially thin or use prescribed fire to determine community composition.		
'Good quality' mallet (approximately 3500 ha) Commercially harvest 'good quality' mallet and re-establish plantations. Research during first rotation: · silvicultural requirements of mallet to maximise yields. · properties and uses of mallet. · techniques for commercial mallet (and other species) establishment and silviculture on private property.	Commercially harvest and convert approximately 1300 ha to natural vegetation. If regeneration consists of dense mallet stands, commercially thin or use prescribed fire to determine forest composition. Commercially harvest 2000 ha and re-establish mallet for third rotation. Commercially harvest and re-establish a 200 ha mallet plantation to demonstrate silvicultural management necessary to produce range of products and benefits. Assist with broad-scale establishment of mallet or other species on private land.	Commercially harvest and regenerate to natural woodland. If regeneration consists of dense mallet, commercially thin. Maintain demonstration plantation. Increasing proportion of mallet on private land.

'Poor quality' mallet - sites unable to produce tool handle quality mallet within 35 years.
'Good quality' mallet - sites able to produce tool handle quality mallet within 35 years.

4. Demonstrate how the establishment of commercial plantations of suitable trees (especially local species, such as Brown Mallet and Sandalwood) can be integrated with surrounding agricultural land uses to benefit landowners, the timber industry and the environment.
5. Promote within the timber industry the need to harvest simultaneously all timber products (eg. tool handles, fence posts and firewood) from plantation areas to minimise the disturbance period to native fauna.
6. Ensure that timber harvesting operations are conducted in accordance with the CALM Visual Resource Management guidelines to reduce aesthetic impacts.
7. Continue to follow, in all operations, the hygiene practices outlined in the CALM Dieback Hygiene Manual.

Research and Monitoring

8. Further develop research with the aims of increasing the yield and quality of mallet, and determining the properties and uses of mallet.
9. Continue silvicultural studies of sandalwood within current plots.
10. Monitor the impact of timber production on fauna populations.
11. Monitor the impact on fauna populations of returning selected plantations to pre-existing vegetation.
12. Monitor the use of plantation corridors by native fauna.

16. APICULTURE

BACKGROUND

Commercial beekeeping involves the short term placement of managed populations of the introduced Honeybee (*Apis mellifera*) into areas of land to take advantage of the availability of nectar or pollen. Commercial apiary operations are, by necessity, highly mobile, with hives being placed where pollen or nectar resources are greatest. Because of this, many apiary sites in Dryandra are used only infrequently.

Within Dryandra Woodland, there are 50 apiary sites managed by 20 registered beekeepers; however, an additional 20 sites in the surrounding area are dependent on the Woodland. The Western Australian Department of Agriculture has calculated the value of apiculture dependant on Dryandra, in an average year, in excess of $ 125 000.

The other source of Honeybees in the natural environment is from feral colonies. The dispersal of colonies from managed hives occurs when abundant food resources (usually in spring) causes a rapid increase in Honeybee numbers. As a result, the queen may leave the hive, taking many of the workers with her.

Environmental concerns

There has been considerable debate over the possible environmental effects of Honeybees on the Australian biota, especially in relation to managed apiary operations in national parks and nature reserves. Environmental concerns have focused on:

- the effects of competition for nectar and pollen between Honeybees and native pollinators;
- the efficiency of pollination by Honeybees; and
- the displacement of native birds and mammals from nesting hollows by feral colonies.

Beekeepers argue that commercially managed hives are only placed where there are abundant nectar resources: there is little point placing them elsewhere. Certainly, nectar flows in some eucalypt species can be so heavy that nectar drips from the blooms in excess (Anderson 1989). As such, any competition with native species is reduced. Research by Paton (1990) and Pyke and Balzer (1985) has shown, however, that Honeybees do compete for nectar when floral resources are low. Paton found that feral bees could remove up to 90% of the nectar and pollen produced by several native plants, and stated that interactions between Honeybees, native pollinators and native plants are likely to be deleterious to the native species. The likelihood of this is largely avoided by apiarists only placing hives where nectar or pollen is abundant. However, in times of widespread low resources, it is possible that the greater foraging efficiency of Honeybees could deprive native species.

The role of Honeybees as pollinators of native flora is still largely unknown. Paton (1993) states that forage behaviour can lead to the inefficient pollination of some native plants. Honeybees forage over smaller areas and transport pollen over shorter distances than native pollinators, thus decreasing the potential gene flow between plants.

It is also possible that Honeybees have a positive effect on native flora, particularly on small reserves where native pollinators have largely disappeared (Paton 1993).

ISSUE

- The impacts of Honeybees on native biota are not well understood.

OBJECTIVE

- *Minimise the impact of apiculture on Dryandra's nature conservation values.*

STRATEGIES

1. In keeping with CALM policy on apiculture:
   - maintain the existing number of apiary sites within Dryandra. No decision on beekeeping will be made until the impacts of Honeybees on conservation values has been sufficiently described;
   - permit no additional apiary sites (ie. additional to the existing sites) within Dryandra during the above period of research;
   - administer apiculture by designating access routes, supervising field activities, sign posting sites and reviewing site management; and
   - make available to registered apiarists with sites in Dryandra Woodland the annual prescribed burning program for the area.
2. Manage access to sites in accordance with dieback hygiene principles. Close and relocate sites (if possible) if access poses an unacceptable disease risk.

17. MINING

BACKGROUND

To date, no economically viable mineral deposits have been discovered in Dryandra Woodland, although the area has low to medium potential for bauxite, base metals, and kaolinite (T. Smurthwaite pers comm.). Part of Dryandra was until recently covered by a special mineral lease (ML 258SA) held by Worsley Alumina; however, this area has now been relinquished from the lease. Any future proposals to explore or mine in Dryandra will be assessed in accordance with the Mining Act (1978), the Environmental Protection Act (1986) and Government policy, including the 'Guidelines for the Application of Environmental Conditions for Exploration and Mining on Conservation Reserves and Other Environmentally Sensitive Land (DOME 1994).

For 'A' Class Reserves mineral exploration is subject to referral to the Environmental Protection Authority (EPA) and the agreement of the Minister for the Environment, whilst mining requires both these steps plus the consent of both Houses of Parliament. Finally, mineral exploration and mining in State forests requires referral to the EPA and ministerial approval.

OBJECTIVE

- *Protect Dryandra's values from exploration and mining.*

STRATEGIES

1. Continue to implement Government policy on mining, including the 'Guidelines for the Application of Environmental Conditions for Exploration on Conservation Reserves and Other Environmentally Sensitive Land'.
2. Ensure that if exploration or mining is approved, CALM recommends that it is subject to conditions that will minimise impacts on the biological, physical, cultural, and landscape values of the Woodland. Rehabilitation will be to CALM and DOME specifications and at the proponent's expense.

PROTECTION

18. DISEASE

BACKGROUND

Plant diseases, caused by *Phytophthora* species and *Armillaria luteobubalina,* are of particular concern in Dryandra. Other fungal diseases such as wind-borne canker, of which there are many species, are also present.

Dieback Disease

Fungi belonging to the genus *Phytophthora* are exotic to the Western Australian environment. Several species affect the native flora of Western Australia—*P. cinnamomi, P. citricola, P. cryptogea, P. megasperma* var *sojae, P. megasperma* var *megasperma, P. nicotianae* var *parasitica* and *P. drechsleri.* Of these, a *P. cinnamomi* infection occurs within ten km of Dryandra and a *P. citricola* infection has been recorded within the Woodland.

Although the climate at Dryandra is not generally conducive to the spread of *Phytophthora* species, under particular conditions (eg. after significant summer rain) or within a micro-habitat (eg. around granite outcrops) the disease may survive. Once released the spores survive well in moist or wet soil and any movement of the soil can spread the disease.

The spores of the fungus may infect a wide range of plants; however, it only flourishes in susceptible plant tissue. Dryandra Woodland vegetation types 1, 2 and 3 have a high proportion of susceptible species, while vegetation type 10 is associated with moisture gaining sites, increasing the disease hazard (see Table 2).

During the term of this Management Plan, methods of increasing plant resistance to dieback disease may become available. CALM is presently testing the application of phosphorous acid to increase the resistance of threatened species that are being

severely impacted by *Phytophthora*. Preliminary results are encouraging (B. Shearer pers comm.).

Honey-Fungus (*Armillaria luteobubalina*)
This fungus has spores borne on the gills of a fruiting body, similar to the common mushroom. The fruiting body is 12-15 cm across and golden yellow, generally growing in clumps near tree bases in the wetter months of the year (June-July). A white mycelial mat is formed under the bark at the base of the affected tree. *Armillaria* feeds on new wood and bark, eventually girdling and killing its host. It has a large host range and is widespread throughout the world. Wandoo is particularly susceptible to *A. luteobubalina* (B. Shearer pers comm.).

Unlike dieback disease fungi, *A. luteobubalina* is naturally occurring in the south-west of Western Australia. The fungus spreads by growing along infected roots and then out on to uninfected roots. In an undisturbed environment this is a slow process. Air-borne spores landing on damaged bark may also establish infections, but this is not considered to happen frequently.

To date, *A. luteobubalina* has been recorded at two locations within Dryandra, with vegetation types 5, 6 and 7 (susceptible species), and type 10 (moisture gaining sites) appearing to be the most susceptible (see Table 2). Although the area of infection is relatively small, the environmental impact of the disease is high.

Canker Fungus Disease
This disease is caused by canker fungi, which are thought to be exotic to Western Australia. There are at least six different species, all of which have aerially dispersed spores. These spores spread by wind and rain splash settling on the stems of plants. Over time the spores grow into the stems, forming a canker or lesion, which moves down the stem gradually killing the plant from the top down. This is in contrast to *Phytophthora* and *Armillaria* where the fungi infect plant roots and gradually starve the plant.

The range of plants affected appears to be wide, with many *Banksia* and *Eucalyptus* species (including Wandoo) having been found to be infected. The geographical range of these fungi currently extends from Eneabba to Hopetoun, encompassing Dryandra Woodland where the canker *Botryosphaeria ribis* is present (B. Shearer pers comm.).

ISSUES

- *Phytophthora, Armillaria* and canker disease fungi infections have been found in Dryandra Woodland. These diseases have the potential to impact on Dryandra, not only in terms of the loss of plant diversity and abundance, but also through the loss of food sources and habitats of fauna.
- Stringent dieback disease hygiene practices need to be carried out for all activities involving the movement of soil, particularly the maintenance of tracks.

OBJECTIVES

- *Prevent, as far as practicable, the introduction of plant diseases into disease-free areas.*
- *Control or, if practicable, eradicate plant diseases likely to cause major environmental problems.*

STRATEGIES

1. Continue to follow, in all operations, the hygiene practices given in the CALM Dieback Hygiene Manual. Develop new procedures as necessary.
2. Continue plant disease surveys of Dryandra to identify and then isolate diseased areas. Re-develop or close any access tracks (vehicular, horse or pedestrian) that passes through inundated, infected or high risk areas.
3. Consider provision of footbaths (containing fungicide) at the entrances to walk tracks that traverse dieback disease susceptible plant communities.
4. Consider temporary closure of tracks when the risk of disease spread is high, for example, after significant summer rainfall.
5. Inform and educate Woodland users about plant diseases and the need to stay on well-formed roads or tracks. Include dieback hygiene information in each Settlement hut.
6. Ensure staff associated with Dryandra are trained in plant disease recognition, sampling and management techniques.

Research and Monitoring

7. Monitor known fungal disease infections. Develop a comprehensive description of each infection, including information on species affected, vegetation association, infection area, rate of spread, soil profile, topography and threat to ground and surface waters. Use this information to update predicted hazard ratings for vegetation associations in the Woodland.
8. Investigate possible disease control and eradication procedures, while ensuring that they do not place other areas or values at risk.

19. FIRE

BACKGROUND

Introduction
The management of fire in Dryandra will need to be flexible to achieve the multiple objectives of

management. During the term of this Plan there will be an on-going requirement for the protection of life, property, and the commercial Brown Mallet plantations, and an increasing emphasis upon the maintenance of habitat and species diversity.

Fire History

We do not have a complete understanding of the fire regimes of the wheatbelt area prior to European settlement. In other south-west areas, however, especially the coastal plain, it is well known that Aboriginal people used fire to modify their environment and increase the availability of food resources. This activity has commonly been termed fire stick farming. The object of fire stick farming in wooded areas was probably to favour or attract game, and to improve access to food sources such as rivers and swamps (Hallam 1985). The present vegetation types have evolved under a fire regime that was influenced by Aboriginal burning and occasional lightning fires.

Since records have been kept, there have been very few wildfires which have started in Dryandra. Of the nine wildfires started in Dryandra between 1938 and 1985, the largest burnt 260 ha of the Woodland and the average area burnt was 40 ha. Clearing for farmland has led to further fragmentation and a reduction in the area of native vegetation over this period (see Map 2). To date, no wildfire has burnt out of Dryandra into private property. Over this same period, there were approximately 69 wildfires in surrounding farmland within a 20 km radius of Dryandra fire tower. The period 1946-1970 was the worst in terms of numbers of wildfires and total area burnt by wildfire. This was due to the clearing of vegetation and associated burning which took place after the Second World War. There have been considerably fewer wildfires since the 1970s following the reduction in land clearing.

These records suggest that Dryandra is under greater threat from wildfires burning into the Woodland than vice versa, and that the fire risk is lower than for the forests in higher rainfall areas of the south-west. This is despite Dryandra experiencing more severe fire weather conditions than the main Jarrah forest belt. The primary reasons for the absence of large and devastating wildfires by comparison with the main forest belt to the west are:

- the lower levels and discontinuous distribution of fuels;
- lower spotting distances due to the lack of fibrous-barked trees;
- the fragmented nature of Dryandra;
- the efficient fire detection and suppression system; and
- the reduced range of fire causes.

Fire Ecology

Burrows *et al.* (1987) considered the natural fire frequency at Dryandra to be relatively infrequent based on the following factors:

- the rate of litter accumulation is variable, depending on canopy density, but is generally slow. For most of Dryandra, litter fuel accumulation rates in the order of 0.5 tonnes per year over the first ten years are typical. Rates slow even further as the canopy ages;
- the high proportion of fire sensitive species, ie. those species that are killed outright by full foliage scorch;
- lack of epicormic crown recovery following fire; and
- the slow post-fire response of rootstock species.

Based on these factors, Burrows *et al.* (1987) considered that infrequent fires in the order of every 20-60 years may be important in maintaining a diversity of successional stages, but that fires less than approximately 15 years apart could lead to a change in community floristics and structure, eg. fire sensitive species with a long juvenile period could be eliminated.

While many fire management issues at Dryandra are similar to those elsewhere, complicating features are:

- the difficulty of predicting fire effects when regeneration is relatively slow;
- the presence of many plant species 'vulnerable' to fire[6]; and
- the highly fragmented nature of the Woodland.

In addition, many of the native fauna species for which Dryandra is noted have specific habitat requirements that may be maintained through the appropriate management of fire. Dense thickets of Rock Sheoak, and poisonous plants such as *Gastrolobium microcarpum*, provide protection for the Woylie and Tammar, while hollow Wandoo logs are of particular importance to Numbats.

Rock Sheoak is highly sensitive to fire, but has seed stored in the canopy and regenerates prolifically after fire. The resulting thicket is ideal Tammar Wallaby habitat. As the vegetation ages and its density decreases, the thickets become suitable for Red-tailed Phascogales. Maintenance of different age classes of this community may require the protection of some thickets from disturbance (including fire) for several decades. Some of the Rock Sheoak areas within Dryandra may eventually require regeneration burns, but none are proposed during the term of this Management Plan.

---

[6] *Plant species vulnerable to fire: vulnerability will depend on the stage of plant development and recent fire history. For example, it is unlikely that a single fire will be catastrophic, but it may well render the population vulnerable to disturbance for a period until reproductive capacity recovers.*

Currently, some poison thickets are being maintained by a low level of seedling establishment in the absence of fire, while other thickets have collapsed through senescence or have not regenerated satisfactorily following fire. A burn under dry soil conditions is one management tool that can be used to regenerate the poison thickets. As the seed stored in the soil is rapidly predated by birds and insects following seed release in early summer (Burrows *et al.* 1987), regeneration is likely to be more prolific after an autumn burn than a spring burn.

Fire also influences the availability of hollow logs through destruction of existing logs and the creation of new logs when hollow trees fall. The balance between these two processes depends on the intensity of the fire. Very intense fires destroy logs, but replaces them by bringing down trees. Less intense fires destroy logs without replacing them. Mild fires (especially in spring when logs are waterlogged) have almost no impact. Hence, fire intensity must be carefully managed. Currently, the supply of hollow logs is adequate for Dryandra's fauna; however, the continued decomposition of logs may necessitate habitat manipulation in the future. Further research on the effect of fire intensity on hollow log production is required (J. A. Friend pers comm.).

Fire Management

Since 1938, most of Dryandra has been subjected only to prescribed edge burning off major roads and tracks. Edge burning involves the use of wind driven fires planned to burn a short distance from the road before self-extinguishing. Historically, very little broadacre burning for fuel reduction purposes was done, but it is likely that some of the edging (especially in autumn) ran deep into the blocks. Between 1979 and 1985 there was some prescribed broadacre burning, with variable results. Since 1985 a system of 50-100m internal buffers, based upon existing roads, has been the cornerstone of wildfire protection, although two broadacre research burns have been conducted to research the effects of fire on Numbats (J. A. Friend pers comm.). The buffers are burnt in either spring or autumn when fuel levels reach 7-8 tonnes per ha. Alternative sides of the road are burnt each time to reduce the frequency of burning of any particular strip, and hence minimise any possible effects on fire sensitive species. Fuel reduction burning near the perimeter of Dryandra results in an invasion of weeds and is therefore not practised.

A Wildfire Threat Analysis (WTA) has been prepared for Dryandra. Values identified as being at risk within Dryandra include:

- the Settlement;
- vegetation where known rare fauna occurs;
- long-unburnt vegetation (fuel datum areas);
- mallet plantations;
- Wandoo woodlands separated from the main block; and
- cultural sites

The WTA also considers the risk of ignition, suppression response capability, and potential headfire behaviour in protecting these assets. The WTA revealed that:

- the risk of ignition is low;
- there is a good detection, access and suppression capability in the area;
- if a fire did start under extreme conditions and was not quickly attacked it would become very difficult to control;
- there are some values vulnerable to broadscale fuel reduction burning, eg. fuel datum areas, vegetation where known rare fauna occurs; and
- strategic protection burning (for example, roadside buffers) would help to reduce the risk of a fire developing, improve the safety of evacuation routes, provide sites at which some wildfires may be controlled, and provide a reasonable level of fire protection. Some broad area burning for research and habitat regeneration will provide further opportunities for strategic protection.

ISSUES

- Special values requiring protection and potential risks have been identified in the WTA.
- Much of Dryandra Woodland has a common boundary with well developed assets such as farms, the protection of which reduces the flexibility for fire management, but increases the role of the community in the detection and suppression of fires.
- A range of habitats is required in Dryandra to maintain the current level of biodiversity. Within some habitats, such as the poison thickets, there are areas that are currently senescent and research is required to develop management prescriptions for the maintenance or restoration of these areas.
- The very slow growth of rootstock species, the poor crown recovery of trees, the high proportion of species likely to be vulnerable to a short rotation fire regime (<15 years) and the slow rates of litter accumulation suggest that fires are infrequent in this environment. Therefore, if broad-acre fuel reduction burns are conducted less than 15 years apart, damage may occur to ecologically important vegetation types over large areas.

OBJECTIVES

- *Minimise the risks of fire to the lives of visitors, neighbours and fire-fighters.*
- *Identify and protect community values in or near Dryandra, including the Settlement, private*

property, recreation facilities, cultural sites, and public utilities.

- *Encourage and maintain the composition and diversity of plant and animal communities, with particular emphasis on threatened species.*
- *Minimise the incidence and restrict the extent of unplanned fires.*
- *Protect plantation areas, allowing fire only for fuel reduction or silvicultural purposes.*
- *Maintain fuel datum areas for research purposes.*

Based on the Wildfire Threat Analysis of Dryandra Woodland, it is proposed that effective fire protection be achieved by a combination of fuel reduced buffers, the maintenance of efficient detection and suppression systems, and regular and constructive liaison with farmers, visitors and the general public. Maps 5a and 5b show the location of the fuel reduced buffers.

In addition to the buffer burns it is proposed to use prescribed fire:

- to reduce the fire hazard at the Settlement and other recreation sites;
- for fuel reduction and revegetation purposes within the mallet plantations; and
- for experimental vegetation management burns.

STRATEGIES

Fire Prevention

1. Maintain a system of 50-100 m burnt buffers along strategic access routes and high risk public roads to assist containment of wildfires to blocks of about 400 to 600 ha, as depicted on Maps 5(a) and (b). Maintain fuel levels within these buffers at less than 7-8 tonnes/ha. Where practicable, link the buffers with natural low fuel areas, such as breakaways and wandoo flats.
2. Maintain low fuel levels (less than 7 to 8 tonnes/ha) in buffer strips and areas immediately adjoining the Settlement, recreation sites and other facilities.
3. Reduce the risk of wildfire by progressively phasing in gas barbecues. In the interim period allow fires in constructed fireplaces only.
4. Restrict fires associated with backpack camping to portable fuel stoves for cooking only.
5. Consider closing areas within Dryandra to the public to protect environmental assets (eg. long unburnt areas) during extreme fire conditions.

Burning Operations

6. Maintain an appropriate range of vegetation community age classes to ensure maximum habitat diversity.
7. Ensure all prescribed burns comply with written prescriptions approved by the Regional Manager. The prescription must incorporate an environmental checklist which takes into consideration the impact of burning operations on the environment. Where monitoring sites or research plots are involved, consult the appropriate research officer.
8. Modify, relocate or defer proposed burns where threatened flora occurs within these areas. Where it is a necessary component of the species' life cycle, or where in exceptional circumstances it is considered by CALM that the burn should proceed, Ministerial permission will be obtained.
9. Map and document all burning and fuel modification operations, as well as wildfire outbreaks in or near Dryandra.
10. Carry out all burns according to visual resource management principles, particularly in visually significant areas (see Section 6. Landscape).

Access

11. Maintain a network of roads to enable safe and rapid access for fire control to blocks of approximately 400 to 600 ha.
12. Minimise construction of any new firelines during wildfire suppression, and ensure post-fire rehabilitation occurs. Construct new firelines and firebreaks according to dieback disease hygiene guidelines.

Visitor Protection and Safety

13. Actively promote public education and awareness of fire risk, safety and survival through pamphlets, information boards and personal contact by staff.
14. Review regularly the Dryandra Settlement Fire Protection Plan. Provide opportunities for visitors to the Settlement to view this document.

Fire Detection

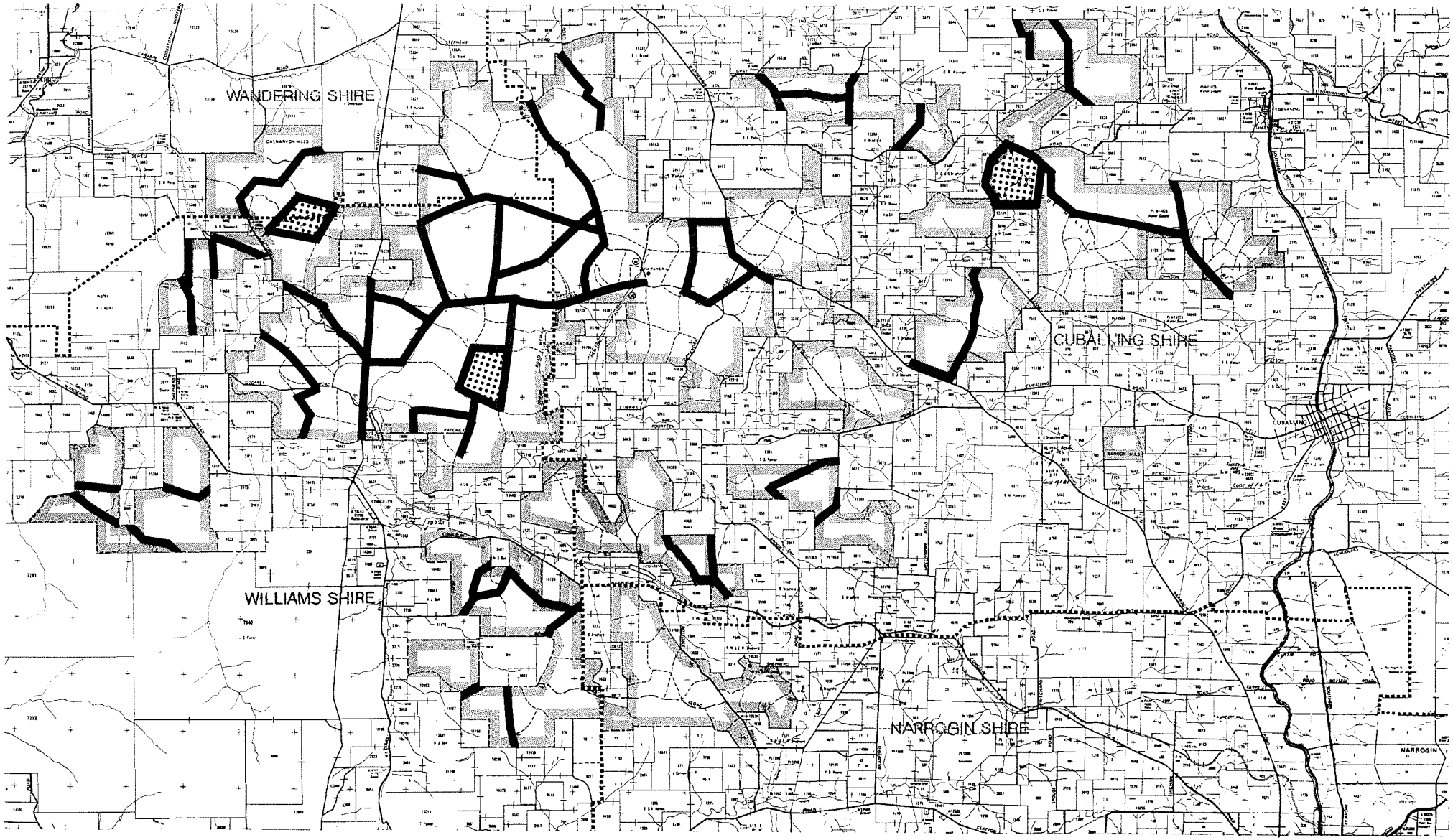
15. Staff the Dryandra fire tower when Fire Danger Index ratings reach or exceed Very High, or when otherwise considered appropriate by the Fire Duty Officer. In addition, continue to utilise fire notifications from the public, neighbours and shires.

Fire Suppression

16. Maintain an effective fire suppression capability within the Narrogin District in accordance with the Narrogin District Fire Control Working Plan.
17. Continue to liaise with the local Bush Fire Brigades and neighbouring shires to ensure an effective fire management force is in place.
18. Ensure compliance with inter-agency and other co-operative fire suppression agreements.

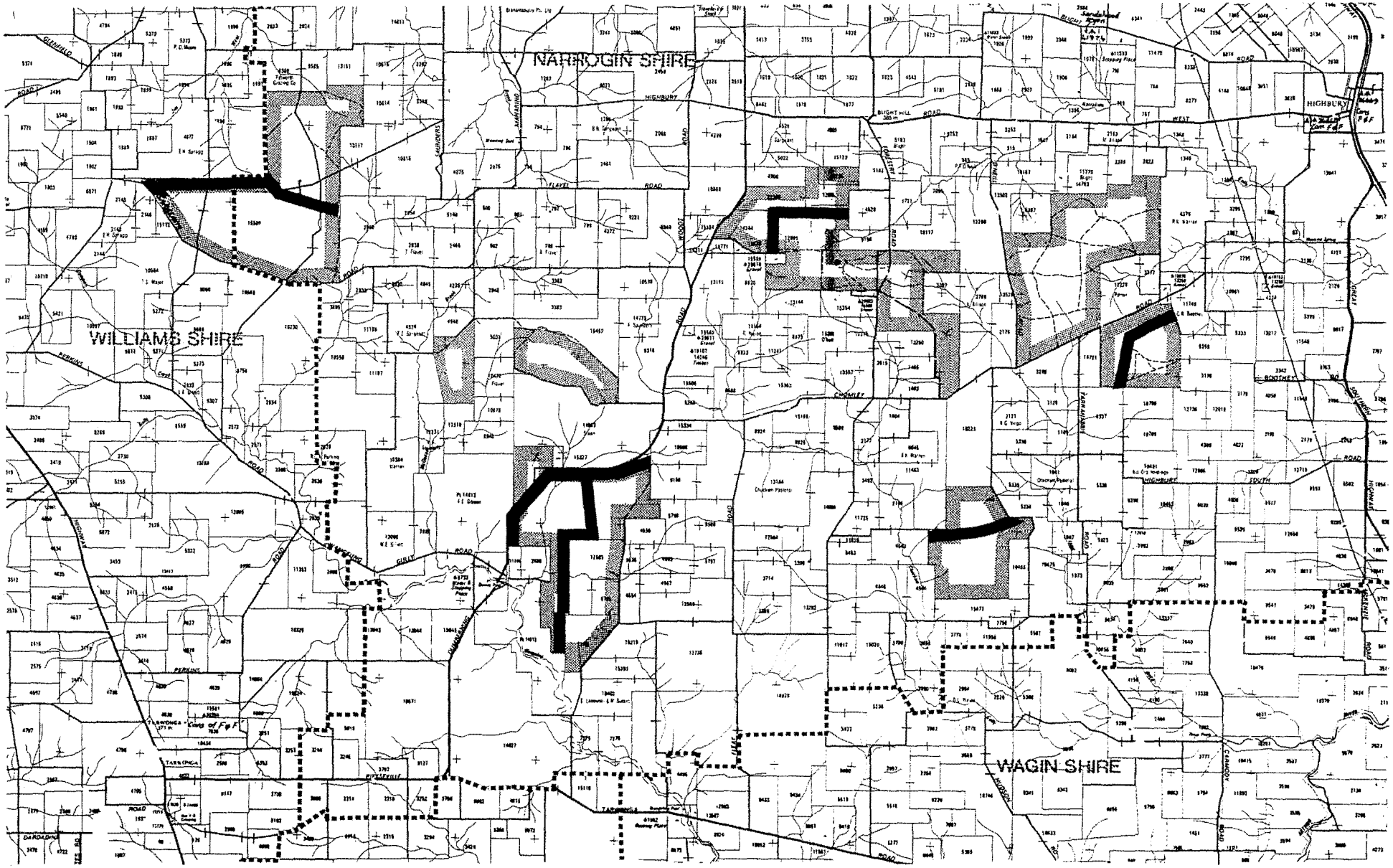
Research and Monitoring

19. Map the distribution, structure and vigour of poison thickets. Conduct two experimental burns during the life of this Plan, with the aim of forming large, continuous thickets. Monitor subsequent thicket development and



DRYANDRA

PROPOSED FUEL REDUCED BUFFERS MAP 5a



HIGHBURY

PROPOSED FUEL REDUCED BUFFERS MAP 5b

use by fauna. If successful, prepare and implement a program of rehabilitation for degraded poison thickets.

20. Research and monitor:
    - the effects of fire on selected biota, including vulnerable species, within fuel datum areas, buffer burns and experimental burns;
    - burning strategies aimed at maintaining the supply of hollow stumps, logs and trees; and
    - the effects of rotational burning for habitat management.
21. Review relevant fire information from other areas that may be applicable to Dryandra.
22. Investigate the role of fire in the silvicultural treatment and revegetation of mallet plantations.

20. WEEDS

BACKGROUND

A weed is defined as a plant or species growing out of place. When growing in native bushland, an unwanted plant is called a bushland or environmental weed.

Weeds may cause major structural change to native plant communities, altering flammability, displacing threatened species and regenerating seedlings, dispossessing native animals of habitat or food, and changing ecosystem processes such as the cycling of water or nutrients.

Healthy native vegetation is normally able to resist invasion of weeds. Most weeds require certain conditions, including the opening up of the canopy, soil disturbance or influx of nutrients before they can spread.

The major source of weeds at Dryandra is from adjacent lands. Major routes of spread are across private property boundaries, along linear disturbance features such as roads, tracks, and railway formations, and along creeklines. Weed dispersal can be increased by vectors including vehicles and machinery, soil movement, and by native and domestic animals.

Of the 890 plant species recorded within the Woodland, 74 are introduced (38 monocotyledons and 36 dicotyledons). Of these, the cape tulips (*Homeria flaccida* and *H. collina*) are declared category P3 weeds under the Agriculture and Related Resources Protection Act 1976. Category P3 plants are those where the numbers of plants or distribution, or both, should be reduced. Soursob (*Oxalis pes-caprae*) is declared P4, ie. those plants that should be prevented from spreading beyond their present distribution.

Some areas, such as creeklines and granite outcrops, are highly susceptible to weed spread due to the high water and nutrient status of these sites. Weed propagules can also be carried down streamlines by water. Most of Dryandra is uplands; consequently weed spread by this route is slow. However, upstream spread of cape tulip, Guildford grass (*Romulea rosea*), Cape Weed (*Arctotheca calendula*), clovers (*Trifolium* species) and Soursob is occurring on some of the creeklines.

Grasses such as veldt grass (*Ehrharta* species), wild oats (*Avena* species) and African Love Grass (*Eragrostis curvula*) can increase the fire hazard and out compete native vegetation for water and nutrients.

Other weeds such as Bridal Creeper (*Myrsiphyllum asparagoides*), watsonia (*Watsonia* species), Freesias (*Freesia leichtlinii*) and perennial grasses are not yet a problem in Dryandra; however, they do pose a threat to native vegetation because of their ability to invade and then dominate native plant communities.

The impact of some widespread weeds, such as Shivery Grass (*Briza minor*) and Guildford Grass is unknown.

There are also many planted species along tracks and firebreaks (*Pinus pinaster* and many non-local native species), some of which may have potential to cause woody weed problems.

ISSUES

- Major weed threats in Dryandra are Guildford Grass, Cape Weed, Bridle Creeper, cape tulip, clovers, soursob, and grasses such as wild oats, Perennial Veldt Grass and African Love Grass.
- The biology and impact of many of the weeds in Dryandra is unknown.
- The high boundary to area ratio of Dryandra, and the large number of internal tracks, increase management concerns in relation to the introduction and spread of weeds.
- The potential for weed introduction and spread needs to be considered in all management strategies, especially those involving disturbance such as timber harvesting, fire suppression, and track and firebreak maintenance.
- Mobile recreation, such as pleasure driving, horse riding, cycling and bush walking are possible methods of weed spread.
- Populations of threatened and priority flora need to be protected from weed invasion.
- Vegetation types 10 (granite outcrops), 11 (York Gum woodland) and 12 (Jam low forest), which are associated with moist, fertile soils, are highly susceptible to weed invasion (see Table 2).
- *Pinus* species and other exotic trees and shrubs could become future weed problems.

OBJECTIVES

- *Prevent, as far as practicable, the introduction of weeds to Dryandra.*
- *Control or, if practicable, eradicate weeds likely to cause major environmental problems.*
- *Minimise detrimental effects of weed control measures on the environment.*

STRATEGIES

1. Monitor the location, extent, spread and, where possible, ecological effects of weeds in Dryandra. Use the results to modify management practices or instigate control measures.
2. Conduct control programs in areas of greatest conservation value. For example, monitor known priority flora populations for weed invasion. Take control measures as necessary.
3. Identify and give priority to control of major weed threats such as cape tulip, perennial grasses and Bridal Creeper.
4. Eradicate, where practical, isolated outbreaks of weeds while the infestations are small and easily controlled.
5. Remove exotic and non-local trees and shrubs where considered necessary. Where records exist about the establishment of exotic plantings, measure and document growth details.
6. Liaise with government authorities and adjacent landowners to promote the control of environmental weeds on lands adjoining Dryandra.
7. Consider the potential for weed introduction and spread when planning management operations, eg. road maintenance, particularly where adjacent to weed sources. Modify strategies as necessary.
8. Involve volunteer groups in weed control where appropriate (see Section 26. Community Liaison and Involvement).

Research and Monitoring

9. Keep abreast of new information in weed research and new methods of control. Utilise this new knowledge to modify control programs, where appropriate, using specialist assistance.
10. Monitor and report on the effectiveness and potential ecological side-effects of control programs.

21. INTRODUCED ANIMALS

BACKGROUND

Non-indigenous animals such as foxes, rabbits, feral[7] cats and pigs, and domestic pets are pests in the natural environment and have a detrimental effect on native biota. They predate native fauna, compete with them for food and shelter, and cause damage to native plants and habitats by grazing, trampling and digging.

Introduced animals present in Dryandra include:

fox	*Vulpes vulpes*
cat	*Felis catus*
rabbit	*Oryctolagus cuniculus*
pig	*Sus scrofa*
House Mouse	*Mus musculus*
Black Rat	*Rattus rattus*
Laughing Turtle-dove	*Streptopelia senegalensis*
Laughing Kookaburra	*Dacelo novaeguineae*
Honeybee	*Apis mellifera*

Under the Agriculture and Related Resources Protection Act 1976, foxes and pigs are declared as 'animals subject to control and restricted introductions and keeping', whilst the rabbit is categorised as a 'prohibited animal'.

The fox is a major predator of fauna, and has been implicated in the decline of many threatened animals (Kinnear *et al.* 1988, Friend 1990a). In parts of Dryandra, foxes are controlled by monthly baiting with 1080-impregnated meat baits. This has resulted in population increases of Numbats, Woylies and Tammar Wallabies (Friend 1990b, Kinnear 1992). Dryandra was one of the areas where current fox-control methods were developed and researched. Research continues on optimising methods of fox control. Cats are also present in Dryandra and could have a similar impact to that of foxes. They appear not to be controlled by the current method of 1080 baiting.

Rabbits can cause erosion, weed invasion, loss of native plant species by overgrazing, and compete with native fauna for food and shelter. Rabbits are present in low numbers within Dryandra, occurring at the Settlement and on some boundaries. Rabbits are currently controlled by intermittent baiting with 1080 when it is considered necessary.

There have been reports of feral pigs in Dryandra. Rooting in soil by pigs has the potential to spread plant diseases, and physically damage the habitats of native fauna. Pigs can also predate on lambs and damage agricultural crops.

[7] *The term 'feral' is generally accepted as referring to domesticated or captive animals gone wild.*

Feral Honeybees are also present in Dryandra. Feral populations originate from poorly maintained commercial hives. Favourable conditions in the hive can lead to a rapid increase in bee numbers, causing the queen bee and many of her workers to leave the hive and establish a feral colony. There has been considerable debate over the possible effects of Honeybees on native flora and fauna (see also Section 16. Apiculture). In summary, the effects attributed include:

- interference with recreation sites
- competition for nectar and pollen resources with native pollinators;
- inefficient pollination of native plants; and
- displacement of native birds and mammals from nesting hollows by feral colonies.

House Mice are very common in Dryandra and throughout Western Australia, sometimes reaching plague numbers. Their impact on native flora and fauna is unknown.

The impact of other introduced animals in Dryandra is not well documented.

Feral animal biology and control is a rapidly growing field of research, and new methods of biological control of feral animals are being developed. Recently, public awareness of the impact of feral animals has increased, resulting in actions such as the involvement of local groups in fox control.

ISSUES

- While current fox control is having a demonstrated benefit on populations of several threatened animals, there is a need to expand the program to all blocks within the Woodland to coincide with reintroductions of threatened species.
- The impact on the native biota by some introduced animals (such as cats, House Mice, Black Rats, Laughing Turtle-dove, Laughing Kookaburra and feral Honeybees) is not well documented and economic, effective control methods are not yet available.
- Current fox control methods involve vehicle movement with a risk of spreading weeds and dieback.
- Domestic animals are not permitted in Dryandra because of the likelihood that they may consume the 1080 baits laid as part of the fox eradication program. Accidental poisoning of farm working dogs from 1080 baits can occur along park boundaries.

OBJECTIVES

- *Prevent, as far as practicable, the introduction of non-native species to Dryandra.*
- *Control or, if practicable, eradicate animals likely to cause major environmental or social problems.*
- *Minimise detrimental effects of feral animal control measures.*
- *Continue to exclude domestic animals from Dryandra.*

STRATEGIES

1. Record the incidence of feral animals, and monitor their location, extent, spread and ecological effects. Instigate control measures, with pigs, foxes and cats receiving high priority.
2. Liaise with the Agriculture Protection Board, adjacent landowners and local authorities regarding pest control in Dryandra and on surrounding lands. Integrate control programs wherever possible.
3. Continue the current fox baiting program, modifying methods in light of new information or with specialist advice. If practicable, expand the program to include all the blocks of Dryandra Woodland.
4. Continue strategies to minimise the risk of accidental poisoning of working dogs, including liaison with adjacent landowners and providing information to the public on the risk of poisoning working dogs.
5. Continue to follow a policy of prohibiting domestic animals from Dryandra, except for guide dogs accompanying blind persons and horses on permitted routes. Provide information as to why domestic animals are not allowed in Dryandra, and the location of alternative bushland areas (eg. Foxes Lair within the Narrogin townsite).
6. Ensure adequate hygiene methods to prevent spread of weeds or plant diseases when using vehicles for fox baiting.
7. Continue to control rabbits where necessary. Modify control methods in light of new information or with specialist advice.
8. Liaise with the apiculture industry to minimise the likelihood of swarming events.
9. Eradicate feral Honeybee colonies that are interfering with recreation sites.

Research and Monitoring

10. Participate in research on introduced animals and their control.
11. Keep abreast of new information in introduced animal research and new methods of control. Utilise this new knowledge to modify control programs where appropriate, using specialist assistance.
12. Monitor and report on the effectiveness and potential ecological side-effects of control programs.

22. GRAVEL, SAND AND STONE

BACKGROUND

Gravel, sand and rock aggregate are needed for road construction and maintenance, and recreation site development. Supplies of these materials have been obtained from within Dryandra in the past by CALM, local shires and other government departments. Narrogin District staff are rehabilitating all gravel pits no longer required.

Traffic volumes in Dryandra are insufficient to warrant bitumenising any roads, and hence there will be an ongoing requirement for gravel for road surfacing and maintenence.

ISSUES

- Raw material extraction and movement can be a major source of plant fungal disease and it is, therefore, important that dieback hygiene procedures are used.
- The major roads in Dryandra will require maintenance over the next ten years. The continuing redevelopment and maintenance of these roads will become an increasing financial burden for CALM.

OBJECTIVE

- *Limit extraction of raw materials from Dryandra to areas where such activity will have minimal impact on the Woodland's flora, fauna and visual landscape.*

STRATEGIES

1. In accordance with NPNCA policy, permit access to basic raw materials from nature reserve or national park areas where the road or facility is within the boundaries or road reserve enclave of the reserve or national park. Where the material is for use on areas or easements not managed by CALM, ensure that all biological survey and dieback assessmant and related costs are borne by the authority accessing the material.
2. Ensure requests for gravel, sand and stone from State forest areas of Dryandra are in accordance with CALM Policy Statement No 2. Local Government Authority Access to Basic Raw Materials from State Forest and Timber Reserves.
3. Use, wherever practicable, materials for road construction and maintenance that visually blend with the surrounding soils.
4. Ensure an up-to-date hygiene map is available before raw materials are extracted. Materials infected with plant fungal disease will not be used on disease-free sites. Ensure all quarries have strictly controlled access.
5. Ensure that conservation values, particularly threatened plants or Aboriginal sites, are not disturbed by extraction of materials.
6. Rehabilitate all pits according to CALM guidelines as soon as extraction of materials is complete.

23. REHABILITATION OF DISTURBED AREAS

BACKGROUND

Disturbance is defined as any activity or process producing, or likely to produce, long-term degradation of habitats and ecosystems. Rehabilitation includes the processes necessary to return disturbed land to a predetermined landform and vegetation condition, land use or productivity.

Rehabilitation may be required after any site disturbance such as gravel pit working, road works, disease or pest attack. Rehabilitation may also be required after recreation activities, or the effects of fire or fire suppression activities such as installation of firelines.

Within the next ten years the main areas requiring rehabilitation are:

- failed mallet plantations (which will eventually be converted to communities of original species);
- gravel pits and some tracks that are no longer required;
- parts of the Settlement field not required for recreation purposes; and
- areas of non-local plants.

ISSUES

- The methodology for converting mallet plantations to a woodland of original species has not been developed and the impact of the process on the threatened fauna has not been assessed (see Section 15. Timber Production).
- The recreational requirements of the Settlement field have yet to be determined. Once this has occurred the remainder of the field, except the seed orchard, will be rehabilitated.

OBJECTIVE

- *Rehabilitate areas degraded by past and present land uses with local plant species.*

STRATEGIES

1. Manage Dryandra, as far as practicable, to avoid disturbance. Rehabilitation should be the last option in a series of management decisions designed to protect Dryandra's values.
2. Minimise the area and degree of disturbances associated with planned activities (for example, recreation site development—see Table 4), and specify rehabilitation requirements.
3. Survey Dryandra for existing disturbances and specify the areas that require rehabilitation. As part of this process determine, in consultation with the Lions Club, what recreation activities are appropriate for the Settlement field and the associated area required. Rehabilitate the remainder of the field, except the seed orchard.
4. Prepare and implement rehabilitation prescriptions for all disturbed areas as resources permit. Natural regeneration is the preferred method of rehabilitation and, where necessary, steps should be taken to encourage it. Where natural regeneration is not possible, species of local provenance should be planted, with restoration as far as practicable of the original species diversity and composition.
5. Ensure that, whenever possible, the cost of rehabilitation is borne by the agency responsible for the disturbance.
6. Liaise with mining companies, Government departments and other land users to ensure an exchange of ideas on the latest techniques and standards in rehabilitation.

Research and Monitoring

7. Investigate techniques for converting the selected areas of mallet plantation to communities of original species, and monitor the effects on fauna.
8. Monitor rehabilitation programs to ensure that the aims are being achieved, and to ensure that improvements are incorporated.

24. PUBLIC UTILITIES

BACKGROUND

The many service and utility easements in the area impinge on Dryandra Woodland. These include the Wandering – Narrogin and York – Williams roads, Telecom cables, water supply pipes and powerlines servicing the Settlement.

ISSUES

- The provision of service and utility corridors and the associated clearing of land has had a direct impact on Dryandra's environment and landscape values. There is also a risk that disease and weeds will be spread, while cleared areas improve access for feral animals.
- Native fauna, in particular the Numbat and Woylie, are at risk from traffic along major roads.

OBJECTIVE

- *Minimise the impact of services and utilities on Dryandra's environment and landscape values.*

STRATEGIES

1. Encourage the placement of any new utility corridors outside Dryandra or along existing access routes. Encourage alternative, low impact methods of providing services, for example underground cables.
2. Ensure that strict dieback disease hygiene conditions apply when maintenance of utilities and corridors is undertaken.
3. Refer any new proposal for utility corridors through the Woodland to the Environmental Protection Authority.

COMMUNITY RELATIONS

25. EDUCATION, INFORMATION AND INTERPRETATION

BACKGROUND

An effective education, information and interpretation program is an essential component of management. It informs the public of the values, facilities, and recreational opportunities available and provides an avenue for greater understanding of the natural environment and its management.

Dryandra Woodland, with its conservation, recreation and production values, and agricultural setting, has a diversity of plants and animals (natural diversity), and land uses. These factors, and recent growth in visitor numbers, have increased opportunities to promote the principle that the maintenance of natural biodiversity is essential to sustain each individual's quality of life—that is, if humans conserve and respect the richness, integrity, and stability of their biological and physical environment, ecosystems will remain healthy and sustain the activities of humans and other life forms. This basic tenet has been adopted as the theme for future education, interpretion and information programs within Dryandra.

Relevant subjects for such programs include sustainable land use, maintenance of biodiversity and ecological processes, minimal impact recreation, and cultural heritage issues.

ISSUES

- The User Survey indicated a need to improve pre-visit and on-site interpretation by providing signs, maps, guides for activities, and information on the Dryandra environment (CALM 1992c).
- Information about Dryandra needs to be integrated with that for other Wheatbelt areas, to avoid unnecessary repetition.

OBJECTIVE

- *Develop the community's understanding of, and commitment to, the principle that biodiversity is essential to sustain each individual's quality of life.*

Community education, information and interpretation programs will aim to achieve the objective by developing awareness and understanding amongst the community, and providing the opportunity for individuals to experience and adopt compatible values.

Programs will complement related themes to be developed in CALM's Katanning and Merredin Districts.

STRATEGIES

Information

1. Provide basic information on the Woodland to visitors, including pre-visit and recreational information, by way of a general brochure.
2. Upgrade visitor orientation to Dryandra by upgrading signposting and installing an information shelter at Old Mill Dam. Ensure all signs, including those erected by the Lions Club, meet the standards of the CALM Signs Manual.

Interpretation and Education

3. Design and implement educational programs and activities that promote the theme that 'biodiversity is essential to sustain each individual's quality of life' by:
   - providing teaching kits and resource information that can be used for environmental education programs;
   - upgrading the Irabina Field Study Centre;
   - providing instructional courses on recreational activities and ecology; and
   - developing an interpretive drive trail

   Components of this theme include: nature conservation; sustainable timber production (including agroforestry), recreation; agriculture; and Aboriginal culture.
4. Focus interpretation and education programs at Dryandra Settlement, the Old Mill Dam and the Irabina Study Centre.
5. Liaise with the relevent groups, eg. tour operators, when preparing audience-specific programs.
6. Develop 'user-pays' systems for:
   - seasonal interpretive activities programs; and
   - the Irabina Study Centre ecology courses.
7. Allocate additional District staff time to education programs at Dryandra Settlement. Investigate stationing staff with an educational role at Dryandra.
8. Train staff and, where appropriate, volunteers in the principles and procedures of public communication, and the planning and effective presentation of nature interpretation programs.

Funding

9. Seek funds and resources for educational programs and activities from the following sources:
   - government (Federal and State);
   - the corporate community, eg. sponsorship; and
   - the private non-profit sector, eg. volunteers.

General

10. Develop communication plans for major management issues. Plans should identify objectives, target audiences and channels of communication

26. COMMUNITY LIAISON AND INVOLVEMENT

BACKGROUND

Dryandra Woodland is a bushland island within the wheatbelt. Therefore, Dryandra is a recreation focus for local towns such as Cuballing, Highbury, Narrogin, Wandering and Williams. The Woodland also provides tourism opportunities that may economically benefit local communities.

Dryandra's Neighbours

Dryandra has a high boundary-to-area ratio. With many adjacent neighbours there is greater potential for impacts from weeds, uncontrolled fire, and feral animals. However, there are also benefits such as the increased role of the community in the detection and suppression of fires.

Changes in land use on adjoining properties, particularly proposed sub-divisions, need to be carefully considered regarding potential impacts on Dryandra's values.

Dryandra is within the boundaries of the Cuballing, Williams, and Narrogin Land Conservation Districts.

Government Agency Liaison
Several government agencies have responsibilities which have the potential to impinge upon the management of Dryandra. These include the Bush Fires Board, Environment Protection Authority, the Australian Heritage Commission, Main Roads Department, the Department of Aboriginal Sites, Water Authority of WA, Western Power, Department of Planning and Urban Development (rural sub-divisions), Agriculture Department (total catchment management), State Emergency Service and the Ministry of Sport and Recreation (outdoor recreation).

The shires of Cuballing, Narrogin, Wandering and Williams, in conjunction with CALM, are involved in fire management and the provision of recreational resources to the local community.

On-going liaison with the Bush Fires Board, local Bush Fire Control Officers and volunteer brigades regarding fire protection of areas adjacent to Dryandra is also essential.

Volunteers
CALM has traditionally enjoyed support from volunteers. Not only does the Department benefit from these activities, but the volunteers also gain meaningful and enjoyable experiences in an area of interest. The community benefits from volunteer programs through the added level of environmental management, and an improved level of services in the form of information and education.

Areas where volunteers can be of assistance in Dryandra include:

- as campground hosts;
- interpretation and education programs;
- weed control; and
- research and monitoring programs.

ISSUES

- Potential exists for community involvement in the implementation of this Plan. This involvement may range from monitoring and research to assistance with interpretation programs.
- CALM supports voluntary activities which contribute to achieving nature conservation and land management objectives, and which build community awareness, understanding and commitment to these objectives.
- Government agencies whose influence extends up to the boundaries or into Dryandra must recognise they can play an important role in the protection of Dryandra's environment.
- Rationalisation of the Woodland boundaries is an important step towards alleviating problems caused by Dryandra's high boundary-to-area ratio (see Section 2. Land Tenure).
- On-going liaison between CALM and local communities is essential.

OBJECTIVE

- *Co-ordinate management of Dryandra with that of adjoining lands.*
- *Encourage and facilitate community involvement in the implementation of this Management Plan.*

STRATEGIES

1. Liaise with adjoining landowners, Land Conservation District Committees, local authorities and Government departments to ensure that, as far as possible, land management is integrated across the landscape.
2. Promote on-going liaison with the Bush Fires Board, local Bush Fire Control Officers and volunteer brigades.
3. Encourage shires and the local community to take responsibility for weed control, feral animal control and visual resource management on adjoining lands.
4. Encourage and assist in the formation of a self-administering Friends of Dryandra group to undertake volunteer programs within the Woodland, including assisting with interpretation programs, nature conservation works, and monitoring.
5. Continue to inform the community about fox baiting.
6. Continue to inform the community about the values of bush corridors and roadside reserve initiatives.
7. Promote and provide advisory services to local communities on issues impacting on Dryandra.

RESEARCH AND MONITORING

27. INVENTORY, RESEARCH AND MONITORING

BACKGROUND

Dryandra Woodland offers many opportunities for research, both to enable better management of its biological, cultural, recreational and economic resources, and to provide information about the natural environments in the central western wheatbelt of which it forms an important remnant.

Monitoring is necessary to measure changes over time. At Dryandra, the effect of management actions, timber harvesting and climate change should be monitored in order to provide early warning of significant changes and allow management response.

The Woodland has already provided the location for a significant body of research. This has been carried out in Dryandra for a number of reasons. These include:

- the fact that Dryandra is the largest remnant of native vegetation in the central western wheatbelt, and provides the best example of the natural environment in that region. Several studies have been based there (Serventy 1970 - woodland ecology; Mc Arthur *et al.* 1977 - soil and landforms; and P. Brown pers comm. - Wandoo dieback);
- Dryandra possesses significant populations of several species of rare fauna. Research has included studies on the the Numbat (Calaby 1960, Friend 1990a and 1990b), and Woylie (Kinnear 1992);
- research required to provide information to assist in the management of Dryandra itself (Butler 1965, Burbidge 1977, Christensen 1978, CALM 1985, and Ninox 1991); and
- the proximity of the Woodland to Perth, availability of accommodation, and the pre-existing body of knowledge have made Dryandra an ideal location for student field studies (Majer 1985, L. Thomas pers comm.).

Inventory, research and monitoring projects should give priority to those values identified as being most at risk (sensitive to disturbance) and to management practices most likely to have adverse social and ecological impacts. Such projects should involve volunteers and educational institutions, as well as CALM staff, thus helping to provide information to the broader community and reducing costs.

OBJECTIVES

- *Seek to improve knowledge of the Woodland's conservation, recreation and production resources so that management can be objectively evaluated and then refined if required.*
- *Ensure methods and information gained at Dryandra are made available to other land managers.*

STRATEGIES

1. Implement an integrated program of inventory, research and monitoring based on the summary given in Table 6. Staff from CALM's Science and Information Division, and Wheatbelt Region Staff should be involved in integrating the program, and should facilitate its implementation.
2. Continue to require all researchers to make their findings readily available to CALM and the public.
3. Encourage and support other groups, agencies, institutions, volunteers and individuals to carry out research and monitoring projects relevant to the conservation and management of Dryandra.
4. Encourage the use of the Settlement and the Irabina Study Centre for research and educational purposes.

PLAN IMPLEMENTATION

28. PRIORITIES

BACKGROUND

The implementation of this Plan of management will be guided by a three year rolling implementation plan, and the annual works program of CALM's Narrogin District. This process is subject to the availability of staff and funds. Priorities will be determined in the context of District and Regional planning.

OBJECTIVE

- *Implement the Plan strategies on a priority basis.*

STRATEGIES

1. Prepare an initial three year rolling implementation plan. Review the implementation plan after this period and amend where necessary. Continue three-yearly reviews for the life of the Plan.
2. Implement management strategies outlined in Table 7 as a matter of high priority.

29. FUNDING AND STAFF

BACKGROUND

Dryandra is serviced by the staff of Narrogin District, which includes a person based at the Settlement. Staff from specialist branches within CALM provide services, advice and assistance as required.

Management of Dryandra is funded by CALM. External funding has also been provided for special projects and on-going maintenance.

ISSUES

- The implementation of this Management Plan will place substantial demands on District staff and funding, particularly in planning, design, supervision and interpretation. Major rehabilitation and new silvicultural work will require additional resources.

Table 6. Summary of inventory, research and monitoring strategies

Section	Rec. no	Strategy
High priority		
5.	7	Monitor the groundwater in Dryandra
8.	8	Carry out general research on fauna ecology.
	9	Research the invertebrate fauna of Dryandra.
	10	Record and describe severe disturbances affecting animal communities.
	11	Monitor the use of corridors.
11.	11	Monitor use of public access routes to establish long term trends in visitor numbers.
	12	Monitor the condition of roads, tracks and walks.
12.1	9	Monitor changes in the patterns and levels of visitor use.
14.	12	Monitor the impact of commercial tours on the Woodland environment.
15.	8	Research quality and yield increase of mallet, and determine properties and uses of mallet.
	11	Monitor the impact on fauna populations of returning plantations to pre-existing vegetation
18.	7	Monitor known fungal disease infections.
19.	19	Research poison thickets.
21.	10	Participate in research on feral animals and their control.
	11	Keep abreast of new information on feral animal research and control methods.
	12	Monitor the effectiveness and potential side-effects of feral animal control programs.
23.	7	Investigate techniques for converting the mallet plantations to a woodland of original species and monitor the effects on fauna.
	8	Monitor rehabilitation programs
Med. Priority		
7.	6	Research management regimes required to maintain plant communities.
	7	Research threatened and priority flora.
	8	Record and describe severe disturbances on plant communities.
	9	Identify keystone species and plant communities.
	10	Keep abreast of new information on the flora and ecology of Dryandra.
9.	1	Research past and contemporary Aboriginal use of Dryandra.
15.	10	Monitor the impact of timber production on fauna.
18.	8	Investigate disease control and eradication procedures.
19.	20	Research strategies to maintain hollow logs and trees.
	20	Monitor fire vulnerable species.
	21	Review fire information from similar ecosystems.
20.	9	Keep abreast of new information in weed research and control methods.
	10	Monitor the effectiveness and potential side-effects of weed control programs.
Low Priority		
3.	1	Monitor weather data.
4.	4	Monitor erosion control techniques.
10.	4	Research past and contemporary European use of Dryandra.
13.4	3	Monitor the use of pedestrian paths.
13.5	9	Monitor changes in pattern/level of camp ground use, vegetation cover and predicted trends.
13.7	3	Monitor the impacts of orienteering, rogaining and cross country running.
15.	9	Continue silvicultural studies of sandalwood.
19.	22	Investigate the role of fire in mallet silviculture.

Table 7. High priority strategies

Section	Rec. No.	Strategy
2.	1	Implement the proposed tenure changes shown on Maps 3a and 3b.
5.	7	Monitor the level and pressure of the groundwater in Dryandra in order to detect potential soil salinity problems
7.	1	Protect Dryandra's plant communities from plant diseases and weeds.
8.	1	Continue to control, and if practicable eradicate, introduced species that are damaging or could potentially damage native fauna.
	2	Protect habitats from plant disease, introduced plants, inappropriate fire regimes and human activities.
	6	In consultation with neighbours, LCDC groups and local authorities, seek to establish and protect vegetation corridors between Woodland remnants.
9.	1	Identify Noongar people having cultural links and on-going interests in Dryandra. In consultation with these people investigate whether cultural activities, including hunting, may be appropriate in Dryandra and how these activities may be managed on a sustainable basis.
11.	1	Maintain and, where necessary, upgrade vehicle access according to Maps 4a and 4b.
12.1	1	Upgrade Contine Hill recreation site.
13.4	1	Progressively develop a range of walks, tracks and routes that enable visitors to explore the Woodland by foot.
14.	8	Approve only commercial concessions that are reliant on the special environmental qualities of the Woodland.
15.	1	Issue ten year licences.
	2	Produce a strategic plan for the management of mallet plantation areas and the associated industries by December, 1995.
	3	Continue to prohibit the harvesting of Wandoo and Powderbark Wandoo in Dryandra Woodland. Identify, in conjunction with the local timber industry alternative sources of these species, including CALM operations in the Darling Range forest belt.
	4	Demonstrate how the establishment of commercial plantations of suitable trees (especially local species) can be integrated with surrounding agricultural land uses to benefit landowners, the timber industry and the environment.
18.	2	Continue plant disease surveys of Dryandra to identify and then isolate diseased areas.
19.	-	Achieve effective fire protection by maintaining fuel reduced buffers, detection and suppression systems, and regular and constructive liaison with farmers, visitors and the general public.
20.	1	Map the incidence of weeds, and monitor their location, extent, spread and, where possible, ecological effects.
21.	1	Record the incidence of feral animals (in particular cats and pigs), and monitor their location, extent, spread and ecological effects. Instigate control measures, with pigs, foxes and cats receiving high priority.
	3	Continue the current fox baiting program, modifying methods in light of new information or specialist advice.
25.	1	Provide basic information to visitors on the Woodland.
	3	Develop and implement community education, information and interpretation programs.
26.	1	Maintain liaison with adjoining landowners, Land Conservation District Committees, local authorities and Government departments to ensure land management is integrated across the landscape
27.	1	Implement an integrated program of inventory, research and monitoring as per Table 5.
29.	5	Identify potential sources of external funding, and projects or areas of operation capable of attracting external funding.

- Changes to the CALM estate (eg. State forest to national park) may increase opportunities for external funding.

OBJECTIVES

- *Maintain District staff numbers at a level that ensures adequate management and maintenance of Dryandra.*
- *Explore ways of increasing funds to implement the Plan.*

STRATEGIES

Within CALM's overall staffing and funding priorities the Department will seek to:

1. Provide sufficient staff and resources to implement this Plan and to maintain new developments.
2. Investigate stationing CALM staff with a management and education role at the Settlement.
3. Provide on-going training to staff.
4. Involve volunteers in as many aspects of management as practicable.
5. Identify potential sources of external funding, and projects or areas of operation capable of attracting external funding. Pursue these sources according to departmental policy and procedure.
6. Investigate fees or other revenue gaining measures to recoup costs where specific services or opportunities are provided for the public.
7. Provide opportunities for people to contribute directly to Dryandra's budget, for example, through donations.
8. Enter into partnerships with organisations, community groups, and local and State government departments where economic benefits can be obtained in joint or cooperative operations.

30. EVALUATION AND REVIEW

BACKGROUND

The results from the inventory, research and monitoring programs detailed in this Plan will be an integral part of the three-yearly evaluation and review process outlined below. The evaluation should determine how effectively the management strategies have achieved the Plan objectives, whilst the review should identify which strategies have been implemented and to what degree.

There is provision under Section 61 of the CALM Act for the Plan to be amended, if required. This involves standard public participation procedures.

OBJECTIVE

- *Ensure the effectiveness of management strategies and progress in the implementation of the Plan.*

STRATEGIES

1. Evaluate and review the implementation plan every three years for the life of the Plan.
2. Evaluate and review the Plan within ten years of its gazettal.

REFERENCES

Australia ICOMOS (1988) The Australia ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter). Australia ICOMOS.

Beard, J.S. (1980) A new phytogeographic map of Western Australia. Western Australian Research Notes **3**: 37-58.

Burbidge, A.A. (1977) The management of Dryandra Forest for wildlife Conservation. Internal report of the Department of Fisheries and Wildlife, Perth (unpubl.).

Butler, W.H. (1965) Report of a survey of the vertebrate fauna of Contine Forestry Reserve, South West Australia. Perth

Calaby, J.H. (1960) Observations on the banded anteater *Myrmecobius f. fasciatus* Waterhouse (Marsupialia), with particular reference to its food habits. *Proceedings of the Zoological Society*, London **135** (2): 183-207.

Christensen, P. (1978) Management conflict in Dryandra Forest. Internal report of the Forests Department of Western Australia, Perth (unpubl.).

Christensen, P. (1980) The biology of *Bettongia penicillata* (Gray, 1837) and *Macropus eugenii* (Desmarest, 1817) in relation to fire. Bulletin 91, Forests Department of Western Australia, Perth.

Clarke, C. (1992) The degradation of the Yornaning Dam and its surroundings: future management strategies. Master of Science Dissertation, Murdoch University, Perth.

Coates, A. (1993) Vegetation survey of Dryandra Woodland. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Conservation Through Reserves Committee (1974) *Conservation Reserves for Western Australia.* Department of Conservation and Environment, Perth.

Dames and Moore (1985) The vegetation of Boyagin Nature Reserve. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Department of Conservation and Land Management, (1985). Fire Considerations in Dryandra Forest. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Department of Conservation and Land Management (1991a) *Fitzgerald River National Park Management Plan, 1991 - 2001, Management Plan No. 15.* Department of Conservation and Land Management, Perth.

Department of Conservation and Land Management (1991b). A report on Aboriginal activities and nature conservation in the south-west of Western Australia. Department of Conservation and Land Management, Perth.

Department of Conservation and Land Management (1991c) Vistat data July 1990 – June 1991.. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Department of Conservation and Land Management (1992a) *Walpole-Nornalup National Park Management Plan, 1992 - 2002, Management Plan No. 22.* Department of Conservation and Land Management, Perth.

Department of Conservation and Land Management (1992b) *Management Strategies for the South-west Forests of Western Australia. A Review - Draft for Public Comment.* Department of Conservation and Land Management, Perth.

Department of Conservation and Land Management (1992c) Dryandra Woodland User Survey Summary, April – October, 1992. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Department of Conservation and Land Management and the Orientation Association of Western Australia (1986) Monitoring vegetation damage due to orienteering. (unpubl.).

Department of Minerals and Energy (1994) *Guidelines for the Application of Environmental Conditions for Exploration and Mining on Conservation Reserves and Other Environmentally Sensitive Land.* Department of Minerals and Energy, Perth.

Environmental Protection Authority (1976) Conservation reserves for Western Australia as recommended by the Environmental

Protection Authority 1975 - Systems 4, 8, 9, 10, 11, 12. Department of Conservation and Environment, Perth.

Forests Department (1926) Working Plan No. 42 - General preliminary mallet working plan working circle. Internal Report of the Forests Department of Western Australia, Perth (unpubl.)

Forests Department (1977) Working Plan No. 86. Internal Report of the Forests Department of Western Australia, Perth (unpubl.)

Forests Department (1982) Working Plan No.87. Internal Report of the Forests Department of Western Australia, Perth (unpubl.)

Forests Department (1981) Land use management for Dryandra Forest. Internal Report of the Forests Department of Western Australia, Perth (unpubl.).

Friend, J. A. (1990a) The Numbat *Myrmecobius fasciatus* (Myrmecobiidae): history of decline and potential for recovery. *Proceeding of the Ecological Society of Australia* **16**: 369-377

Friend, J.A. (1990b) Numbat dawn. *Landscope*, **5**(4) Winter Edition. Department of Conservation and Land Management, Perth.

Germantse, R.G. (1987) The history of Dryandra Forest. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Gilbert, L.E. (1980) Food web organisation and conservation of neotropical diversity. In: Soule, M.L. and Wilcox, B.A. (eds), *Conservation Biology - an Evolutionary Perspective.* Sinawer Sunderland, Massachusetts. pp 11-33.

Hallam, S.J. (1975) *Fire and hearth. A study of Aboriginal usage and European usurpation in South-western Australia.* Australian Aboriginal Studies No. 58. Australian Institute of Aboriginal Studies, Canberra.

Hallam, S.J. (1981) The first Western Australians **in** Stannage, C.T. (ed*). A new history of Western Australia.* University of Western Australia Press, Perth.

Hallam, S.J. (1985) The history of Aboriginal firing **in** Ford, J.R. (ed*) Fire Ecology and Management of Western Australian Ecosystems.* Environmental Studies Group Report No 14, WAIT, Perth. pp 7-20.

Hewett, P (1993) Report on *Eucalyptus astringens* thinning trial. Internal report of the Department of Conservation and Land Management, Perth (unpubl).

Hibbs, T., Wood, J. and Blackwell, M. (1994) Wave Rock Management and Development Plan Final Report. Wheatbelt Development Commission and Shire of Kondinin.

Hussey, B.M.J., Hobbs, R.J. and Saunders, D.A. (1991) *Guidelines for Bush Corridors.* Surrey Beatty and Sons Pty Ltd, Sydney.

Kinnear, J.E. (1992) Vexing the vixens. *Landscope*, **7**(4) Winter Issue. Department of Conservation and Land Management, Perth.

Kinnear, J.E., Onus, M.L. and Bromilow, R.N. (1988) Fox control and Rock-Wallaby population dynamics. *Australian Wildlife Research* **15**: 435-50.

Lefroy, E.C., Hobbs, R.J. and Scheltema, M. (1993) Reconciling agriculture and nature conservation. Towards a restoration strategy for the Western Australian wheatbelt **in** *Nature Conservation 3: Reconstruction of Fragmented Ecosystems. Global and Regional Perspectives.* Surrey Beatty and Sons Pty Ltd, Sydney.

Mc Arthur W.M., Churchward, H.M. and Hick, P.T. (1977) Landforms and soils of the Murray River catchment area of Western Australia. CSIRO Australia Division Land Resource Management Series No 3 pp 1-23. Division of Land Resources Management, CSIRO, Perth.

McDonald, R. C., Isbell, R. F., Speight, J. G., Walker, J. and Hopkins, M. S. (1984) *Australian Soil And Land Survey Handbook.* Inkata Press, Melbourne.

Majer, J.D. (1985) Invertebrate studies in disturbed and pristine habitats of Dryandra State Forest. Research Paper 80. Forests Department of Western Australia, Perth.

Main, A.R. (1987) Management of remnants of native vegetation - A review of the problems and the development of an approach with reference to the wheatbelt of Western Australia **in** Saunders, D.A., Arnold, G.W., Burbidge A.A. and Hopkins, A.J.M. (eds*), Nature Conservation: The Role of Remnants of Native Vegetation.* Surrey Beatty and Sons Pty Ltd, Sydney. pp 1-13.

Manning, R.J.G. (1988) A report on beekeeping in national parks and reserves Western

Australia. Internal report of Western Australian Department of Agriculture, Perth (unpubl.).

Merrilees, D., Dix, W.C., Hallam, S.J., Douglas, W.H. and Berndt, R.M. (1973) Aboriginal man in south Western Australia. *Journal of the Proceedings of the Royal Society of Western Australia.* **56**: 44-55.

Ninox Wildlife Consulting, (1991) Dryandra State Forest - A comparison of the vertebrate fauna of selected mallet plantations and natural vegetation communities. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Paton, D. C. (1993) Honeybees in the Australian environment: does *Apis mellifera* disrupt or benefit the native biota? *Bioscience* **43**(2): 95-103.

Paton, W. (1988). The commercial use of Brown Mallet *(Eucalyptus astringens).* Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Pyke, G. H. and Balzer, L. (1985) The effect of the introduced hoeybee on Australian native bees. Occasional Paper No. 7, National Parks and Wildlife Service, NSW

Pustkuchen, O.E. (1981). *The Way Through - The Story of Narrogin.* Artlook books Trust, Perth.

Saunders, D. A. (1989) Changes in the avifauna of a region, district and remnant as a result of fragmentation of native vegetation: the wheatbelt of Western Australia. A case study. *Biological Conservation.* **24**: 99-135

Sanders, A. and Harold, G. (1991) An Inventory of Mammals, Amphibians and Reptiles in the Wheatbelt Region of Western Australia. Internal report of Department of Conservation and Land Management, Perth (unpubl.).

Serventy, V. (1970) Dryandra *The Story of an Australian Forest.* Reed Publishers, Sydney.

Shea, S. and Sharp, J. (1992) Emerging tourism opportunities - Western Australia's 'natural advantage'. A paper presented to the Into Asia Conference. November, 1992, Perth.

Strahan, R. (1983) *The Complete Book of Australian Mammals.* Angus and Robertson, Sydney.

Stankey, G. H. and Wood, J. (1982) The recreation opportunity spectrum: an introduction. *Australian Parks and Recreation.* February 1982.

Stuart-Street, A. and Kirkpatrick, B. (1994) *Landscape Character Types of Western Australia.* Department of Conservation and Land Management, Perth.

PERSONAL COMMUNICATIONS

Brown, Paul	Program Leader - Nature Conservation, Swan Region, CALM
Davis, Dr Jenny	Lecturer, Environmental Studies, Murdoch University.
Friend, Dr J. A. (Tony)	Senior Research Scientist, Science and Information Division, CALM.
Gorton, Steve	Senior Operations Officer, Narrogin District, CALM
Handcock, Brian	former Regional Manager, Wheatbelt Region, Western Australian Tourism Commission.
Hopkins, Angas	Principal Research Scientist, Science and Information Division, CALM.
Morris, Keith	Section Manager, Science and Information Division, CALM.
Noongar TAFE Students	Aboriginal Studies, Narrogin TAFE.
Shearer, Dr Bryan	Principal Research Scientist, Science and Information Division, CALM.
Smurthwaite, T.	Department of Minerals and Energy.
Thomas, Leslie	Tutor, External Studies, Murdoch University.

APPENDICES

Appendix 1 List of Threatened and Priority Flora

Species	Conservation Priority Codes
Eucalyptus olivacea	R
Gastrolobium tomentosum	R
Grevillea crowleyi	1
Acacia deflexa	2
Aminita carneiphylla	2
Andersonia bifida	2
Billardiera sp. Dryandra (D. M. Rose 397)	2
Chamelaucium croxfordii ms	2
Dryandra cynaroides	2
Dryandra acanthopoda ms	2
Persoonia hakeiformis	2
Schoenus aff. *clandestinus*	2
Stenanthum coronatum	2
Triglochin stowardii	2
Acacia brachyphylla var. *recurvata*	3
Acacia semitrullata	3
Chorizandra subpinnatifida	3
Dryandra subpinnatifida	3
Thysanotus tenuis	3
Caladenia integra	4
Darwinia sp. Dryandra (G. J. Keighery 9295)	4
Darwinia thymoides ssp. nov (J. Alford and G. J. Keighery 64)	4
Eucalyptus latens	4
Hemigenia platyphylla	4
Hibbertia montana	4
Nemcia stipularis	4
Rynzia crassifolia	4
Stylidium expeditions	4

Conservation Codes

R. Declared Rare Flora—Extant Taxa
Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

1. Priority One - Poorly Known Taxa
Taxa which are known from one or a few (generally < 5) populations which are under threat, either due to small poulation size, or being on lands under immediate threat, eg. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, eg. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2. Priority Two - Poorly Known Taxa
Taxa which are known from one or a few (generally < 5) populations, at least some of which are not believed to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3. Priority Three - Poorly Known Taxa
Taxa which are known from several populations, at least some of which are not believed to be under threat (ie. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

4. Priority Four - Rare Taxa
Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Appendix 2 Crown Land outside the Dryandra Woodland as on Map 3a and 3b

No.on Map 3a	Reserve No.	Area (ha)	Vesting	Purpose
1	A2059	37.9	—	Stopping Place
2	28666	7.7	Shire of Williams	Parklands
3	16156	0.2	—	Gravel
4	Townsite			
5	13243	42.5	Shire of Williams	Recreation
6	9549	2.0	—	School
7	11207	15.2	—	Stopping Place and Water Supply
8	15886	1.5	—	Gravel
9	27141	37.8	—	Conservation of Timber
10	19747	4.2	Shire of Cuballing	Landscape Protection
11	14300	95.1	—	Timber State forest
12	1864	52.2	NPNCA	Cons of Flora and Fauna
13	21830	44.8	NPNCA	Cons of Flora and Fauna
14	32463	23.7	—	Gravel
15	20802	83.5	NPNCA	Cons of Flora and Fauna
16	7530	56.7	Shire of Cuballing (WPL 21 years)	Recreation
17	24579	9.5	—	Rifle Range
18	Pt15925		Minister for Water Resources	Water Supply
19	21230	68.8	NPNCA	Cons of Flora and Fauna
20	4698		—	Water Supply
21	5271	84.3	Shire of Cuballing	Recreation
22	6593	43.3	Minister for Water Resources	Water Supply
23	Pt15925		Minister for Water Resources	Water Supply
24	20474	8.7	—	Timber Mallet
25	19794	235.9	—	Timber Mallet

Appendix 2 Crown Land outside the Dryandra Woodland as on Map 3a and 3b (cont'd)

No.on Map 3b	Reserve No.	Area (ha)	Vesting	Purpose
26	30394	74.5	NPNCA	Cons of Flora and Fauna
27	14486	39.2	Shire of Williams (WPL 21 years)	Recreation, Camping and Hall
28	8733	79.4	Shire of Narrogin	Stopping Place and Water Supply
29	19107	98.1	—	Timber Mallet
30	29610	8.1	—	Gravel
31	1865	36.3	—	Travellers and Stock
32	12203	4.1	Shire of Narrogin	Recreation
33	41974	16.5	Executive Director - CALM	Sandalwood Regeneration
34	11593	15.0	Shire of Narrogin	Stopping Place
35	18976	8.1	—	Quarry
36	26668	17.0	NPNCA	Cons or Flora and Fauna
37	26669	54.1	NPNCA	Cons of Flora and Fauna
38	Townsite			
39	29611	4.0	—	Gravel
40	29610	8.1	—	Gravel
41	19153	2.4	—	Quarry and Access There To
42	14883	0.8	—	Water Supply

4119-0895-500