

**BUDDEROO NATIONAL PARK, MACQUARIE PASS NATIONAL PARK, BARREN  
GROUNDS NATURE RESERVE AND ROBERTSON NATURE RESERVE**

**PLAN OF MANAGEMENT**

**NSW National Parks and Wildlife Service**

**October, 1998**

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## FOREWORD

Budderoo National Park, Barren Grounds Nature Reserve, Macquarie Pass National Park and Robertson Nature Reserve form an inter-related group of parks and reserves at the eastern edge of the Southern Highlands, southwest of Wollongong. They comprise extensive areas of plateau and adjacent escarpment, predominantly supporting heathland, woodland, tall open forest and rainforest. The escarpment provides spectacular scenery and several lookouts and waterfalls are popular visitor attractions.

The parks and reserves contain a diverse range of habitats and wildlife including several rare and threatened plant and animal species and significant rainforest areas. Considerable emphasis is given in the plan of management to conservation of these. Survey, weed control and appropriate fire management will be undertaken for the threatened species and regeneration of formerly cleared rainforest and floodplain areas will be encouraged.

A range of Aboriginal sites and historic places occur in the area, illustrating past landuse. Aboriginal sites will be protected and the historic Nurrewin homestead complex and Kellys Cottage will be conserved.

The parks and reserves are close to major population centres and within day trip distance of Sydney. They provide important opportunities for recreation and education about the natural environment. Educational facilities include a major rainforest interpretation centre at Minnamurra in Budderoo National Park, a Royal Australasian Ornithologists Union Bird Observatory in Barren Grounds Nature Reserve and interpreted walking tracks in the other areas.

The plan of management provides for maintenance and expansion of educational opportunities and promotion of tourism in suitable areas. Information signs or shelters will be placed at popular locations in Budderoo and Macquarie Pass National Park and track signposting in Barren Grounds Nature Reserve will be improved.

Recreation facilities at the Cascades Picnic Area, Jamberoo Lookout, Gerringong Creek and the Barren Grounds nature trail will be improved.

This plan of management establishes the scheme of operations for Budderoo National Park, Barren Grounds Nature Reserve, Macquarie Pass National Park and Robertson Nature Reserve. In accordance with the provisions of Sections 75 and 76 of the National Parks and Wildlife Act, 1974, this plan of management is hereby adopted.

PAM ALLAN

Minister for  
the Environment

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## 1. INTRODUCTION

The National Parks and Wildlife Act, 1974, requires that a plan of management be prepared for each national park or nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead.

The procedures for the adoption of a plan of management are specified in the Act and involve five stages:

- \* The Director-General gives notice that a plan of management has been prepared.
- \* The plan (if for a national park) is placed on public exhibition for at least one month and any person may comment on it.
- \* The plan and copies of all representations are referred to the National Parks and Wildlife Advisory Council for consideration.
- \* The Director-General submits the plan, together with the recommendations of the Advisory Council, to the Minister.
- \* The Minister may adopt the plan after considering the recommendations of the Advisory Council or may refer the plan back to the Director-General and Council for further consideration.

Once a plan has been adopted by the Minister, no operations may be undertaken within the national park or nature reserve except in accordance with the plan.

Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve have been considered together in this plan of management because of their proximity, the close relationship between their natural systems and their interlinked recreational and educational opportunities.

A plan of management for Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve was placed on public exhibition from November 1995 to January 1996. Sixteen representations were received during the period of public exhibition which raised sixteen issues. All comments received were considered by the Minister.

The planning process leading to the development of this plan has involved the collection and use of information, which for reasons of document size, has not been included in the plan. For additional information or inquiries about any aspect of the plan, contact the Service's Nowra District Office at 55 Graham Street, Nowra or by phone on (044) 23 9800.

## 2. MANAGEMENT CONTEXT

### 2.1 NATIONAL PARKS AND NATURE RESERVES IN NEW SOUTH WALES

#### 2.1.1 National Parks

The national park concept was introduced into Australia through the establishment of Royal National Park in 1879, only seven years after the world's first national park was created at Yellowstone in the United States of America.

The International Union for the Conservation of Nature and Natural Resources (IUCN) in 1994 defined a national park as:

“A natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.”

National parks are part of the regional pattern of land use. The management of a national park aims at minimising disturbance to natural and cultural resources. Other land uses, e.g., agriculture, forestry and mining, are distinguished by an acceptance or encouragement of environmental modification. National parks, therefore, provide for only a limited part of the range of land uses in a region.

#### 2.1.2 Nature Reserves

Fauna reserves in New South Wales were first established under the Fauna Protection Act of 1948, which was replaced by the National Parks and Wildlife Act of 1967. Under the latter Act, fauna reserves were reclassified as nature reserves. The 1967 Act has been replaced by the National Parks and Wildlife Act, 1974.

Under the National Parks and Wildlife Act, nature reserves are areas of special scientific interest containing wildlife or natural environments or natural phenomena.

The purposes of nature reserves are defined in the Act as:

- "(a) the care, propagation, preservation and conservation of wildlife;
- (b) the care, preservation and conservation of natural environments and natural phenomena;
- (c) the study of wildlife, natural environments and natural phenomena; and
- (d) the promotion of the appreciation and enjoyment of wildlife, natural environments and natural phenomena.

Nature reserves are valuable refuge areas where natural processes, phenomena and wildlife can be studied. They differ from national parks which include as a major objective the provision of appropriate recreation opportunities.

## **2.2 BUDDEROO NATIONAL PARK, MACQUARIE PASS NATIONAL PARK, BARREN GROUNDS NATURE RESERVE, ROBERTSON NATURE RESERVE**

### **2.2.1 Location, Reservation and Regional Setting**

Budderoo National Park, Barren Grounds Nature Reserve, Macquarie Pass National Park and Robertson Nature Reserve are located on plateau and escarpment country, roughly 30 km southwest of Wollongong and 100 km south of Sydney (see summary maps).

Barren Grounds Nature Reserve was gazetted in 1956 from a crown reserve created in 1949 and was the third faunal reserve to be established in NSW. It has an area of 2024 ha.

Macquarie Pass National Park, area 1064 ha, was reserved in 1969.

Robertson Nature Reserve was gazetted in 1979 from a former reserve dating from 1884 and has an area of 5.3 ha.

Budderoo National Park was gazetted in 1986. It includes the Minnamurra Falls area which was first reserved for public use in 1896. The park has an area of 5746 ha. A further 104 ha in the Minnamurra area have recently been acquired but not yet reserved. This land will be managed as if it were part of the park.

The adjacent highlands and coastal plain are used for cattle raising, dairying and cropping. Extensive urban and small acreage development has occurred along the coast and the large population centre of Wollongong is located nearby. The district is popular for holidaying and for day trips from Sydney.

### **2.2.2 Importance of Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve**

#### **Geology and Geomorphology**

Budderoo and Barren Grounds, together with Morton National Park, Royal National Park, Blue Mountains National Park and other parks further north are part of a large group of sandstone national parks and reserves in the Sydney-Bowen Basin. They protect part of the southern section of the Basin, primarily Hawkesbury Sandstone plateau and its escarpment edge.

Robertson Nature Reserve is located on remnant basalt lying on the sandstone plateau while most of Macquarie Pass National Park is located on the escarpment.

A complex of geological strata including the Illawarra Coal Measures and a number of igneous intrusions is exposed on the escarpment.

Interesting features include a slot gorge at the lower falls at Minnamurra, a natural stone bridge at Barren Grounds, and invasion and baking of coal seams by igneous intrusions at Minnamurra.

#### **Landscape**

The heathland/woodland vegetation complex of much of the plateau, particularly at Barren Grounds, has produced an attractive open landscape. This contrasts markedly with the sudden drop and moist forests of the escarpment. The sheer cliffs and several major waterfalls provide spectacular scenery. Each of the waterfalls has a distinct character. Panoramic views are available at a number of locations.

The escarpment forms the scenic backdrop to the adjacent coastal plain and Kangaroo Valley and is an important part of the attractive landscape of the district. It rises from the coastal plain to over 600m above sea level and cliffs attain heights of over 100m.

The amphitheatre shape of Macquarie Pass National Park and the Minnamurra Falls area of Budderoo give a feeling of enclosure and escape from the outside world. The high, projecting Budderoo Plateau and Barren Grounds also produce a sense of isolation from the adjacent developed coastal plain.

### **Biological Values**

Together with small areas of crown land and state forest, the parks and reserves link large areas of natural vegetation and reserved areas to the south (Morton National Park) and north (land managed for water catchment by Sydney Water). This linked system of protected land greatly enhances the viability and biodiversity of each area.

The diverse landform has resulted in a complex range of vegetation types ranging from the cool temperate rainforest, open forests, woodlands, heaths and sedgeland of the plateau to the tall open forests, warm temperate rainforest and subtropical rainforest of the slopes, gullies and ridges below the escarpment.

The heathland of Barren Grounds and Budderoo is one of only four large areas of heath on the south coast, the others being at Jervis Bay, the Tianjara and Little Forest Plateaus in Morton National Park and Nadgee Nature Reserve. Many species of plants and animals are restricted to heathland, including a number of threatened species.

Robertson Nature Reserve, although only 5.3 ha, conserves one of the largest and least disturbed areas of rainforest remaining from the Yarrawa Brush, an extremely dense cool temperate/warm temperate rainforest which formerly covered much of the basalt plateau around Robertson. The reserve is a scientific reference area against disturbed areas of rainforest nearby and for comparison with similar rainforest on plateau basalts further north along the tablelands of NSW. Samples of the other main vegetation type of the Robertson Basalt, *Eucalyptus obliqua*/*E. fastigata*/*E. radiata* subsp. *robertsonia* open forest are found in Budderoo National Park.

Budderoo, Barren Grounds and Macquarie Pass contain considerable areas of cool temperate, warm temperate and subtropical rainforest along the escarpment. Together with Illawarra Escarpment State Recreation Area they protect examples of the formerly extensive rainforests of the Illawarra area. The Illawarra district is the most southerly of the five major concentrations of rainforest vegetation in NSW. It contains the major area of coachwood *Ceratopetalum apetalum* warm temperate rainforest in NSW, the northern limit of plumwood *Eucryphia moorei* cool temperate rainforest and the southern limit of a significant number of subtropical species (Mills, 1986).

Most of the subtropical rainforest occurring in the Illawarra has been cleared and very little of the remaining areas are protected in reserves (Mills, 1989). Stands in the parks and reserves are therefore of particular significance.

A large number of threatened or regionally rare plants occur in the parks and reserves. Many of these are ferns and other species occurring in wet sheltered sites. They are concentrated at Minnamurra Falls, Carrington Falls, upper Brogers Creek, Wonga Falls and in Macquarie Pass National Park. Species include the threatened herb *Irenepharsus trypherus*, the ferns *Blechnum gregsonii*, *Hymenophyllum pumilum*, *H. bivalve*, bordered filmy fern *H. marginatum*, narrow filmy fern *H. rarum*, crepe fern *Leptopteris fraseri*, jungle bristle fern *Macroglena caudata*, *Sphaerocionium lyallii*, mother spleenwort *Asplenium bulbiferum* ssp. *gracillimum* and the threatened orchid



*Pterostylis pulchella*. *Parsonia* sp. reaches its southern limit in the Gerringong Creek gorge (Bofeldt, 1994).

Several regionally rare species have been recorded on basalt soils on the plateau. These are simple spleenwort *Asplenium attenuatum*, parsley fern *Botrychium australe*, black oliveberry *Elaeocarpus holopetalus*, smooth helicia *Helicia glabriflora* and mother shield fern *Polystichum proliferum* (Bofeldt, 1994).

Significant plants also occur in sandstone areas of the plateau. The regionally rare species *Monotoca ledifolia* occurs on some rocky outcrops in Budderoo and Barren Grounds and *Tetradlea neglecta* has been found in open woodland areas (Jordan, 1989). The area above Carrington Falls has the only known population of the threatened species *Grevillea rivularis* and the only location of *Adenochilus nortonii* south of the Blue Mountains. Three rare species of algae have been recorded at only one location in upper Lamonds Creek at Barren Grounds (Gunning *et al.*, 1987). Braidwood waratah *Telopea mongaensis* reaches its northern limit above Brogers Creek (Bofeldt, 1994).

The varied and unusual habitats in the parks and reserves support a large number of native animal species, including a high proportion of threatened or uncommon species.

Threatened species recorded include the ground parrot *Pezoporus wallicus*, eastern bristlebird *Dasyornis brachypterus*, powerful owl *Ninox strenua*, tiger quoll *Dasyurus maculatus*, long-nosed potoroo *Potorous tridactylus*, common bent-wing bat *Miniopterus schreibersii*, red-crowned toadlet *Pseudophryne australis*, giant barred frog *Mixophyes iteratus* or *M. balbus* and giant burrowing frog *Heleioporus australiacus*. The broad headed snake *Hoplocephalus bungaroides* is also likely to occur. A rare, undescribed species of frog, *Litoria* sp., similar to the Jervis Bay Tree Frog *Litoria jervisiensis* has been recorded in heath at Barren Grounds. A rare unnamed moth of the *Sabatinca* genus occurs in the Minnamurra area.

The plateau areas of Barren Grounds and Budderoo are important for conservation of the ground parrot and vital for the eastern bristlebird. The habitat of these species has been greatly reduced outside reserves. While the ground parrot still occurs in significant numbers in Tasmania, however, the eastern bristlebird is confined to three disjoint areas, in the vicinity of the NSW/Queensland border, the Illawarra region and the vicinity of the NSW/Victorian border. The Barren Grounds/Budderoo Plateau and the Bherwerre Peninsula at Jervis Bay have the only relatively high populations of the species (Baker, 1996).

The area is of regional significance for conservation of the tiger quoll and long-nosed potoroo.

Macquarie Pass National Park has an isolated eastern population of the blotched blue tongue lizard *Tiliqua nigrolutea* (Gary Daly, pers. comm.), a species which normally occurs on the Southern Highlands and southwards into Victoria and Tasmania.

The rainforests of the Illawarra district are the most southerly stronghold for a number of native birds which depend upon rainforest fruit for their diet. The parks and reserves are hence important for conservation of southerly populations of these species. They include the topknot pigeon *Lophoaimus antarcticus*, yellow-throated scrubwren *Sericornis citreogularis*, green catbird *Ailuroedus crassirostris*, logrunner *Orthonyx temminckii*, white-headed pigeon *Columba leucomela* and emerald dove *Chalcophaps indica*.

## **Cultural Heritage**

The parks and reserves contain a variety of Aboriginal sites, including a major axe-grinding groove site and a very important art site complex.

Historic places include a number of tracks, buildings and other structures which illustrate the history of the local area from European exploration and settlement to recreational use and development of the conservation movement since World War II.

Nurrewin within Macquarie Pass National Park is aesthetically and historically significant as a substantial sandstone residence demonstrating changing land use on the escarpment through the 19th and 20th centuries.

## **Research Values**

Barren Grounds Nature Reserve has been used extensively for research. The large amount of information collected in the reserve over time is valuable as base data for further research and in building understanding of the area's ecology.

Budderoo and Macquarie Pass National Parks also receive some use for research and together with Barren Grounds provide a range of environments and a reference area against the modified surrounding areas.

## **Educational Values**

The parks and reserves are located in popular tourist areas within day trip distance of Sydney and close to Wollongong and smaller centres on the coast and highlands. Along with attractions in nearby Morton National Park they provide valuable opportunities for educational use and promotion of community awareness of the environment and conservation.

Each of the areas has an interpreted walking track and other locations are suitable for provision of interpretive information.

A Royal Australasian Ornithologists Union Bird Observatory in Barren Grounds Nature Reserve provides visitor information, natural history courses and guided walks.

The Minnamurra Rainforest Centre in Budderoo provides talks and guided walks in the rainforest and is one of the three major rainforest education centres in NSW, the other two being in Dorrigo National Park and Sea Acres Nature Reserve on the north coast.

Robertson Nature Reserve is a focus for community education about the formerly extensive Yarrawa Brush and encouragement of rainforest revegetation projects in the area.

## **Recreational Values**

Budderoo and Macquarie Pass National Parks and Barren Grounds Nature Reserve provide valuable recreation opportunities in a natural environment for urban visitors. Carrington Falls and the Minnamurra Rainforest Centre are popular tourist destinations. Macquarie Pass National Park has the potential to be promoted for tourism.

A range of facilities and settings is provided from the relatively sophisticated facilities set within a rainforest escarpment area at the Minnamurra Rainforest Centre to opportunities for walking and pack camping in woodland on the Budderoo Plateau. The recreational opportunities complement those available in the coastal villages and Seven Mile Beach National Park.

## Summary of Significance

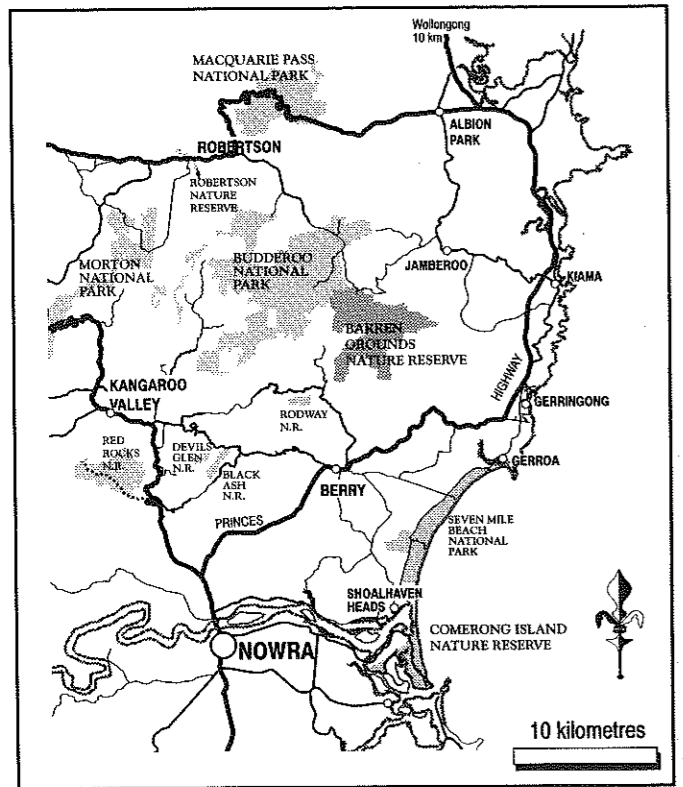
The parks and reserves are of state and regional conservation significance for the following reasons:

- they contain a large number of rare and threatened plant and animal species. In particular, Budderoo National Park has part of the only population of the rare plant *Grevillea rivularis* and Barren Grounds and Budderoo together have significant populations of the ground parrot *Pezoporus wallicus*, eastern bristlebird *Dasyornis brachypterus*, tiger quoll *Dasyurus maculatus* and long-nosed potoroo *Potorus tridactylus*;
- Robertson Nature Reserve protects one of the largest of the few remaining areas of Yarrawa Brush, an extremely dense cool temperate rainforest, while the other parks and reserve contain important remnant areas of cool temperate and sub-tropical rainforest and extensive areas of warm temperate rainforest;
- Barren Grounds, together with Budderoo, contains one of the four significant areas of heath on the south coast;
- the two parks and Barren Grounds Nature Reserve link large conservation areas to the north and south along the coastal escarpment, thus maintaining biodiversity and viability;
- the parks and Barren Grounds contain several historic places which illustrate the history of settlement of the district and are associated with development of the conservation movement after World War II;
- the areas contain attractive and in places spectacular landscapes with several well known lookouts and waterfalls;
- they provide a variety of educational opportunities close to large population centres including a major rainforest education centre; and
- they provide a range of outdoor recreation opportunities for tourists and locals.



# BUDDEROO & MACQUARIE PASS NATIONAL PARKS / BARREN GROUNDS & ROBERTSON NATURE RESERVES

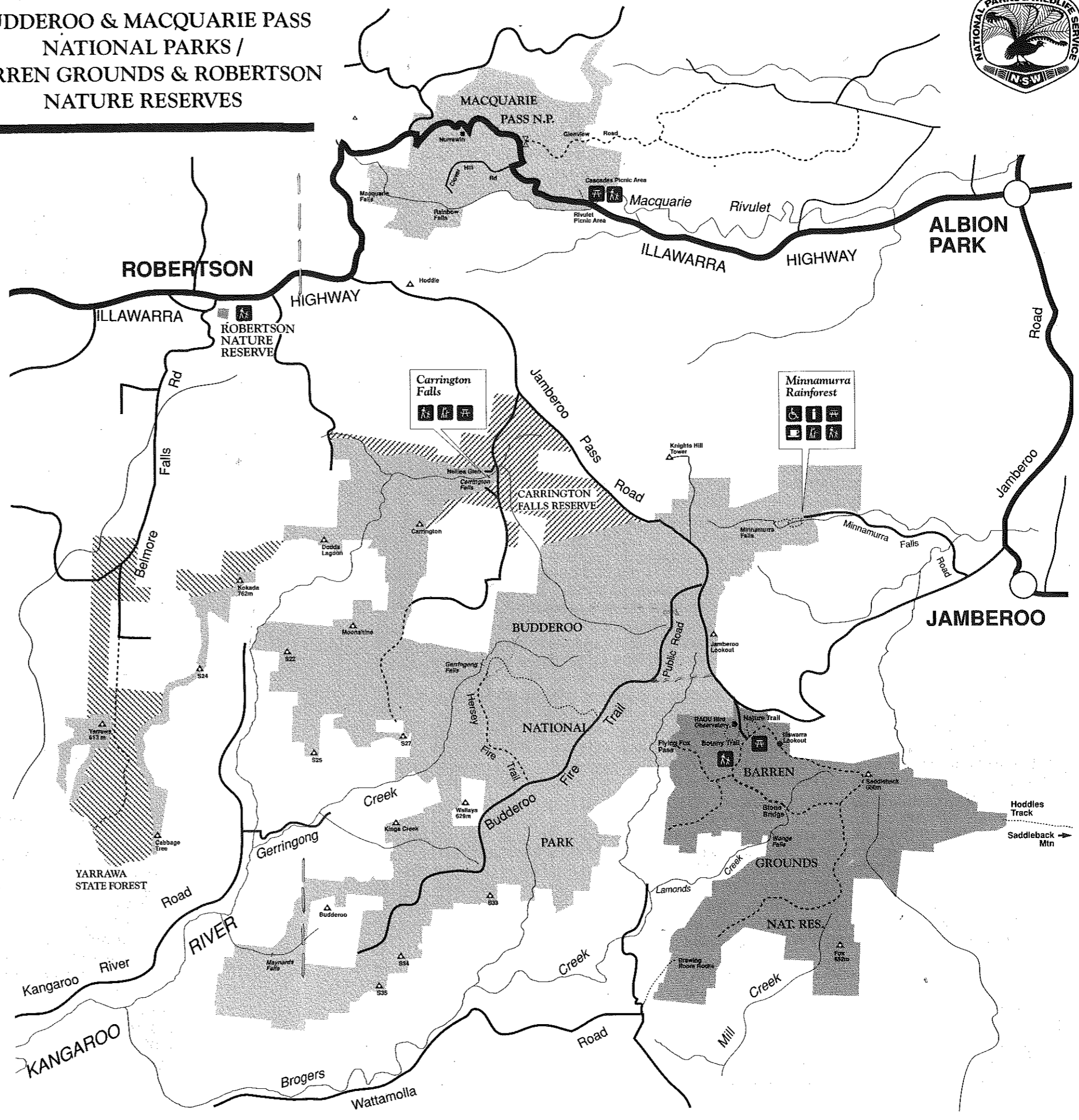
## LOCALITY MAP



## KEY

- National Park
- Nature Reserve
- Carrington Falls Reserve (DLWC)
- Yarra State Forest
- Arterial road
- Public Road
- Park access road
- Fire trail
- Walking track
- Picnic area
- Handicap access
- Information
- Kiosk
- Walking tracks
- Lookout

5 Kilometres



### 3. OBJECTIVES OF MANAGEMENT

#### 3.1 GENERAL OBJECTIVES FOR NATIONAL PARKS AND NATURE RESERVES

The following general objectives relate to the management of national parks and nature reserves in New South Wales:

- \* protection and preservation of scenic and natural features;
- \* conservation of wildlife;
- \* maintenance of natural processes as far as is possible;
- \* preservation of Aboriginal sites and historic features;
- \* encouragement of scientific and educational enquiry into environmental features and processes, prehistoric and historic features; and
- \* provision of appropriate opportunities for enjoyment and recreation.

#### 3.2 SPECIFIC OBJECTIVES FOR BUDDEROO NATIONAL PARK, MACQUARIE PASS NATIONAL PARK, BARREN GROUNDS NATURE RESERVE, ROBERTSON NATURE RESERVE

In addition to the above general objectives the management of Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve will be subject to the following specific objectives:

- \* maintenance of biodiversity;
- \* protection of significant vegetation communities and populations of rare plants, particularly stands of rainforest in all four areas and *Grevillea rivularis* in Budderoo National Park;
- \* protection of the habitat and populations of threatened animal species, particularly the ground parrot *Pezoporus wallicus* and the eastern bristlebird *Dasyornis brachypterus* in Barren Grounds and Budderoo;
- \* encouragement of regeneration of native vegetation communities in each area disturbed by past clearing, logging, inappropriate recreational use, frequent burning or weed invasion;
- \* provision of opportunities for scientific research, particularly in Barren Grounds;
- \* provision of educational opportunities aimed at improving public knowledge and appreciation of the natural systems of the four areas and support for conservation;
- \* promotion of appreciation of the value of rainforest remnants and encouragement of protection and revegetation programs outside the parks and reserves;
- \* provision of a range of recreation opportunities based on the natural landscapes within the two national parks; and

- \* continued provision of high quality developed tourist facilities aimed at encouraging appreciation of the value of rainforest within the Minnamurra Rainforest area of Budderoo National Park.

### **3.3 OVERALL STRATEGY**

The above objectives will be achieved primarily by:

- management of fire to ensure habitat diversity and long term habitat maintenance;
- control of introduced species that have significant impacts on the natural values of the areas;
- continued encouragement of scientific research;
- maintenance and improvement where necessary of most existing recreation facilities; and
- maintenance and extension of information and interpretive facilities and programs to support the educational role of the four areas and encourage public appreciation and care for their environments.

## 4. POLICIES AND FRAMEWORK FOR MANAGEMENT

This chapter contains the policies and framework for the management of Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve together with relevant background information. Policies are summarised under the following section headings:

- 4.1 NATURE CONSERVATION
- 4.2 CULTURAL HERITAGE
- 4.3 USE OF THE AREA

The policies established in this plan of management provide the framework for future management and are consistent with anticipated resources available to the Service and anticipated community trends over the next five to ten years.

The activities identified in the implementation table at the end of this plan of management are those to which priority will be given in the foreseeable future.. Other management actions may be developed over the life span of this plan consistent with the policies set out in the plan.

Where not specifically provided for in this plan of management, the management of Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve will be in accordance with the National Parks and Wildlife Act and in line with general Service policies.

### 4.1 NATURE CONSERVATION

Natural heritage comprises all aspects of the natural environment including physical features such as geology and soils, plants and animals and the relationships between these. For convenience, management of landscape values and of fire are also considered in this section.

#### 4.1.1 Geology, Landform, Soils and Water Quality

Budderoo National Park, Barren Grounds Nature Reserve, Macquarie Pass National Park and Robertson Nature Reserve sample an area of highland, plateau and escarpment in the southeastern corner of the Sydney Basin.

Robertson Nature Reserve is located on a highland basalt area while Budderoo National Park covers most of the sandstone Budderoo Plateau and much of the adjacent escarpment. The plateau is a projection at the eastern end of the highlands. Barren Grounds Nature Reserve comprises an easterly extension of the Budderoo Plateau and also includes escarpment areas. Most of Macquarie Pass National Park lies below the escarpment at the southern end of the Woronora Plateau. It consists mainly of steep ridges and gullies topped by cliff.

The highest and youngest strata in the area is Robertson Basalt, an olivine basalt of Tertiary age which forms very fertile soils. Most basalt land in the district has been cleared for agriculture and Robertson Nature Reserve protects one of the very few remaining naturally vegetated areas. Small remnant basalt areas are also found at high points on the Budderoo Plateau within Budderoo National Park. An intrusion of Triassic Budderoo Lamprophyre is located partly within the park at Wallaya Trigonometrical Station.

Beneath the basalt is the Triassic Wiannamatta Group, which produces reasonably fertile soils. A small amount is exposed along the western edge of Macquarie Pass National Park and at Knights Hill in Budderoo National Park. Small patches of clay soil

in central areas of Budderoo National Park are probably remnants from the Wiannamatta Group.

The next layer is horizontal Triassic Hawkesbury Sandstone. Most of Budderoo National Park, Barren Grounds and the western end of Macquarie Pass National Park are comprised of this, in common with extensive plateau areas to the west and north. Patches of Quaternary alluvium occur on the sandstone of the plateau within Budderoo National Park.

Soils on the sandstone are commonly infertile, sandy or peaty, shallow and frequently waterlogged, particularly at the eastern end in Barren Grounds. They are very prone to erosion if disturbed. Rehabilitation of an area north of Gerringong Falls disturbed by vehicle use is needed.

Disturbances causing any change to the soil nutrient status or drainage on the plateau can result in significant vegetation change and hence impact on habitats and landscape.

The edge of the Hawkesbury Sandstone is a sheer cliff around the plateaus, forming the Illawarra Escarpment and the northeastern boundary of Kangaroo Valley. The cliffline is deeply dissected in places by streams. These form several waterfalls of which the highest are Carrington Falls and Gerringong Falls in Budderoo National Park and Macquarie Falls in Macquarie Pass National park.

Beneath the Hawkesbury Sandstone the cliff is composed of shales and sandstone of the Narrabeen Group. This is weaker than the Hawkesbury Sandstone and more prone to erosion. Lower layers of the escarpment, including the steep ridges and gullies of Macquarie Pass and Minnamurra, consist in descending order of Kangaloon Sandstone, the Permian Illawarra Coal Measures (shale, conglomerate, sandstone and coal seams), Cambewarra Latite, Minnamurra Latite and Budgong Sandstone (volcanic sandstone). These are softer and form more fertile soils than the upper sandstones and produce a complicated vegetation pattern. Not all are present in each area.

Differences in erosion resistance of the various strata of the escarpment occasionally result in rock falls and landslides. Talus slopes occur beneath the cliffline. The steep slopes, combined with the high intensity rainfall of the area, can result in severe erosion where the vegetation cover is removed and along stream beds and gullies.

The Macquarie Pass and Minnamurra Falls areas are located in horseshoe shaped amphitheatres in the escarpment. These formations act as a scoops for moist easterly air, maintaining the moist forests in these areas (see 4.1.2).

A small area of alluvial floodplain of the Macquarie Rivulet is located at the eastern end of Macquarie Pass National Park.

Several major streams, including the Kangaroo River, Gerringong Creek, Brogers Creek, Broughton Creek and tributaries of the Macquarie Rivulet arise within the parks and reserves. Protection of water quality in these streams is important for wildlife and downstream users.

Water within the Macquarie Rivulet at the eastern end of Macquarie Pass National Park is of doubtful quality because of adjacent agricultural activities. Water testing and possibly control of pollution sources are needed.

Recent testing has also shown that water quality in the Minnamurra River is at times unsuitable for drinking and warning signs have been installed in facilities in the Minnamurra Rainforest Centre. Investigations are being carried out into suitable treatment methods.



## Policy

- \* All works will be undertaken in a manner which minimises soil erosion and water pollution and causes as little disturbance as possible to soil nutrient status and hydrological characteristics.
- \* Where erosion occurs as a result of recreational use or management works, remedial measures will be undertaken.
- \* Tracks, facilities and management works will be located and designed so as not to significantly intrude upon the open plateau landscape or significant features such as the escarpment and falls.
- \* As far as possible, earthmoving equipment will not be used for fire suppression on the shallow, waterlogged soils of the plateaus.
- \* The cooperation of neighbours and relevant land use authorities will be sought where necessary to prevent pollution of creeks in the parks and visual and other impacts.

## Action

- \* Erosion control and rehabilitation of the disturbed area north of Gerringong Falls will be undertaken.
- \* A water treatment system will be installed to provide safe drinking water at the Minnamurra Rainforest Centre.

### 4.1.2 Native and Introduced Plants

The parks and reserves exhibit a transect of vegetation from the warm temperate/cool temperate rainforest on basalt of the Robertson Nature Reserve through woodland and heath on the sandstone plateau to warm temperate and subtropical rainforest and tall moist eucalypt forest on the escarpment.

The rainforest of Robertson Nature Reserve consists of a mixture of cool and warm temperate species with an occasional subtropical element. Common canopy trees include sassafras *Doryphora Sassafras*, featherwood *Polyosma cunninghamii*, coachwood *Ceratopetalum apetalum* and possum wood *Quintinia sieberi*. The ground cover is a mixture of shrubs such as *Citriobatus pauciflorus*, soft tree ferns *Dicksonia antarctica*, numerous vines and small ferns.

Maintenance of canopy cover and wind protection around the boundaries of the nature reserve is vital to the continued viability of the rainforest. It is also important to prevent people from entering the reserve along now closed tracks. The reserve contains a number of weeds, principally small leafed privet *Ligustrum sinense*, large leafed privet, *Ligustrum lucidum* and English ivy *Hedera helix*. These are progressively being removed and replaced with natives by a group of trained volunteers. Perimeter weeds are being retained until a screen of natives has been established. Several large pine trees in the northwestern corner are inhibiting growth of native plants beneath them. They also provide shade and wind protection, however, and must be replaced with native species.

Small patches of featherwood *Polyosma cunninghamii* cool/warm temperate rainforest also occur on basalt soils at the western edge of Macquarie Pass National Park and in the Knights Hill area of Budderoo National Park. The latter area has been partly cleared for agriculture in the past. Its regeneration would significantly increase the area

of protected cool/warm temperate rainforest occurring on Robertson Basalt. Blackberry *Rubus fruticosus* and some lantana *Lantana camara* occur in disturbed areas at Knights Hill. Rabbits are probably inhibiting regeneration of native vegetation in the area.

The plateau area of Budderoo National Park and Barren Grounds Nature Reserve is a complex mixture of forest, woodland and heathland varying in response to soil and ground water characteristics. There is a reduction in rainfall and soil moisture from east to west across the plateau and an increase in soil depth (Burrough *et al.* 1977). This has resulted in shallow wet soils supporting mainly heath in Barren Grounds and a more diverse vegetation pattern in Budderoo with greater occurrence of woodland and forest.

The heathland contains a great variety of shrubs and sedges. Some of the most common are *Banksia paludosa*, *Hakea teretifolia*, *Dillwynia floribunda*, *Epacris obtusifolia*, *Melaleuca squarrosa*, *Leptocarpus tenax*, *Gymnoschoenus sphaerocephalus*, *Isopogon anemonifolius* and *Baeckea linifolia*. *Eucalyptus dendromorpha* occurs as a mallee in better drained areas of heathland.

In drainage depressions in the heath are areas of closed sedgeland with species such as *Chorizandra sphaerocephalus*, *Lepidosperma limicola*, *Gleichenia dicarpa*, *Leptocarpus tenax* and *Gymnoschoenus sphaerocephalus* dominating, and some shrubs, particularly *Leptospermum* spp.

Open woodland and woodland occur in patches between heath in Barren Grounds and more extensively in Budderoo. Open woodland occurs in areas of more shallow and poorly drained soils than woodland. Dominant trees are *Corymbia gummifera* and *E. sieberi*. Some *E. piperita* occurs in better drained woodland areas. The understorey consists of shrubs and sedges. Common species in open woodland are *Acacia obtusifolia*, *Banksia spinulosa*, *Banksia ericifolia*, *Leptospermum polygalifolium*, *Hakea teretifolia* and *Gleichenia dicarpa*. In woodland the main understorey species are *Leptospermum trinervium*, *Banksia paludosa*, *Hakea dactyloides*, *Lambertia formosa*, *Bossiaea kiamensis* and *Leptocarpus tenax*.

In areas of deeper sandy soil, mainly in the western part of Budderoo, is an open forest of *E. sieberi*/*C. gummifera* with *E. piperita* and *Allocasuarina littoralis*. The understorey is of similar shrub species to woodland, but is dominated by *Leptospermum* spp.

On basalt and shale remnants on the plateau are small areas of open forest dominated by *E. obliqua*, *E. radiata* and *E. fastigata*. *E. cypellocarpa*, *E. piperita*, *E. elata* and *Angophora floribunda* are also common. The ground cover consists of low shrubs, ferns and grasses such as *Lomandra longifolia*, *Blechnum nudum* and *Poa* sp. It is probable that the increased frequency of fire on the plateau since settlement has prevented development of a more mesic understorey.

Very few weeds occur on the plateau areas because of the generally low nutrient soils. Introduced grasses are spreading along some of the fire trails but do not appear to be invading undisturbed native vegetation.

Below the escarpment the vegetation consists of rainforest and tall open forest. The tall open forest occurs on north and west facing slopes of the escarpment and ridges and slopes at Macquarie Pass and Minnamurra Falls. Dominant species vary with altitude, soil and aspect but are principally *E. saligna*, *Syncarpia glomulifera*, *E. quadrangulata*, *E. smithii*, *E. fastigata*, and *E. muelleriana*. Rainforest species dominate the understorey. Typical species are *Acacia binervata*, *Cryptocarya glaucescens*, *Melicope micrococca*, *Synoum glandulosum*, *Doryphora sassafras*, *Chlerodendrum tomentosum* and *Livistona australis*, vines such as *Hibbertia*

*scandens*, *Marsdenia rostrata* and *Smilax australis* and a ground cover of small shrubs and ferns.

Much of the Minnamurra and Macquarie Pass areas are regenerating after past clearing by logging and farming operations. The extensive areas of tall open forest, in particular, are largely products of regeneration. Their similarity to the original vegetation is uncertain but it appears that most of the original canopy species still occur (Faulding and Benson, 1985). A large clearing remains in the Clover Hill area of Macquarie Pass National Park. Natural regeneration of native vegetation in this area is likely to be very slow because of the thick grass cover.

Three main types of rainforest occur below the escarpment. These are small areas of a plumwood *Eucryphia moorei* cool temperate/warm temperate mix at the highest elevations along the escarpment, large areas of warm temperate rainforest or mixed warm temperate/subtropical rainforest at medium elevations, and small areas of subtropical rainforest on lower slopes along creeks.

The plumwood cool/warm temperate rainforest is dominated by coachwood *Ceratopetalum apetalum* and *Eucryphia moorei*. Other species are similar to warm temperate rainforest (Mills, 1989).

Coachwood warm temperate rainforest is characterised by the presence of *Ceratopetalum apetalum* but contains a great variety of other species depending upon differences in soil, rainfall, altitude and other factors. Common species are *Acmena smithii*, *Polyosma cunninghamii*, *Cryptocarya glaucescens* and *Doryphora sassafras*. Understorey and ground cover are often sparse but typical species include *Tasmannia insipida*, *Coprosma quadrifida*, *Citriobatus pauciflorus*, tree ferns and small ferns (Mills, 1989).

Mixed subtropical/warm temperate rainforest occurs on topographic benches along the escarpment on better soils than those which support the coachwood warm temperate rainforest. Large trees such as *Citronella moorei*, *Dendrocnide excelsa*, *Ficus macrophylla*, *Toona ciliata*, *Pennantia cunninghamii* and *Doryphora sassafras* dominate the canopy. Shrubs, ferns, epiphytes and vines are common. The rainforests of this type in Kangaroo Valley such as below Carrington Falls and Gerringong Falls have fewer species because of the lower temperatures (Mills, 1989).

Patches of moist subtropical rainforest occur below Minnamurra Falls, Carrington Falls, Gerringong Falls and along the Macquarie Rivulet and some of its tributaries. There are few elsewhere within Budderoo and Barren Grounds because in most cases the lower slopes have not been reserved. These forests are very species rich and varied but are characterised by a high proportion of subtropical species, a dense shrub understorey, many vines and epiphytes and a dense ground cover of ferns. Characteristic tree species are *Livistona australis*, *Toona australis*, *Pennantia cunninghamii*, *Citronella moorei*, *Dendrocnide excelsa*, *Elaeocarpus kirtonii* and some warm temperate species such as *Polyosma cunninghamii* and *Doryphora sassafras* (Mills, 1989).

The former flood plain vegetation at the eastern end of Macquarie Pass National Park has been almost entirely cleared. Regeneration of the flats would increase the vegetation diversity of the park and provide an example of a once widespread community.

Extensive areas of native vegetation below the escarpment around Budderoo and Barren Grounds are held in private ownership. Retention of native vegetation cover in these areas is important for the viability of the natural systems and communities of the area, particularly where the reserved strips are very narrow such as adjacent to the Yarrowa State Forest. Establishment of conservation agreements with neighbours would be valuable.

Weeds are common in disturbed areas below the escarpment. The main problems are lantana, mainly along the eastern side of the escarpment, mist flower *Ageratina riparia* and crofton weed *Ageratina adenophora*. These inhibit regeneration of native vegetation and invade native forest where there is soil disturbance or incomplete canopy cover. Other weeds include cape ivy *Delairea odorata*, wandering jew *Tradescantia albiflora*, coral trees *Erythrina sykesii* and stinging nettles *Urtica spp.* Large areas of lantana occur in the cleared flats of the Macquarie Rivulet. Weed removal and replacement with natives has been undertaken in high profile areas at the Minnamurra Rainforest but resources are not generally available to control weeds elsewhere.

The Noxious Weeds Act 1993 took effect from 1 July 1993. The Act places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands. In addition to weeds identified under the Noxious Weeds Act, the Service controls other plants considered to be weeds where these have an unacceptable environmental impact.

Mist flower threatens the habitat of the rare plant *Irenepharsus trypherus* and other uncommon species at Minnamurra (Mills, 1988) and probably other locations. This weed is becoming widespread in moist areas of the Illawarra Escarpment and is likely to be an on-going threat. Control in areas where significant native species occur will be necessary.

Rare plants at Minnamurra Rainforest, Carrington Falls (see 2.2.2) and Jamberoo Lookout (*Epacris coriacea*), while not currently threatened, are close to areas of heavy recreational use. Most of the *Grevillea rivularis* community near Carrington Falls is located outside Budderoo National Park on an adjacent crown reserve proposed for addition to the park. This reserve also contains open forest with more fertile soils and a greater range of tree species than occur in the park.

*Monotoca ledifolia* occurs on some rocky outcrops in Budderoo and Barren Grounds and *Tetratheca neglecta* has been found in two open woodland areas (Jordan, 1989). Survey is needed to determine the location of other rare plants.

Several areas of the parks and reserves have particularly high scientific value because they contain uncommon vegetation communities or provide habitat for rare species. They are:

- areas of rainforest and open forest on basalt in Robertson Nature Reserve and Budderoo National Park;
- heathland, sedgeland and adjacent woodland on the Budderoo and Barren Grounds plateaus which are habitat for the rare ground parrot and eastern bristlebird;
- the complex of temperate and sub-tropical rainforest and rare plants in the Minnamurra Rainforest area of Budderoo; and
- the Carrington Falls area, both above and below the escarpment, which contains temperate and subtropical rainforest and a number of rare plants, including part of the only population of *Grevillea rivularis*.

Each of these areas is popular for recreation and educational use.

## Policy

- \* The existing pattern of native plant communities in the parks and reserves will be maintained by management of fire (see 4.1.4) and other disturbances.
- \* Areas of rare or threatened species and significant plant communities, particularly the scientific areas listed above, will be protected from damage by recreational or other use.
- \* Research into the distribution and management requirements of rare and threatened plants in the parks and reserves will be encouraged.
- \* A dense perimeter vegetation screen will be maintained around Robertson Nature Reserve. A perimeter fence will be maintained where necessary to prevent entry to the reserve other than by the designated entrance.
- \* Weeds will progressively be removed from Robertson Nature Reserve. Priority will be given to weeds which are likely to invade rainforest or prevent regeneration of natives. Ground disturbance will be minimised, and weeds will be replaced by native seedlings. Privet will not be removed from the perimeter until plantings of natives have produced an adequate wind and light screen. Similarly the pine trees will be progressively removed in conjunction with establishment of natives.
- \* Continuation of volunteer weeding and planting programs at Robertson Nature Reserve will be encouraged.
- \* Introduced plants will be controlled where they:
  - have been declared noxious;
  - threaten the integrity of native communities or significant species;
  - may affect neighbouring lands;
  - are spreading significantly or have a high capacity for dispersal; and/or
  - are new isolated occurrences.
- \* Establishment of conservation agreements will be encouraged for suitable naturally vegetated private land adjacent to the parks and reserves, particularly along the escarpment.

### **Action**

- \* Survey will be undertaken for rare plants, particularly *Irenepharsus trypherus*, occurring in gullies and other locations threatened by mist flower. Programs for weed control or other necessary management will be determined and implemented.
- \* Cooperative management of *Grevillea rivularis* will be sought with the Carrington Falls Reserve Trust.
- \* Regeneration of native vegetation in clearings at Knights Hill, Clover Hill and the eastern end of Macquarie Pass National Park will be monitored. Weed control, rabbit control and planting of natives will be undertaken where considered necessary to accelerate revegetation.
- \* The Service will continue to seek addition of the Carrington Falls Reserve to Budderoo National Park. If this is not possible the Service will seek to have

management of the reserve vested in the Director-General of National Parks and Wildlife.

- \* A weed survey and control program will be prepared and progressively implemented.

#### 4.1.3 Native and Introduced Animals

Approximately 160 bird species have been recorded in Barren Grounds Nature Reserve of which nearly a third breed in the reserve. The importance of the area for the threatened ground parrot and eastern bristlebird has been noted in section 2.2.2. Other birds found in the heathlands include Richards pipit *Anthus novaeseelandiae*, flame robin *Petroica phoenicea*, superb fairy wren *Malurus cyaneus*, southern emu wren *Stipiturus malachurus*, tawny-crowned honeyeater *Phylidonyris melanops* and beautiful firetail *Emblema bella*. The woodlands commonly have yellow-tailed black-cockatoos *Calyptorhynchus funereus*, the fan-tailed cuckoo *Cuculus pyrrhophanus*, eastern yellow robin *Eopsaltria australis*, striated thornbill *Acanthiza lineata* and a number of honeyeaters. In moist forests below the escarpment are birds such as the topknot pigeon *Lophoaimus antarcticus*, Australian king-parrot *Alisterus scapularis*, southern boobook *Ninox novaeseelandiae* and superb lyrebird *Menura novaehollandiae*. Many species use more than one habitat within the reserve.

Thirty species of native mammals have been recorded in Barren Grounds. Common species include the swamp wallaby *Wallabia bicolor*, long-nosed bandicoot *Perameles nasuta*, eastern pygmy possum *Cercartetus nanus*, sugar glider *Petaurus breviceps*, common ringtail possum *Pseudocheinus peregrinus*, common wombat *Vombatus ursinus*, brown antechinus *Antechinus stuartii*, bush rat *Rattus fuscipes* and grey-headed flying fox *Pteropus poliocephalus*. Most of the mammals occur in woodland and forest, with moist forest patches providing habitat for the rarer mammals of the reserve such as the long-nosed potoroo (see section 2.2.2).

Information about reptiles and amphibians in Barren Grounds is limited. Records include 14 species of frog, of which three are threatened, 12 lizards including the lace monitor *Varanus varius* and eastern water dragon *Physignathus lesueurii* and 11 species of snake including the swamp snake *Hemiapsis signata*, green tree snake *Dendrelaphis punctulatus* and red-bellied black snake *Pseudechis porphyriacus*.

There are no comprehensive species lists for Budderoo or Macquarie Pass National Parks. The range of species occurring in Budderoo is very similar to Barren Grounds. The relative populations will differ, however, because of the more extensive woodland and forest areas in Budderoo. Forest and woodland communities are structurally more complex than heath and therefore support a wider range of animals.

Macquarie Pass is important for animals dependent upon moist forest and rainforest, including threatened species. The park may have a greater range of moist forest species than the other areas because of its large area of moist forest and extensive adjacent areas of native vegetation in land managed by Sydney Water. The platypus *Ornithorhynchus anatinus* is found in creeks in Macquarie Pass and the Minnamurra Rainforest area and the threatened powerful owl *Ninox strenua* and broad-headed snake *Hoplocephalus bungaroides* may occur.

Robertson Nature Reserve probably has no large native mammals owing to its small size but common wombats *Vombatus ursinus* and short-beaked echidnas *Tachyglossus aculeatus*, the copperhead snake *Austrelaps superba* and small lizards occur. It has a varied assemblage of birds including honeyeaters, white browed scrubwren *Sericornis frontalis*, crimson rosella *Platycercus elegans*, wonga pigeon *Leucosarcia melanoleuca*, eastern whipbird *Psophodes olivaceus* and satin bowerbird

*Ptilonorhynchus violaceus*. The threatened tiger quoll *Dasyurus maculatus* may occur in the reserve.

The threatened ground parrot *Pezoporus wallicus* occupies closed heath and sedgeland of which there are extensive areas at Barren Grounds and smaller patches on the Budderoo Plateau. An appropriate fire regime is needed for its conservation (see section 4.1.4).

The threatened eastern bristlebird *Dasyornis brachypterus* utilises the ecotone between tall dense heath and adjacent woodland. It depends upon the woodland and forests as refuge after fire. Little survey has been carried out for bristlebirds but they appear to be more numerous in Budderoo than Barren Grounds, possibly because of the greater amount of woodland. The birds are very sensitive to disturbance (Baker and Clarke, 1991). There is insufficient knowledge about the habitat needs of the eastern bristlebird. Its management is further discussed in section 4.1.4.

Several threatened species listed in section 2.2.2 (the long-nosed potoroo, tiger quoll, and common bent-wing bat) occupy moist forest below and on the edge of the escarpment as well as forest and woodland areas on the plateau. Protection of these areas from frequent fire is important to maintain the dense cover needed for protection from predators.

The threatened frog species listed in section 2.2.2 in Barren Grounds/Budderoo (*Litoria* sp., giant burrowing frog, red-crowned toadlet) and Macquarie Pass (great barred frog and red-crowned toadlet) (Gary Daly, pers. comm.) have specific habitat requirements and are very sensitive to impacts such as changes in soil nutrient, water quality and vegetation cover. Survey and mapping of their habitats plus investigation of their management requirements are needed.

It is vital for conservation of the important rare species and other native animals in the parks and reserves that connections between the areas and to larger naturally vegetated lands nearby be maintained.

Macquarie Pass National Park is cut by the Illawarra Highway and traversed by a major transmission line easement. Such developments have high environmental impact, particularly considering the small size of the park. It is important that a continuous scrub cover remain under the power line in order to permit continued movement of native animals across the easement. Any major upgrading or re-routing of the highway within the park could greatly effect habitats and wildlife movement.

Introduced species occurring in the parks and reserves include rabbits in disturbed areas of plateau basalt and escarpment benches, foxes, cats, goats and occasionally cattle escaped from inholdings and unfenced neighbouring properties below the escarpment.

Goats are the main concern as numbers appear to be increasing and they have the potential to cause considerable damage to native vegetation. Goats tend to utilise rocky areas which, being relatively protected from fire, are prime locations for rare and threatened plants.

Foxes and cats have a significant impact on populations of native animals in the parks and reserves. There is some concern that tracks caused by ground parrot survey may facilitate predation by foxes.

## **Policy**

- \* High priority will be given to maintenance of habitat for the ground parrot and eastern bristlebird on the Barren Grounds and Budderoo plateau and precedence will be given to conservation of the eastern bristlebird.
- \* The habitats of other threatened species will be protected from disturbance.
- \* Introduced animals will be controlled where they significantly threaten populations of native plants or animals and practical control methods are available. Priority will be given to control of goats and to control of foxes on the Barren Grounds/Budderoo plateau.
- \* Pest control programs will be undertaken in cooperation with neighbours and other authorities.
- \* Fencing of currently unfenced boundaries with neighbouring grazing properties will be encouraged with the service assisting where possible.
- \* Inventory and research into the distribution, habitat and management requirements of threatened native animals will be encouraged, with priority to the eastern bristlebird and frog species.
- \* The Service will endeavour to ensure that wildlife corridors be maintained between the parks and reserves and other areas of naturally vegetated land.

### **Action**

- \* A monitoring program will be established to record numbers of ground parrots and eastern bristlebirds and their response to fire. Surveys will avoid repeated use of the same routes in order to prevent track formation.
- \* Survey and investigation will be undertaken of the management needs of the threatened frog species occurring in the parks and reserves.
- \* On-going goat, fox and feral cat control programs will be undertaken.

#### **4.1.4 Fire Management**

Fire is an important component of the environment of the Budderoo Plateau and Barren Grounds and significantly influences the vegetation pattern. Contemporary ecological research in fire prone ecosystems has established broad principles about the fire regimes needed to avoid the extinction of species and thus conserve biodiversity. Groups of plant and animal species respond similarly to fire according to the characteristics of their life-history. It is not necessary to specify fire regimes for the conservation of every species, rather fire regimes for groups of species or an ecosystem should be developed.

A diversity of fire regimes is needed to maintain natural diversity. Accordingly the management of fire should aim to provide a pattern of fires of high, moderate and low intensity, frequency and extent. Extinctions are most likely when fire regimes of relatively fixed intensity, frequency and extent prevail without variation.

Scientific understanding of the fire requirements for plant communities is generally more advanced than for animal communities, although recent research demonstrates that the conservation of many animal species also depends upon a mix of fire regimes including occasional high intensity fires. The use of regular and low intensity fires has an unacceptable impact on critical requirements for native animals, particularly on shrubs and ground cover.



With these general principles as a basis, fire management guidelines will be developed in a fire management plan for Budderoo National Park and Barren Grounds Nature Reserve which define fire regime thresholds for several major groups of plant communities. If these thresholds are exceeded the decline and extinction of plant species can be expected.

The dense heathland regenerates rapidly after fire. Research has shown, however, that a number of species occurring in the woodlands need fire free periods of at least 8-10 years after high intensity fires to permit seed production (Bradstock and Myerscough, 1988 and Bradstock and O'Connell, 1988). *Banksia ericifolia* is an important food source for honeyeaters, other birds and possums.

Evidence such as photographic records and the presence of tree stumps in heathland suggest that the woodland communities on the Budderoo plateau and Barren Grounds were formerly more extensive but have been reduced by frequent fires since settlement of adjacent plateau areas. Frequent fire also appears to have altered the floristic and structural composition of the forests on basalt and shale areas of the plateau and reduced their habitat value for moist forest species. Frequent fire on the plateau may, however, have expanded the habitat of the ground parrot by increasing the area of suitable heath.

Provision of suitable habitat for the ground parrot and eastern bristlebird is an important consideration in fire management in the plateau areas. Some research at Barren Grounds (Jordan, 1991) indicates that ground parrots recolonise an area less than two years after fire, that populations peak at 5-6 years after fire and that numbers are greatly reduced in heaths older than 14 years. More recent research, however, indicates that populations remain high in heaths up to fifteen years after they have been burnt. Moreover, ground parrots have been observed in heath at Gerringong Falls which has not been burnt for about 20 years (Holme and Jordan, 1989). Research in populations elsewhere in Australia has showed significantly different responses to vegetation age since fire, probably because of differing climates and vegetation species composition. Baker and Whelan, 1992 stressed that vegetation characteristics are important in determining ground parrot density, not fire age in itself. Baker also emphasised the need for site specific research (Baker 1996).

Eastern bristlebird populations appear to be severely affected by fire and rely on the availability of nearby fire refuges. Recolonisation is relatively slow after fire (Baker, 1996). Survey by Bramwell *et al.*, 1990 found greater eastern bristlebird populations in an area of 9 years post fire at Barren Grounds than an area 6.5 year after fire. Given that bristlebirds occupy woodland, scrub and tall heath it is possible that the appropriate fire frequency for this species corresponds with that necessary for regeneration of woodland tree and shrub species.

These studies provide insufficient evidence that any particular fire regime will provide optimal habitat for the ground parrot and bristlebird, although they do indicate the likely range of appropriate fire frequency. Fire management must be based on monitoring of vegetation recovery since previous fires and on further research. For eastern bristlebird populations at Jervis Bay, Baker 1996 recommended that no prescribed burning be undertaken for the purpose of habitat manipulation until further research has been undertaken and that known eastern bristlebird concentrations be protected in the event of a wildfire. Monitoring of ground parrot and eastern bristlebird populations and their response to fire is provided for in section 4.1.3 of the plan.

The most important consideration in fire management on the plateau areas is to avoid burning of a large proportion in a single wildfire or within a short time period. The dense heathland can carry another fire in less than three years during extreme fire weather. Strategies for minimising the likelihood of widespread fire will be examined in the fire management plan to be prepared for the park and reserve.

It is important to prevent unscheduled fire in research plots in the vicinity of the residence and lodge at Barren Grounds and also to avoid use of fire retardants in these and other heathland areas. Retardants can increase soil nutrient levels and hence lead to increased plant growth rates and invasion of weeds.

A common source of fire on the Budderoo Plateau has been from adjacent agricultural land on the plateau to the west and below the escarpment. Fires from the west commonly swept across the plateau, burning large areas. Lightning strikes and arson associated with car dumping are other sources of fire.

Prescribed burning and other hazard reduction may be undertaken in strategic parts of the Budderoo Plateau. Generally, however, management will rely on rapid fire suppression in this area because of the risk of damage to the woodland and forest from prescribed burning being followed by wildfire at too short an interval.

Prescribed burning is undertaken along the Budderoo Track in order to minimise the entry of fire into Barren Grounds from the Budderoo Plateau (as frequently occurred in the past) and to protect an important area of ground parrot habitat in the western part of Barren Grounds.

Most private property adjacent to Budderoo and Barren Grounds lies below the escarpment and is at little risk from wildfire on the plateau. Fire protection work may be appropriate, however, for inholdings on the Budderoo Plateau and a group of houses along the Jamberoo Pass Road near Dhruwalgha Mountain.

The moist eucalypt forests of the parks and reserves should not be subject to fire more frequently than once every 30 years and as far as possible rainforest should not be burnt at all. The escarpment forests have occasionally burnt as a result of escaped fire from adjacent properties but they are unlikely to carry extensive fires except in extreme conditions.

Prescribed burning is inappropriate on the escarpment and plateau basalt areas because it would damage important plant communities and be likely to result in a dryer and more fire prone forest.

Macquarie Pass National Park was extensively burnt in 1939 and 1968 but has had only minor outbreaks since. It is not considered a high fire risk area because of the extensive moist forests, although the ridge areas would burn readily if a fire became established. The steep terrain and dense timber of the park would make control of a wildfire difficult. Prescribed burning, however, would not be appropriate because of the complex vegetation pattern and severe impact that frequent burning would have on the moist forests.

The risk of fire in Robertson Nature Reserve is low as it is bordered by roads and cleared properties.

The response to fire of most of the rare plants in the four areas is unknown and until this is determined the areas where they occur should be protected from frequent fire.

The Service participates in local cooperative arrangements including District Fire Committees which aim to coordinate and monitor fire management and fire control between different fire authorities.

## **Policy**

- \* Fire will be managed in accordance with fire management plans and the policies below to:

- protect human life and property within and immediately adjacent to the parks and reserves;
  - protect rare species and plant communities of special significance and fire sensitive species and communities;
  - maintain those plant communities and plant or animal species which require a particular fire frequency or intensity;
  - maintain habitat diversity;
  - protect Aboriginal sites and historic places; and
  - protect management and recreation facilities.
- \* Prescribed burning on the Budderoo Plateau and Barren Grounds will:
- aim to maintain the existing mix of woodland and heathland;
  - be undertaken as far as possible between March and June in order to avoid the eastern bristlebird and ground parrot breeding and moulting seasons;
  - be determined by vegetation monitoring, fuel sampling and research results;
  - minimise creation of tracks in heathland;
  - vary in frequency in individual areas; and
  - take into account long term impacts on the floristic composition of plant communities.
- \* Protection works will be undertaken around the RAOU observatory buildings as necessary.
- \* No prescribed burning will be undertaken in Robertson Nature Reserve, Macquarie Pass National Park or escarpment areas of Budderoo and Barren Grounds.
- \* As far as possible fire, including prescribed burns, will be excluded from areas of rainforest, tall open forest below the escarpment, open forest on plateau basalt and locations of rare and threatened plants known to be fire sensitive or whose response to fire is not known.
- \* Unscheduled fires will be suppressed as quickly as possible in order to limit their extent.
- \* The use of heavy machinery for fire suppression will be avoided in the vicinity of rare plants, Aboriginal sites and historic places and in heath and sedge land.
- \* Fire retardants will not be used in areas of heathland in Barren Grounds and Budderoo except in close vicinity of the lodge and residence.
- \* Records will be kept of all fires within the parks and reserves.

- \* Areas disturbed by fire suppression operations will be rehabilitated as soon as practical after the fire.
- \* Management tracks marked on the centre maps will be maintained to a high standard of access, safety and stability.
- \* Research will be encouraged into the ecological relationships of fire in the heath and woodland areas and the response of rare and threatened plants to fire.
- \* Close contacts will be maintained with volunteer bush fire brigades, Council fire officers, State Forests and land use planning and development authorities. The Service will continue to actively participate in local District Bush Fire Committees.
- \* The Service will seek to involve neighbours in co-operative hazard reduction works for mutual protection.
- \* The Service will actively advise against development in high fire risk areas close to the park and reserve boundaries as a contribution to local government planning and development approval processes.

### **Action**

- \* Fire management plans will be prepared for Barren/Grounds Budderoo and for Macquarie Pass National Park by June 1998. The plans will detail fire management strategies and programs, requirements for resource and neighbouring lands protection and co-operative arrangements.
- \* Annual fire management works programs will be prepared detailing hazard reduction, habitat management burns and trail maintenance requirements.
- \* The impact of fire on vegetation structure and species composition, particularly in woodland, and the response of rare and threatened plants to fire will be monitored.

## **4.2.2 CULTURAL HERITAGE**

Cultural heritage comprises important components of the environment that may have aesthetic, historic, scientific and social significance to present and future generations. Cultural heritage includes both Aboriginal and non-Aboriginal history.

### **4.2.1 Aboriginal Sites**

Little is known about Aboriginal use of the parks and reserves. At the time of European exploration the area of the parks was utilised by the Wodiwodi tribal group. There appears to have been seasonal movement between the coast and the highlands exploiting changing food resources. Within a short period only remnants of the original inhabitants were to be found.

The strong attachment of Aboriginal people to their land and culture is being acknowledged by the European community. It is important to preserve as much as possible of the evidence of Aboriginal occupation, particularly in parks and reserves where the complementary natural environments are protected.

A number of Aboriginal sites have been recorded, consisting of artefact scatters, rock shelters with occupation deposits and art, and axe grinding grooves, including one site of 90 grooves. Most sites have been found along the main streams on the Budderoo

Plateau, the plateau area of Macquarie Pass National Park and below the escarpment cliffline. It is highly likely that many more sites exist.

There are historical references to corroborees taking place on the river flats below the Minnamurra Falls area and it is probable that the food resources of the area were used at these times. The Illawarra Local Aboriginal Land Council has indicated that there may be areas of Aboriginal spiritual significance in the Minnamurra area.

Aboriginal sites, particularly art sites and artefact scatters, are very vulnerable to disturbance by visitors and for this reason their location will not be publicised. Some of the known Aboriginal sites are presently in need of protection measures.

## **Policy**

- \* The Service will liaise with the Aboriginal community on all aspects of Aboriginal site management and active involvement of Aboriginal people will be encouraged.
- \* Significant Aboriginal sites will be protected from disturbance by recreation or management activities.
- \* Significant sites threatened by natural processes such as erosion will be protected if possible or identified as priority sites for detailed recording and research.
- \* All development work will be preceded by an inspection for Aboriginal sites by a qualified person. Where impact on a site by development is unavoidable, appropriate salvage measures will be identified and implemented before work proceeds.
- \* New recreation facilities will not be located close to Aboriginal sites unless protection measures have been undertaken.
- \* The location of Aboriginal sites will not be publicised except where:
  - a conservation study has been prepared and any management works necessary to protect the site from damage have been implemented;
  - the site will be interpreted to promote public knowledge and appreciation of Aboriginal culture; and
  - the Local Aboriginal Land Council is in agreement with the proposal.
- \* Non-destructive research into past Aboriginal use of the area and the distribution of sites will be encouraged.

## **Action**

- \* A sign will be constructed advising visitors of the significance of the axe grinding grooves at Carrington Falls and their vulnerability to damage from inappropriate visitor activities.
- \* A management plan will be prepared for the art site complex in Barren Grounds covering detailed recording, assessment of degree of weathering, levels of visitation, protective works required and monitoring.

## 4.2.2 Historic Places

The earliest Europeans to visit the area of the parks and reserves were cedar cutters in the escarpment forests during the early 1800's. Most of the cedar had been removed by 1850. Cedar cutting played a major role in the early development of the district and remaining cedar trees are therefore of cultural interest.

Removal of hardwood timber continued on parts of the escarpment until the 1960s. Old roads, remains of cables and other features are reminders of former timber cutting. A sawmill operated just below the car parking area at Minnamurra during the 1930s (O'Keefe, 1982). There are no remains apart from a grinding wheel.

Settlement of the coast adjacent to the parks and reserves began in the 1820s following the issuing of free land grants. Clearing was extended to the escarpment foothills in the 1850s by tenant farmers producing mainly wheat, corn, potatoes, eggs and dairy products. Many farms also had orchards. The original large holdings were subdivided in the late 1800s, resulting in further clearing and agricultural development.

Numerous piles of stone in the Minnamurra area and Macquarie Pass remain from past track formation and paddock clearing. The remains of cobblestone roads can be found near Minnamurra Falls. A stone wall in the Minnamurra area marks the site of a cottage occupied in the 1880s. Cattle yards were located adjacent to the current carpark.

Downstream from the Minnamurra Rainforest area is a hut of local historical significance known as Kellys Cottage. It was built by Michael Kelly in 1853-54 of turpentine slabs, with a shingle roof and sandstone and brick chimney. The roof was later covered with corrugated iron and the chimney, mantlepiece and cedar lining slabs were removed to a museum formerly located in the Falls area. A camelia tree adjacent to the cottage is believed to be one of the oldest in the southern hemisphere. Replacement of material removed from the cottage and other conservation works are needed.

Charles Throsby penetrated the Yarrowa Brush in 1817 in search of a route to the coast. It was not until the Robertson Land Act of 1861, however, that settlement of the Brush occurred and then large areas were rapidly cleared for vegetable growing, dairying and cattle raising.

In 1830 surveyor Hoddle cut a bridle track from the tablelands across the Yarrowa Brush along the present route of the Robertson to Jamberoo Road, through Barren Grounds from the present entrance road, past the Saddleback Trig site and down the escarpment below Noorinan Mountain. It was little used until the 1860s when the poor condition of the track between Mount Kiera and Mount Kembla led to use of part of Hoddle's track for cattle movement. This continued until the Jamberoo Pass road was constructed in 1875. Hoddle's route was upgraded during World War II to give better access for removal of cattle to the highlands in the event of an invasion. Today only the section below the escarpment is discernible.

There are several other historical passes through the escarpment within Budderoo and Barren Grounds. These were used for travel between the highlands, coast and Kangaroo Valley and to transport wood, cattle, butter and other produce. The remains of a flying fox used to haul logs out of the valley is located on the Timber Track at the western end of Barren Grounds.

An Aboriginal track across the escarpment at Macquarie Pass was cleared by a Ben Rixon in 1863 (Derbyshire and Allen, 1984). A road was constructed in 1898 and it was upgraded and sealed during World War II.

The stone footings and fireplace of a farm house of unknown date, a corrugated iron shed and a weatherboard dairy (now converted to a cabin) remain from former agricultural use at Clover Hill in Macquarie Pass National Park. As well as the former farm buildings, Clover Hill contains a fibro/split log cottage, a concrete brick cabin with recent stone extensions, a partly built stone chapel and a partially completed swimming pool. The cottage is in very poor condition. The cabins were rented to tourists until the area was added to the park. An area of 1.19 ha containing the buildings is leased by the former owner for the remainder of his life. The buildings will be vulnerable to vandalism when no longer occupied. Closure of the access road when this occurs is provided for in section 4.3.2.

The Nurrewin property, north of Clover Hill, was partially cleared and farmed from the 1860s. Selection at that time of an area high on the escarpment was unusual. It was later acquired by the Mann Thompson family and the existing house and associated buildings were constructed in 1904 of locally quarried sandstone. Internal walls were plastered/concrete veneered and the ceiling was boarded. Workmanship was of a high standard. Some modifications have occurred but these have not significantly affected the original fabric. The building was used as a boarding house during World War II and was later operated as a tea room for passing motorists. Rooms in what is now the garage were rented out to bushwalkers. The grounds contain extensive lawns, plantings, two poultry runs, a shed and an old swimming pool. Coal for the fire places was quarried from an outcrop near the house.

Considerable repair and maintenance work have been carried out on the main building at Nurrewin in accordance with a conservation plan. Extension of the coverage of the conservation plan is needed to include the rest of the structures and the landscape. Continued occupation of Nurrewin is essential to ensure the building's conservation, especially in view of its proximity to the Illawarra Highway.

Evidence of a log cabin of cabbage tree palms with an iron roof and stone chimney, adjacent stables, grotto and pool are located southwest of Nurrewin. The cabin was probably constructed during the 1960s and is reported to be on the site of a former cedar slab building built in 1856. The cabin was burnt in the 1970s but stone footings, fencing and fruit trees remain. The pool has largely been destroyed by rock washed down the creek. A nearby building of hand made bricks and weatherboard with an iron roof still exists but is in poor condition.

Some remains of a slab hut of unknown date are located at the eastern end of Macquarie Pass National Park. The hut is reported to have been occupied by a Mr Owen and to have been the location for his invention of the Owen sub-machine gun used during World War II.

Coal mining was undertaken adjacent to the lower falls at Minnamurra in 1920 but the coal proved to be of poor quality and the operation ceased. Coal mining is also reported to have occurred at the foot of the northern cliffline at Macquarie Pass National Park.

Following construction of the south coast railway line in 1888, the area became popular with tourists from Sydney. Trips from Albion Park to Macquarie Falls were an attraction. Macquarie Pass contains a number of tracks used early this century for bushwalking and rock climbing.

The Minnamurra Falls area was visited in the early 1800s and has been a popular picnic spot since the 1870s. A walking track to the Falls was constructed in the late 1800s and other facilities such as rest spots, bridges and toilets were constructed by Jamberoo Council during a 1930's unemployment relief program. The former kiosk was the most important element of these structures as an early example of a food

outlet/ticket collection building. An area of land near the kiosk area was used for a short time as a camping area by the Department of Sport and Recreation.

Barren Grounds was popular for bushwalking from the late 1800s but was subject to grazing and burning under permissive occupancies. This led to pressure from conservation societies for its protection and it has been associated with leaders of the early conservation movement such as Myles Dunphy, Paddy Pallin and Allen Strom. The area became the third Fauna Reserve gazetted in NSW. The picnic area and a stone building for accommodation of researchers and honorary rangers (The Lodge) were constructed during the early 1960s by the Fauna Protection Panel. The Lodge is now used for accommodation as part of the RAOU Bird Observatory (see 4.3.2).

Robertson Nature Reserve has long been used as a local recreation area and contains old gate posts, walking tracks and a stand of old pine trees.

Part of a crashed firefly aircraft from World War II is located near Fox Trig in Barren Grounds.

### **Policy**

- \* The historic places of the parks and reserves will be conserved in accordance with the Burra Charter of Australia ICOMOS.
- \* All work involving ground disturbance will be preceded by an investigation for historic places, including surface archaeological remains.
- \* The house, other structures and grounds at Nurrewin will be managed and maintained in accordance with relevant conservation plans and will continue to be occupied. Preference will be given to use by a community group or commercial organisation for education, accommodation, conservation or cultural purposes, with public access allowed.
- \* Kellys Hut will be conserved in accordance with a conservation plan.
- \* Features such as the stone walls and cobblestone roads at Minnamurra will be kept clear of vegetation except where retention of existing vegetation is necessary for their stability.
- \* Other structures, apart from any significant structures at Clover Hill, will not be maintained. Clearings will be allowed to revegetate.

### **Action**

- \* Historic places will progressively be fully recorded.
- \* A survey will be undertaken to map the historic places and structures in the Minnamurra Rainforest area.
- \* The historic significance of the buildings and structures at Clover Hill will be assessed and a management strategy will be determined.
- \* Conservation planning will be undertaken for the landscape at Nurrewin and structures other than the main building, and identified works will be carried out.
- \* A conservation plan will be prepared and implemented for Kellys Hut and the surrounding landscape.
- \* Expressions of interest will be invited for leasing of Nurrewin.



### 4.3 USE OF THE AREA

The major categories of use that can be appropriate, to varying degrees, on Service areas are:

- education and promotion of the area, the Service and the conservation of natural and cultural heritage;
- certain types of recreation;
- research; and
- management operations, by the Service itself and other authorities with statutory responsibilities in the area.

The extent to which these categories of use will be provided for in Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve is indicated below.

#### 4.3.1 Promotion and Interpretation

The parks and reserves are located close to major population centres and to the popular tourist destinations of the Southern Highlands and South Coast. They are within day trip distance of Sydney and are part of an established tourist circuit through the highlands and the Illawarra coastline. In conjunction with nearby locations such as Fitzroy Falls they are well placed for promoting Service areas and the conservation of natural and cultural heritage.

Provision of information is also a valuable management tool. It enhances the enjoyment and safety of visitors and encourages appropriate visitor behaviour.

The Budderoo and Barren Grounds plateaus are fragile areas which are vulnerable to erosion, vegetation damage and disturbance to rare species by recreation use. The steep moist forest areas below the escarpment are also vulnerable to erosion and weed invasion from concentrated use. Only sites which have hardened tracks and other facilities are suitable for promotion of high levels of use.

The major visitor facility within the area is the rainforest education centre in the Minnamurra Rainforest area of Budderoo National Park. This includes a visitor centre and interpreted walking tracks featuring the rainforest of the area. The centre is very popular as a tourist destination and for environmental studies. Talks and guided walks are given to bus groups.

The main walking tracks at Carrington Falls, the interpreted walking track at Robertson Nature Reserve and the Cascades track at Macquarie Pass are suitable for promotion. Construction of a viewing platform at the end of the Cascades track may become necessary to prevent erosion.

Both Robertson Nature Reserve and the Minnamurra Rainforest Centre are focuses for community rainforest revegetation projects outside the reserved areas, with advice provided to community groups.

The RAOU Bird Observatory at Barren Grounds provides residential and day trip educational opportunities for the general public, school groups and organisations. The observatory consists of a visitor information centre, wardens house a demountable classroom, a demountable accommodation building and the main accommodation

building, The Lodge. It is operated under a lease detailing activities and arrangements for any proposed works.

Provision of interpretive signs around the Barren Grounds nature trail, rather than the current system of numbered posts combined with a leaflet, is needed.

A considerable amount of illegal use occurs in Macquarie Pass National Park and to a lesser extent in Budderoo National Park, including bird trapping in the Clover Hill area, rubbish and car dumping, vandalism, rock and wood removal and use of recreational vehicles off public access tracks. Promotion of public appreciation of the values of these parks is an important part of reducing such activities.

## **Policy**

- \* Understanding and appreciation of the natural and cultural values of the parks and reserves by visitors and the local community will be promoted, in particular:
  - the geological sequence and geomorphology of the area;
  - the remnant nature of the rainforests and their high ecological values;
  - the value of the plateau and escarpment areas as habitat for rare and threatened plants and animals;
  - Aboriginal use of the area; and
  - the history of timber getting, agricultural and recreational use of the area.
- \* The Minnamurra Rainforest Centre will be promoted as the major visitor destination in the region for the understanding and appreciation of rainforest.
- \* Tourist use of Carrington Falls, the Cascades Picnic Area and Robertson Nature Reserve will be promoted. These areas will be used for encouragement of appreciation of the natural and cultural environment and promotion of conservation.
- \* Information will also be provided about other recreation facilities shown on the plan of management map by means of signposting and leaflets. Use of other tracks and areas will not be promoted.
- \* Robertson Nature Reserve and the Minnamurra Rainforest Centre will be used as focal areas for encouragement of on-going rainforest regeneration works on private land in the Robertson and Jamberoo areas.
- \* Promotional material and interpretive programs will be designed to promote care for the environment and hence assist management to protect natural and cultural heritage values.
- \* Information and interpretive material will be targeted to the range of visitors, including disabled and ethnic groups.
- \* Existing interpretive facilities will be maintained and will be improved as necessary.
- \* The Service supports continued operation of the Barren Grounds Bird Observatory. The need for the observatory to cover the costs of management and to undertake appropriate works or activities to achieve this is recognised. Use of the observatory will be in accordance with the following conditions:

- continuation of the purpose and style of use as set out in the 1988 lease for the observatory;
- minimisation of visual and other environmental impact;
- no major expansion of facilities or increase in accommodation capacity; and
- continued public access to the leased area.

### **Action**

- \* Small interpretive signs will be located along the Barren Grounds nature trail in place of the current numbered posts.

### **4.3.2 Recreation Opportunities**

Access to Robertson Nature Reserve, much of Macquarie Pass National Park and the Minnamurra Rainforest section of Budderoo is via sealed public roads. Short sections of unsealed road provide access to facilities in other sections of Budderoo National Park and in Barren Grounds Nature Reserve.

Current estimates of annual visitation to the four areas are 120 000 people at Budderoo (the majority at Minnamurra), 45 000 at Macquarie Pass National Park, 11 000 at Barren Grounds and 5 000 at Robertson Nature Reserve.

While provision for appropriate recreational use is a major purpose of national parks, nature reserves are managed primarily for protection of their scientific values. The only facility for visitor use in Robertson Nature reserve is the interpreted walking track. Barren Grounds offers limited but important recreation opportunities as described below.

#### **Barren Grounds Nature Reserve**

Barren Grounds provides basic facilities designed to enable visitors to enjoy its special environment. Day bus groups visit the reserve for walks, some conducted by the RAOU, and the area is also popular with family groups and others for walking and picnicking. A significant proportion of visitors undertake weekend courses at the RAOU Bird Observatory.

A picnic area near the reserve entrance provides tables, drinking water and pit toilets. The toilets at the picnic area overflow frequently because of the high water table. Firewood collection has affected natural values around the picnic area and wood fires will no longer be permitted.

Management tracks and some walking tracks provide opportunities for short, medium and long distance day walks across the plateau. Some of the tracks are suffering erosion, particularly the track to the Stone Bridge. The loop nature trail is poorly drained and commonly very wet. Upgrading of the fencing at the Illawarra Lookout is needed to ensure that it complies with modern safety standards.

Walkers are required to stay on formed tracks within the plateau area of the nature reserve to avoid creation of new routes through the dense heath and hence greater access through the area by foxes.

Some of the historic passes on the escarpment are used by walkers, principally the Drawing Room Rocks track and Hoddles track. These are steep, subject to erosion

and unsuitable for heavy use. Both tracks are quite well known, however, and will be maintained. An arrival point such as a sign is needed for the Hoddles Track at the base of the escarpment cliff to discourage walkers from continuing onto the plateau, with consequent erosion and other impacts. The area between the escarpment and Saddleback Trig is very important for ground parrots and eastern bristlebirds and is the largest relatively undisturbed area of their habitat in the reserve.

### **Budderoo National Park**

Most of the visitation to Budderoo National Park is to the Minnamurra Rainforest Centre (about 85 000 per year). The Rainforest Centre is managed by the Service as a business, with the aim of making operations self-funding over time. The centre is heavily used on weekends and on a high proportion of Sundays some visitors cannot gain entry because all car parking is in use. Any significant increase in car parking would, however, result in crowding and reduce visitor enjoyment. Options for a small increase in parking and additional bus parking for weekday group use are being explored. Increased parking near the visitor centre may require relocation of picnicking to the Kellys Cottage area because of the steep terrain and limited area available near the Visitor Centre. Installation of an effluent treatment system is being considered in conjunction with facility expansion, as the present pump-out system is expensive.

Most of the rest of the visitation to Budderoo National Park is to the Carrington Falls area. A low key picnic area, walking tracks to the Falls and swimming holes in the creeks are the attractions. This area provides a more isolated, natural setting and views than the nearby Fitzroy Falls and Belmore Falls areas in Morton National Park. Improvement of the toilet facilities adjacent to the picnic area is needed.

The Nellies Glen area on the northern side of the falls is very close to a primitive camping area in the adjacent Carrington Falls Reserve and informal walking tracks connect the two areas. It is important that the camping area and access be managed in a manner which avoids pollution or vegetation damage near the waterhole.

There are several old walking tracks and lookouts immediately south of the Carrington Falls picnic area and west of Nellies Glen, partly in the adjacent Carrington Falls Reserve. Some track sections are eroded and the lookout fences are not satisfactory by today's safety standards. These lookouts are not needed as good views can be obtained from several lookouts within the main development area.

Informal tracks around the top of the escarpment near Carrington Falls provide opportunities for medium distance walking. Because of limited funds for maintenance use of these tracks will not be promoted.

The other main recreational attractions in Budderoo National Park are Jamberoo Lookout and Gerringong Creek. Jamberoo Lookout contains a safety fence and area for carparking. Better delineation of the car park and provision of a seat would improve the area's appearance. Further fencing is needed to prevent car dumping over the escarpment near the lookout.

Access to Gerringong Creek is by foot along the Hersey Fire Trail. The area is an attractive destination for easy medium distance walking to a natural location with swimming holes and nearby falls. Provision of a dry path through a swampy area between the fire trail and the creek is needed. No other facilities will be provided in order to retain the area's natural character.

### **Macquarie Pass National Park**

The majority of visitors to Macquarie Pass National Park are probably tourists using the Cascades Picnic Area as a roadside stop. Recreation facilities in this area consist of

barbecues at the Cascades and Rivulet picnic areas (located on opposite sides of the highway) and a walking track along the creek at the Cascades area. Both areas are subject to damage by illegal vehicle use and vandalism of facilities. Redevelopment of the Cascades area and regular maintenance of both areas to establish an obvious management presence are needed, in order to minimise these activities and make the area more attractive for the general user.

The Glenview management track on the northern side of the highway is an attractive route for walking and for picnicking at a creek crossing approximately 1.5 km from the highway. Signposting is needed to make visitors aware of this opportunity.

Public vehicle access is presently available to the Clover Hill area in the southwestern part of Macquarie Pass National Park. The access road is located in a steep, wet area and is subject to frequent landslides. Facilities previously provided at the end of the road were destroyed by vandals. The area is very attractive, being set in moist forest beside a series of waterfalls in the Macquarie Rivulet and rimmed by cliffs. Because of high erodability and the presence of many small waterfalls the area would not be suitable for promotion of general public use unless extensive access control and facility development were undertaken. It is considered preferable to retain the attractive natural character of the area as an alternative to more developed locations such as Minnamurra. Closure of the entry road in the future will allow use for walking and walk-in camping, assist protection of the farm buildings (see 4.2.2) and any recreation facilities provided and reduce maintenance requirements on the road.

In order to provide for vehicle parking for visitors to Clover Hill, a parking area will be established in a clearing south of the highway opposite the Glenview Track, with walking access along a disused track which joins the Clover Hill Track. This will provide a single track head for the Glenview and Clover Hill Tracks in an attractive location for bush picnicking.

Some old tracks within the park are used occasionally by walkers. Because of limited funds the tracks will not be upgraded or their use promoted.

Leasing of Nurrewin as discussed in section 4.2.2 may involve provision of accommodation or day use facilities and hence improve opportunities for visitors to the park.

## **Camping**

Walk in camping is permitted within Budderoo and Macquarie Pass National Parks but is not permitted in the nature reserves because of their unsuitability and special management emphasis on protection of the natural environment.

Vehicle camping facilities are not provided in the parks and reserves because of the environmental impact and costs of development and management. Facilities are available nearby in Morton and Seven Mile Beach National Parks, the Bendeela area in Kangaroo Valley, Carrington Falls Reserve and a number of privately operated camping areas and accommodation centres.

## **Horseriding, Bicycling and Swimming**

Horseriding is not appropriate in the parks and reserves because of the high potential for erosion, introduction of weeds and conflicts with walkers.

Management tracks in Budderoo and Macquarie Pass are suitable for bicycle riding. Riding would cause erosion of management tracks in Barren Grounds, however, because of the poor drainage.

Swimming is not permitted in the Minnamurra Rainforest Centre because of the damage that would be caused to creek banks and the risk of pollution of the Minnamurra River by large numbers of swimmers. It is allowed in the remainder of Budderoo and in Macquarie Pass National Park.

### **Illawarra Escarpment Walking Track**

Establishment of a walking track along the length of the Illawarra Escarpment, partly through Macquarie Pass National Park, Barren Grounds and Budderoo has been proposed by the Illawarra Region of Councils and is being considered by the NPWS.

Proposals for construction of any new tracks or upgrading of existing tracks will require a thorough assessment of environmental impact, especially on the sensitive and very significant natural values of Barren Grounds Nature Reserve. In particular the effects of disturbance of populations of rare fauna, increased predation by foxes, the potential for track erosion and the risk of fire given the possibility of walkers camping along the track, will have to be considered. Camping will not be permitted in Barren Grounds Nature Reserve. The Service will require any such proposal to be placed on public exhibition.

### **Policy**

- \* Recreational use of the two nature reserves will be restricted to walking on formed and signposted tracks and low key picnicking in the Barren Grounds picnic area.
- \* Provision for recreational use of the national parks will be primarily for low key use which encourages appreciation of their natural and cultural heritage.
- \* The Minnamurra Rainforest Centre will be managed as a major visitor destination in a natural forest setting, providing a visitor centre, interpretive facilities, kiosk, picnic areas, parking and walking tracks.
- \* Other facilities in the national parks will continue to be provided as follows:
  - Carrington Falls - low key day use area in a natural setting with picnic facilities, car park, toilets, walking tracks and lookouts between the picnic area and the Kangaroo River, and a car park, toilets and walking access to Nellies Glen on the northern side of the river;
  - Cascades picnic area - car park, picnic facilities, toilets and walking track;
  - Rivulet picnic area - car park, barbecues;
  - Jamberoo Lookout - car park, safety fence, seat;
  - Gerringong Creek- walking access along Hersey Fire Trail and walking track from the fire trail to the creek;
  - Clover Hill - car parking at highway, walking access along walking track and management track, walk-in camping, barbecues and toilets if use warrants;
  - Glenview track - car parking at highway, walking access along management track to creek above Cascades.

- \* Recreation facilities such as picnicking facilities or walking tracks which may be required as part of future use of Nurrewin will be permitted in accordance with a lease.
- \* Walking tracks at Minnamurra Rainforest, Carrington Falls between the picnic area and the Kangaroo River, and Robertson Nature Reserve will be maintained to a high standard of surface.
- \* Other formal walking tracks will be maintained to the extent necessary to keep them clear of vegetation and control erosion.
- \* Walking tracks which are not marked on the plan maps will not be maintained or signposted, although erosion will be controlled where necessary.
- \* Walkers within the plateau area of Barren Grounds Nature Reserve, Robertson Nature Reserves and the Minnamurra Rainforest Area will be required to stay on formed tracks.
- \* The Illawarra Escarpment Walking Track, if established, will be permitted to pass through Budderoo and Macquarie Pass National Parks using existing tracks as far as possible. Any new tracks must be constructed using external funding and to appropriate standards to minimise maintenance requirements. Any location of the Walking Track in Barren Grounds Nature Reserve will be subject to assessment of environmental impacts and alternative routes.
- \* Walk-in camping will be permitted in Macquarie Pass and most of Budderoo National Park more than 1 km from any public vehicle access road. Walk-in camping will not be permitted within the Minnamurra Rainforest area or in the nature reserves.
- \* The Service will liaise with the Carrington Falls Reserve Trust regarding cooperative management of recreational use in the reserve and adjacent park areas.
- \* Public vehicle use within the parks and reserves will be permitted only on public access roads shown on the plan maps. These roads will be maintained to 2WD standard.
- \* Public use of the Clover Hill track will be permitted until it is closed upon vacation of the buildings at Clover Hill.
- \* Swimming will not be permitted in the Minnamurra Rainforest Centre.
- \* Horseriding will not be permitted within the parks and reserves.
- \* Bicycle riding will be permitted on public vehicle access roads and on management tracks within the national parks. It will not be permitted on management tracks in Barren Grounds Nature Reserve.
- \* Large groups visiting the parks or reserves will be required to book in advance. In particular, groups larger than 15 person will be required to register with the district office before visiting Barren Grounds Nature Reserve. Limits will apply to group sizes and numbers of groups to avoid environmental damage and overcrowding.
- \* Nature study and adventure programs by commercial, government and community organisations may be permitted in Macquarie Pass National Park

and in Budderoo National Park apart from the Minnamurra Rainforest Centre, subject to the other provisions of this plan and the following:

- no vehicle use of management tracks will be permitted;
- limits will be placed on group sizes, locations of activities and frequency of use to minimise environmental impacts and conflicts with other park users;
- use of minimum impact bushwalking and safe practices will be required;
- program leaders will be required to have adequate qualifications, experience and knowledge of the area;
- programs will be required to include interpretation of the environment and promotion of understanding of conservation requirements and minimum impact practices;
- prior notice will be provided to the Service of routes, activities, frequency, group sizes and any other information deemed necessary; and
- licences will be altered or revoked if unacceptable environmental impacts are found to occur.

\* Educational activities, including licenced commercial operations, may be permitted in Robertson and Barren Grounds Nature Reserves subject to the same requirements as listed in the policy above for Budderoo and Macquarie Pass National Parks.



## Action

- \* Options for provision of additional parking and picnicking at the Minnamurra Rainforest Centre and installation of an effluent treatment system will be investigated. Proposals will be placed on public display and the most appropriate will be implemented.
- \* A short all weather walking track will be formed from the end of the Hersey Fire Trail to Gerringong Creek. A destination and minimum impact bushwalking sign will be erected at the beginning of the fire trail.
- \* The toilets at the Carrington Falls picnic area will be upgraded.
- \* Old lookout fences south and west of the main Carrington Falls area will be removed and tracks to the lookouts will be rehabilitated to promote vegetation growth.
- \* Jamberoo Lookout will be improved by delineation of a car parking area, further fencing to prevent car dumping and provision of a seat.
- \* Upon vacation of the buildings at Clover Hill, the access road will be closed to public vehicle use. A small parking area will be constructed on the western side of the highway opposite the Glenview Track and a walking track joining to the Clover Hill Track will be established. If use warrants, toilets and barbecues will be constructed at Clover Hill.
- \* An information sign will be erected at the carpark for walkers using the Glenview Track and Clover Hill Track, including destination and minimum impact bushwalking information.
- \* The Cascades picnic area will be re-organised and improved by:
  - provision of a formal car parking area;
  - provision of a clear entrance and termination to the walking track;
  - landscaping to reduce the size of the grassed area and provide shade trees;
  - provision of toilets;
  - relocation of the barbecues to distribute them around the site in accordance with the landscaping; and
  - erection of an information shelter.
- \* Erosion control, including possible realignment, and maintenance will be undertaken as necessary on walking tracks, with high priority to the track to Stone Bridge in Barren Grounds Nature Reserve.
- \* Visitors to Barren Grounds will be advised by signposting that wood fires are not permitted in the reserve.
- \* The feasibility of relocation of the toilets at Barren Grounds picnic area or replacement with another type will be investigated.
- \* The Barren Grounds nature trail will be reconstructed to provide a dry track.

- \* The fencing at Illawarra Lookout in Barren Grounds will be upgraded and the access track from the Griffiths Fire Trail will be re-routed to go directly to the lookout.
- \* An arrival point such as a sign or small viewing platform will be constructed for the Hoddles Track below the escarpment, designed to discourage walkers from continuing up the escarpment.
- \* Information and track signposting in Barren Grounds Nature Reserve will be reviewed and upgraded to provide clear information about where people may walk, track distances, the prohibition on camping and the reasons why people must not walk through other sections of the reserve.

### **4.3.3 Research**

Ready access from Wollongong and the presence of the RAOU observatory at Barren Grounds have facilitated scientific research on a number of topics including heathland fire ecology, bird biology and plant pollination. Most of the research has been conducted by students at Wollongong University and wardens of the observatory. This has produced valuable information for determining management policies and programs. Research use can, however, affect ecological and scientific reference area values, lower recreation values and damage management tracks and must be managed.

Research topics considered important for management of the parks and reserves are listed in earlier sections of this plan of management.

### **Policy**

- \* The parks and reserves will continue to be made available for appropriate research.
- \* Manipulative research such as research involving scheduled burns will not be permitted in Robertson Nature Reserve and will not be permitted in the other areas unless it is in accordance with management objectives and programs.
- \* Vehicle use of management tracks by researchers will only be permitted if it can be demonstrated that the research cannot be undertaken elsewhere and that vehicle use is essential.
- \* Research structures and long term markers must be placed in locations which will minimise their visual impact and must be removed upon completion of the research.
- \* Researchers will be encouraged to design programs to provide information directly useful for management purposes.
- \* Close liaison will be maintained with researchers to obtain as much mutual information and assistance as possible. The results of research will be required to be provided to park managers.
- \* Research topics likely to provide information useful for management will be promoted to Wollongong University and other appropriate institutions.

### **Action**

- \* An inventory will be kept of research undertaken in the four areas.

#### **4.3.4 Management Operations**

Service management facilities within the parks and reserves consist of office and workshop facilities at the Minnamurra Rainforest Centre, management tracks, a radio transmitter at Knights Hill, a weather station at Barren Grounds and two staff residences (Nurrewin and a cottage near the Minnamurra Rainforest Centre).

As stated in section 4.2.2, occupation of Nurrewin is essential for its protection and leasing will be invited in order to finance its conservation. If this is not successful it will continue to be used as a staff residence.

The cottage at Minnamurra may be used as a residence to provide security for the Rainforest Centre.

Management tracks within Barren Grounds have high maintenance needs because of the poor drainage over much of the area. The tracks should be used as little as possible.

Management facilities operated by other authorities within the parks and reserves include a trigonometrical station and a rain gauge within Barren grounds, a rain gauge at Clover Hill, a storage shed at Nurrewin and several trigonometrical stations in Budderoo.

Macquarie Pass National Park is crossed by a powerline along its northern side. A power line also crosses the northern edge of Barren Grounds. Arrangements for maintenance of the lines in a manner which minimises clearing have been made with Illawarra Electricity.

Access to neighbouring properties at the eastern end of Macquarie Pass National Park takes place via the Glenview and Rivulet management tracks. Inholdings within Budderoo National Park are accessed by public roads.

#### **Policy**

- \* Existing Service management facilities will be maintained. Minor additional facilities may be established where necessary.
- \* Only essential works, facilities and operations by other authorities and individuals will be permitted unless they are consistent with the provisions of this plan.
- \* Facilities maintained by other authorities will be required to be subject to licences detailing measures to minimise the environmental impact of the facilities and works associated with them.

#### **Action**

- \* Licences will be arranged for facilities maintained by other authorities and for access to neighbouring properties through Macquarie Pass National Park, where no existing formal agreement exists.

## 5. PLAN IMPLEMENTATION

This plan of management is part of a system of management developed by the National Parks and Wildlife Service. The system includes the National Parks and Wildlife Act, management policies, established conservation and recreation philosophies, and strategic planning at corporate, Regional and District levels.

The implementation of this plan will be undertaken within the annual programs of the Service's Nowra District. Priorities, determined in the context of district and regional strategic planning, will be subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister.

District programs are subject to on-going review, within which, works and other activities carried out at Budderoo National Park, Macquarie Pass National Park, Barren Grounds Nature Reserve and Robertson Nature Reserve are evaluated in relation to the objectives laid out in this plan.

The environmental impact of all development proposals will continue to be assessed at all stages of the development and any necessary investigations undertaken in accordance with established environmental assessment procedures.

Section 81 of the Act requires that this plan shall be carried out and given effect to, and that no operations shall be undertaken in relation to the parks or reserves unless they are in accordance with the plan. However, if after adequate investigation, operations not included in the plan are found to be justified, this plan may be amended in accordance with section 75(7) and 76(6) of the Act.

As a guide to the orderly implementation of this plan, relative priorities for identified activities are summarised below:

Activity	Plan ref
<b>HIGH PRIORITY</b>	
<b>Budderoo</b>	
* Undertake rehabilitation of disturbed area at Gerringong Falls	4.1.1
* Install water treatment system at Minnamurra RFC	4.1.2
* Survey and conserve <i>Irenepharsus trypherus</i>	4.1.2
* Seek cooperative management of <i>Grevillea rivularis</i> with Carrington Falls Reserve Trust	4.1.2
<b>Barren Grounds</b>	
* Undertake erosion control on walking tracks with highest priority to the track to Stone Bridge	4.3.2
* Advise by signposting that woodfires are not permitted in Barren Grounds	4.3.2
<b>All areas</b>	
* Control goats, foxes and feral cats	4.1.3

- \* Prepare annual fire management works programs 4.1.4

## **MEDIUM PRIORITY**

### **Macquarie Pass**

- \* Prepare fire management plan 4.1.4
- \* Extend Nurrewin conservation planning and implement 4.2.2
- \* Improve Cascades picnic area 4.3.2

### **Barren Grounds/Budderoo**

- \* Monitor ground parrot and bristlebird populations and their response to fire 4.1.3
- \* Prepare fire management plan 4.1.4
- \* Monitor impact of fire on vegetation structure and species 4.1.4

### **Budderoo**

- \* Seek addition or management of Carrington Falls Reserve 4.1.2
- \* Interpret Carrington Falls axe grinding grooves 4.2.1
- \* Prepare and implement conservation plan for Kellys Hut 4.2.2
- \* Investigate options for additional parking, picnicking and effluent treatment at Minnamurra RFC 4.3.2
- \* Improve walking track to Gerringong Creek 4.3.2
- \* Remove old lookouts and close tracks at Carrington Falls 4.3.2

### **Barren Grounds**

- \* Reconstruct Barren Grounds nature trail and erect signs 4.3.1 4.3.2
- \* Investigate options for Barren Grounds toilets 4.3.2
- \* Upgrade Illawarra Lookout and re-route track 4.3.2
- \* Improve track signposting in Barren Grounds 4.3.2

### **All areas**

- \* Prepare and implement weed survey and control program 4.1.2
- \* Investigate management needs of rare frogs 4.1.3
- \* Record historic places 4.2.2
- \* Keep inventory of research 4.3.3

**LOW PRIORITY****Macquarie Pass**

- \* Monitor and assist regeneration at Clover Hill and eastern end of park 4.1.2
- \* Seek expressions of interest for leasing Nurrewin 4.2.2
- \* Assess significance of Clover Hill structures 4.2.2
- \* Gate Clover Hill track, construct car park and walking track 4.3.2
- \* Erect Clover Hill and Glenview information sign 4.3.2

**Budderoo**

- \* Monitor and assist regeneration at Knights Hill 4.1.2
- \* Survey historic structures in Minnamurra Rainforest area 4.2.2
- \* Improve Jamberoo lookout 4.3.2
- \* Upgrade Carrington Falls toilets 4.3.2

**Barren Grounds**

- \* Prepare conservation plan for Aboriginal art site complex 4.2.1
- \* Construct arrival point below escarpment for Hoddles Track 4.3.2

**All areas**

- \* Arrange licences for alien facilities 4.3.4

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