# Kwiambal National Park and Ashford Caves Crown Reserve

# Draft Plan of Management

**NSW National Parks and Wildlife Service**

**March 2004**

## Acknowledgments

This plan of management was prepared by staff of the Northern Tablelands Region of the Parks Service Division of the Department of Environment and Conservation (referred to as the National Parks and Wildlife Service, or NPWS, in this document), with the assistance of staff from the Northern Directorate Planning Group.

NPWS specialists, the Northern Tablelands Regional Advisory Committee and members of the public provided valuable information and comments.

NPWS would like to thank all those who attended the field day and workshop, and those who took the time to complete and submit the Kwiambal National Park Draft Plan of Management 'Comments Form'. Comments received were considered in the preparation of this draft Plan of Management. NPWS acknowledges the valuable contribution these comments made to the planning process.

For additional information or enquires about any aspect of the plan, contact the NPWS Tenterfield Office, 10 Miles St, Tenterfield or by phone on (02) 67364298.

**NSW National Parks and Wildlife Service**



**ISBN 0 7313 6586 0**

# INVITATION TO COMMENT

The *National Parks and Wildlife Act 1974*, requires that a plan of management be prepared for each area it manages. 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 draft plan is placed on public exhibition for at least 90 days and any person may comment on it;
- The plan and all submissions received on the plan are referred to the Regional Advisory Committee for consideration;
- The plan, submissions and any advice from the Regional Advisory Committee are referred to the National Parks and Wildlife Advisory Council for consideration;
- The recommendations of the Advisory Council are referred to the Minister for the Environment, and a copy referred to the Regional Advisory Committee;
- After considering the submissions, the recommendations of the Advisory Council and any advice from the Regional Advisory Committee, the Minister may adopt the plan or may refer the plan back to the NPWS and Council for further consideration.

Once a plan has been adopted by the Minister, no operations may be undertaken within the planning area except in accordance with the plan.

Members of the public, whether as individuals or as members of community interest-groups, are invited to comment on this plan of management. Submissions should be in writing, and as detailed and specific as possible; however any comments, no matter how brief, are welcome. Comments should be forwarded to:

**The Planner – Kwiambal National Park**
**National Parks and Wildlife Service**
**Tenterfield Area Office**
**10 Miles St**
**Tenterfield NSW 2372**

**The closing date for comments on the plan is Monday 28 June 2004.**

All submissions received by NPWS are a matter of public record and are available for public inspection upon request to NPWS. Your comments on this draft plan of management may contain information that is defined as “personal information” under the NSW *Privacy and Personal Information Protection Act 1998*. The submission of personal information with your comments is voluntary.

# CONTENTS

**page**

# 1. MANAGEMENT CONTEXT

## 1.1 LEGISLATIVE AND POLICY FRAMEWORK

The management of national parks and karst conservation reserves in New South Wales (NSW) is in the context of a legislative and policy framework, primarily the *National Parks and Wildlife Act 1974* (*NPW Act*), the *Threatened Species Conservation Act 1995 (TSC Act*) and the policies of the National Parks and Wildlife Service (NPWS). Section 72AA of the NPW Act lists the matters to be considered in preparation of a plan of management. The policies are compiled from the legislative background, the NPW Regulations and internationally accepted principles of park and reserve management. They relate to nature conservation, Aboriginal and historic heritage conservation, recreation, commercial use, research and communication.

Other legislation, international agreements and charters may also apply to management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) requires the assessment and mitigation of environmental impacts of any works proposed in this plan.

The plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within the planning area except in accordance with the plan. The plan will also apply to any future additions to the planning area. Where management strategies or works are proposed for the planning area or any additions that are not consistent with the plan, an amendment to the plan will be required.

This plan of management will apply to Ashford Caves Crown Reserve once it is reserved as a protected area under the NPW Act (refer to section 1.2).

## 1.2 MANAGEMENT PURPOSES AND PRINCIPLES

National parks are reserved under the NPW Act to protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor use.

Under the Act, national parks are managed to:

- conserve biodiversity, maintain ecosystem functions, protect geological and geomorphological features and natural phenomena and maintain natural landscapes;
- conserve places, objects, features and landscapes of cultural value;
- protect the ecological integrity of one or more ecosystems for present and future generations;
- promote public appreciation and understanding of the park's natural and cultural values;
- provide for sustainable visitor use and enjoyment that is compatible with conservation of natural and cultural values;

- provide for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to conservation of natural and cultural values; and
- provide for appropriate research and monitoring.

The tenure for Ashford Caves is currently a Crown Reserve but it is proposed that the tenure will be changed to either a karst conservation reserve or alternatively added to Kwiambal National Park. Karst conservation reserves are subject to the same legislative context as national parks (refer to section 1.1)

Karst conservation reserves are dedicated under the NPW Act to identify, protect and conserve areas, including subterranean land, containing outstanding or representative examples of karst landforms and natural phenomena.

Under the Act, karst conservation reserves are to be managed to:

- conserve the karst environment, including the protection of catchment values, such as hydrological processes and water quality,
- conserve cultural values,
- protect natural water movement and air movement regimes and processes within the karst environment,
- conserve biodiversity, the maintenance of ecosystem function, the protection of the geological and geomorphological features and natural phenomena and the maintenance of natural landscapes, cave formations and fossil deposits,
- provide for research and monitoring,
- promote public appreciation and understanding of the karst conservation reserve's natural and cultural values,
- provide for sustainable visitor use and enjoyment that is compatible with the karst conservation reserve's natural and cultural values, and
- provide for sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to the conservation of the karst conservation reserve's natural and cultural values.

# 2. KWIAMBAL NATIONAL PARK & ASHFORD CAVES CROWN RESERVE

## 2.1 LOCATION, GAZETTAL AND REGIONAL SETTING

Kwiambal National Park (referred to as “the park” in this document) and Ashford Caves Crown Reserve (referred to as “the reserve”) are located on the north-west slopes of NSW, approximately 30 km north-west of Ashford and 90 km north of Inverell. The reserve is 1.5 km south of the park (see the map). An area of 2118 ha adjoining the southern boundary of the park has been acquired by NPWS but is yet to be gazetted as part of the park. All references to “the park” in this plan include the lands acquired but not yet gazetted as national park. Collectively the park, reserve and lands acquired are referred to as “the planning area” in this document.

Kwiambal National Park was dedicated in April 2000 and has an area of 1301 ha at the junction of the Macintyre and Severn Rivers. It consists of former crown reserves and private land purchased by NPWS.

Ashford Caves Crown Reserve covers 15 ha and is in the process of being reserved as a protected area under the NPW Act. The class of protected area chosen could be an addition to the national park or as a separate karst conservation reserve. This plan treats Ashford Caves Crown Reserve as though its tenure were a protected area under the NPW Act rather than a Crown Reserve. When Ashford Caves Crown Reserve is reserved as either national park or karst conservation reserve it will be managed under the provisions of the NPW Act and in accordance with this plan.

The planning area is located within the traditional area of the Kwiambal (pronounced Kigh-am-bal) Aboriginal people of the Ashford district and is in the Inverell Shire local government area.

The junction of the Severn and Macintyre Rivers forms the north-western corner of the park and both rivers delineate most of the north and western boundaries. Severn State Forest lies on the northern and north-western boundary of the park and an additional area of State Forest land occurs along the southern border of the park. All other boundaries are freehold and/or leasehold.

The park is situated in the Northern Complex Province of the Nandewar Biogeographical Region, which is poorly represented in the current protected area estate. The planning area forms part of one of the largest areas of remnant woodlands on the north-west slopes of NSW. Nearby reserves include Arakoola Nature Reserve, Taringa Nature Reserve, Severn River Nature Reserve and Kings Plains National Park.

## 2.2 LANDSCAPE CONTEXT

Natural and cultural heritage and on-going use are strongly inter-related and together form the landscape of an area. Much of the Australian environment has been influenced by past Aboriginal and non-Aboriginal land use practices, and the activities of modern day Australians continue to influence bushland through

recreational use, cultural practices, the presence of introduced plants and animals and in some cases air and water pollution.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how it has been used by humans. Rich in water, food and materials, the area provided a year-round living for the Kwiambal Aboriginal people before European settlement. Europeans initially used the area for sheep and cattle grazing along with growing cereal crops, however tobacco growing, on the flats of the Severn and Macintyre Rivers, became the largest industry in the area. Selective logging occurred throughout most of the planning area. Gauno mining occurred sporadically at Ashford Caves. Prior to the dedication of the park, tourism was focussed on Macintyre Falls and the limestone caves, where basic facilities were developed by the local council and the Ashford Lions Club.

Both Aboriginal and non-Aboriginal people place cultural values on natural areas, including aesthetic, social, spiritual, recreational and other values. Cultural values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness, natural and cultural heritage, non-human threats and on-going use are dealt with individually, but their inter-relationships are recognised.

# 3. KEY VALUES AND MANAGEMENT DIRECTION

## 3.1 SIGNIFICANCE OF THE PLANNING AREA

Kwiambal National Park and Ashford Caves Crown Reserve protect an outstanding diversity of ecosystems that contain unique vegetation communities, significant plant and animal species, all in a spectacular geological landscape with a rich Aboriginal and European history. The key values of the area are summarised below.

**Natural values** include:

- diverse plant communities, including significant patches of dry rainforest and white cypress-pine woodlands, that are poorly represented in the current reserve network.
- caves that provide important habitat for rare cave fauna, particularly a viable population of the large bent-wing bat (*Miniopterus schreibersii*) – listed under the *Threatened Species Conservation Act 1995*, and the eastern horseshoe bat (*Rhinolophus megaphyllus*).
- a large number of rare or threatened plant and animal species.
- placement within one of the largest areas of remnant woodlands on the north-west slopes of NSW.

Significant **scenic values** include:

- long river frontage along the Severn and Macintyre rivers.
- spectacular river gorges, including Macintyre Falls and the Severn River Falls.
- huge granite boulders and a rolling landscape of rugged hills.
- karst features at the caves, and related geomorphological processes.

Key **cultural heritage values** include:

- a diversity of Aboriginal sites and places, contributing towards understanding of Aboriginal culture along the lower reaches of the Macintyre and Severn Rivers, as well as on adjoining slopes and ridges.

Major **recreation and tourism values** include:

- easily accessible lookouts, walking tracks and associated facilities at Macintyre Falls Picnic Area.
- camping at Lemon Tree Flat Camping Area, on the Severn River.
- swimming and fishing in the Severn and Macintyre Rivers.

**Research and educational values** include:

- geological processes, diverse and significant plant and animal communities, cultural features and a variety of management issues provide numerous opportunities for research.
- the cave system is an important resource for education and interpretation of micro-bats, karst resources and their associated ecosystems.
- bone breccias and sediment deposits in the caves have a high potential for providing information on past environmental changes, and changes in the faunal composition of the area.

- community education regarding woodland and riverine communities and their importance.

## 3.2 MANAGEMENT DIRECTION FOR THE PLANNING AREA

The planning area will be managed to protect its natural and cultural heritage values while providing opportunities for ecologically sustainable public use. Strategies and programs to protect, and where necessary restore, the natural and cultural values of the planning area include:

- Manage the planning area as an interrelated reserve system;
- Control, and where possible eradicate, introduced plant and animal species;
- Protect and monitor threatened and biogeographically significant species and communities;
- Protect cultural heritage sites;
- Involve Aboriginal people in the management of cultural heritage values;
- Protect water catchment values;
- Implement fire regimes designed to maintain the diversity of vegetation communities;
- Engender greater public awareness and appreciation for the values and management of the planning area;
- Manage visitor use in an ecologically sustainable manner; and
- Maintain a good working relationship with neighbours so as to enhance the protection and viability of the planning area.

Public 2WD vehicle access will be maintained to key visitor facilities, including Macintyre Falls Picnic Area, Lemon Tree Flat Camping Area and the Limestone Caves Picnic Area. High quality interpretive information will be provided at key visitor nodes to encourage appreciation of the high conservation values of the planning area and understanding of their important place in the regional landscape. Minimal impact recreation practices will be encouraged.

The management of weeds, pests and fire is a core management philosophy in the planning area.

# 4. CONSERVATION OF NATURAL AND CULTURAL HERITAGE

## 4.1 GEOLOGY AND LANDFORM

There are four major rock types within the planning area – metabasalts (5%), limestones (3%), greywackes (Texas Bed sediments: 16%) and granites (76%). These rocks have been variously metamorphised, deformed, mineralised and altered (Hunter, 1998).

The landscape of the planning area is rugged, with low rocky ridges and hills interspersed with small undulating areas of deeper soils in gullies or on plateaus (Roberts, 1982). Elevation ranges between 300m and 500m above sea level. The Macintyre and Severn Rivers have formed steep-sided gorges in their lower sections within the park and contain a number of waterfalls including Macintyre Falls and Severn River Falls.

The Ashford Caves Crown Reserve is part of a limestone outcrop which occurs for about ten kilometres along Limestone Creek. A karst region is comprised substantially of soluble rocks, such as limestone or dolomite, and is characterised by landforms produced by solution, abrasion or collapse and/or by underground drainage. The limestone in the reserve is of Devonian to Permian age (Lishmund et al., 1986), and weathering of limestone during the Tertiary produced karst features (caves and rillen karst) and alluvial deposits (Hunter, 1998).

The Australian Speleological Federation (1985) lists four caves in the limestone outcrop, the main cave (part of the reserve) and three other small caves occurring on private property. The main cave has six entrances and approximately 560m of passage. The main entrance was highly modified to allow for the extraction of guano between 1916 and the 1960s. The cave is poorly endowed with ornamentation and, as a result of extensive guano mining, only a few areas of undisturbed cave sediment remain. The hill above the cave exhibits a number of interesting karst features (Harrison, 1999).

In 1997 the World Commission on Protected Areas, a commission of the World Conservation Union, produced Guidelines for Cave and Karst Protection (Watson *et al.*, 1997). These guidelines were developed to increase awareness of cave and karst protection issues and the special management considerations essential for the protection of cave and karst areas. They were designed to provide a guide for planners, managers and users of karst. This plan of management is based on the World Conservation Union guidelines, although not all are specifically mentioned and some strategies have been modified where appropriate to better apply to the management of Ashford Caves Crown Reserve.

### Desired Outcomes

- Geological and landscape values of the planning area are protected.

**Strategies**

- *Visitor facilities and management infrastructure will be located and designed so as to minimise their visual and environmental impact.*

- *The Guidelines for Cave and Karst Protection (Watson et al., 1997) will guide the management of karst areas in the reserve.*

## 4.2 NATIVE PLANTS

The vegetation of the park has been mapped into eight communities: mixed stands (or 'dry rainforest'); granite woodlands; metasediment woodlands; riverine woodlands, metabasalt woodlands; granite open woodlands, limestone woodlands; and alluvial woodlands (Hunter, 1998). A total of 407 plant species have been recorded, however white cypress pine (*Callitris glaucophylla*), silver-leaved ironbark (*Eucalyptus melanophloia*) and tumbledown gum (*E. dealbata*) dominate the majority of the communities.

Five rare or threatened plant (ROTAP) species, classified as nationally significant by Briggs and Leigh (1996) have been recorded in the planning area. These include; Severn wattle *(Acacia williamsiana*); Rodd's star hair (*Astrotricha roddii*); caustic vine (*Euphorbia sarcostemmoides*); daisy bush (*Olearia gravis*), and toadflax (*Thesium australe*). The NPWS recognises that ROTAP species have high conservation significance, and warrant specific management considerations to ensure their protection.

Rod's star hair, caustic vine and toadflax are also listed on the *Threatened Species Conservation Act 1995* (TSC Act). These species require special management consideration to promote the recovery of their populations. Under the provisions of the *TSC Act,* recovery plans must be prepared for all threatened species. Recovery plans outline specific management actions to promote the recovery of threatened species populations. These plans are progressively being prepared and will be used to guide management of threatened species in the area.

Most of the planning area has been subjected to logging. It appears to have begun around 1900 and re-logging occurred in the 1940's, 1950's and in some areas the 1980's. Clearing for grazing and tobacco are the other main historical disturbances in the planning area. Most of these areas will regenerate naturally with time, however the former tobacco field adjacent to the Macintyre River was cropped intensively for a period of 25 years and will require revegetation. A revegetation plan has been prepared for this former tobacco field. The most efficient way to revegetate the area would be to undertake a direct seeding program, however, such a program would require considerable funding. An alternative strategy involves planting-out seedlings over smaller areas. This approach, although labour intensive, provides an opportunity to involve students from local schools, as well as Commonwealth Government initiatives such as Green Corps. There may be a chemical residue in the soils where tobacco was grown, as there is usually a heavy use of chemicals in tobacco crops. Any chemical residue will need to be considered in the revegetation of the area.

**Desired Outcomes**

- The full range of native plant species found in the planning area is conserved, including the habitat and populations of all significant plant species.

- The diversity, structure and habitat values of native vegetation communities are conserved and restored where subject to past disturbance.

- The former tobacco field is revegetated using locally indigenous species.

- Increased knowledge is gained of the ecological requirements of vegetation communities, and particularly rare or threatened species.

**Strategies**

- *Rehabilitate the tobacco field along the Macintyre River using locally indigenous species. Continue to seek funding for a direct seeding program, but in the interim continue with the existing tree planting program. Seek to involve students from local schools, as well as Commonwealth Government initiatives such as Green Corps.*

- *Encourage the natural revegetation of other disturbed areas and take steps to assist revegetation using locally indigenous species, where needed.*

- *Introduce a program to monitor the status of the significant communities and threatened plant species and to evaluate the success of management programs.*

- *Ensure that all staff and/or contractors working in the planning area are aware of the location of significant plant species or communities, and that any works do not impact upon these species.*

- *Ensure that facilities for, and activities by, park management and visitors do not impact on rare or threatened plant species.*

## 4.3 NATIVE ANIMALS

The vegetation communities of the planning area, together with riparian areas, rock outcrops and overhangs, provide habitat for a diverse range of native animals. A vertebrate fauna survey has identified 101 birds, 32 reptiles, 11 frogs and 30 mammals (Spark, 1998). Ten of these species are listed as vulnerable under the *TSC Act* and the habitat is predicted to be suitable for a further eighteen threatened species (refer to table 1).

The cave system, although heavily disturbed due to past activities, provides important habitat for cave dwelling fauna, particularly the large bent-wing bat (*Miniopterus schreibersii*) and the eastern horseshoe bat (*Rhinolophus megaphyllus*). Dwyer (1966) describes the caves as a maternity site for the eastern horseshoe bat. Richards (1979) also described the caves as a maternity site for the

little cave bat (*Eptesicus pumulis*), however, following taxonomic revision of this species, Spate (1994) believes the species to have been the eastern cave bat *(Vespadelus troughtoni)*, which roosts in small caves and is known to be very elusive. In 1997 two female lactating eastern horseshoe bats were trapped (Spark, 1998). Further research is needed to determine whether the eastern horseshoe bat and eastern cave bat continue to use the caves as a maternity site.

A healthy population of large bent-wing bats has been recorded by Spate (1994) and Spark (1998), however, the status of the species in the caves and impacts from current visitor pressures are not known. Dwyer (1966) describes an increase in numbers of this species in the caves during autumn, and found that the colony persisted through the year with relative permanence through April to mid June. He assumed that the cave was important for mating and/or a transient roost for colonies of adult females *en route* to maternity colonies (Dywer, 1966).

Cave bats are sensitive to human disturbance at anytime, however there are two periods when cave bats need as little disturbance as possible (Spate, 1994). Broadly these are the summer when there is the birth and rearing of young and late autumn, winter and early spring when the populations will be under stress due to lower temperatures and possible food shortages (Hall, 1982).

Sixteen taxa of invertebrate cave fauna have been recorded within the reserve caves (Eberhard and Spate, 1995). Moore (1964) described a new endemic species of beetle, *Speotarus princeps*, belonging to the subfamily *Lebiinae*, which has never previously been found in caves. It is unknown if the species is still present. The amount of disturbance that occurs as a result of visitation and from past guano mining has either reduced the amount of habitat available for invertebrates or substantially altered it (Spate, 1994).

All records of native animals are collected and stored on the NSW Wildlife Atlas, a state-wide data base established by NPWS.

NPWS is required by the *TSC Act* to prepare and implement recovery plans for all listed threatened species. These are progressively being prepared and will be used to guide management of threatened species in the area.

**Table 1. Threatened species known or predicted to occur in the planning area**

| Common Name | Scientific Name | Status under the TSC Act |
|---|---|---|
| **Recorded in the planning area** | | |
| **Mammals** | | |
| Koala | *Phascolarctos cinereus* | Vulnerable |
| Squirrel glider | *Petaurus norfolcensis* | Vulnerable |
| Large bent-wing bat | *Miniopterus schreibersii* | Vulnerable |
| Greater longeared bat | *Nyctophilus timoriensis* | Vulnerable |
| Little pied bat | *Chalinolobus picatus* | Vulnerable |
| Yellow-bellied sheathtail bat | *Saccolaimus flaviventris* | Vulnerable |
| **Birds** | | |
| Turquoise parrot | *Neophema pulchella* | Vulnerable |
| Speckled warbler | *Chthonicola sagittata* | Vulnerable |
| Grey-crowned babbler | *Pomatostomus temporalis* | Vulnerable |
| Brown treecreeper | *Climacteris picumnus* | Vulnerable |
| **Expected to occur in the planning area** | | |
| **Mammals** | | |
| Large-footed myotis | *Myotis adversus* | Vulnerable |
| Great pipistrelle | *Falsistrellus tasmaniensis* | Vulnerable |
| Large-eared pied bat | *Chalinolobus dwyeri* | Vulnerable |
| Eastern cave bat | *Vespadelus troughtoni* | Vulnerable |
| **Birds** | | |
| Painted honeyeater | *Grantiella picta* | Vulnerable |
| Square-tailed kite | *Lophoictinia isura* | Vulnerable |
| Glossy black-cockatoo | *Calyptorhynchus lathami* | Vulnerable |
| Barking owl | *Ninox connivens* | Vulnerable |
| Regent honeyeater | *Xanthomyza phrygia* | Endangered |
| Black throated finch | *Poephila cincta* | Endangered |
| Bush stone-curlew | *Burhinus grallarius* | Endangered |
| Hooded robin | *Melanodryas cucullata* | Vulnerable |
| Black-chinned honeyeater | *Melithreptus gularis* | Vulnerable |
| Diamond firetail | *Stagonopleura guttata* | Vulnerable |
| **Reptiles** | | |
| Border thick-tailed gecko | *Underwoodisaurus sphyrurus* | Vulnerable |
| Five-clawed worm skink | *Anomalopus mackayi* | Endangered |
| Pale headed snake | *Hoplocephalus bitorquatus* | Vulnerable |
| Murray Turtle | *Emydura macquarii* | Vulnerable |

Spark (1998) recommended that additional fauna surveys be undertaken in the planning area when the silver-leaved ironbark (*Eucalyptus melanophloia*) and white box (*E. albens*) are flowering to identify migratory bird species that may seasonally utilise the area. An autumn survey for reptiles and amphibians would also maximise the opportunity of detecting species that were not detected during the early summer survey conducted by Spark (1998).

**Desired Outcomes**

- The full range of native fauna found in the planning area is conserved.
- The habitat and populations of all threatened fauna species and biogeographically significant species are protected and maintained.

**Strategies**

- *Protect the habitats of threatened and biogeographically significant fauna species from impacts of visitor, introduced species and inappropriate fire regimes.*
- *Determine the status of cave bats at Ashford Caves, and whether the site is still used by maternity colonies.*
- *Develop a cave management plan and visitor use strategy to ensure ongoing protection of cave bats.*
- *If considered necessary to protect the bats and cave environment, visitor access to the cave may be controlled, which is most likely during critical periods in the bats breeding cycle.*
- *Provide information on the bats and cave access requirements at the reserve (refer to section 5.1).*
- *Encourage further research into the status and management of invertebrates at the caves.*
- *Continue to record the distribution of threatened and significant fauna species in the planning area.*
- *Undertake targeted surveys for threatened species likely to occur in the planning area.*
- *Undertake additional fauna surveys when the silver-leaved ironbark and white box are flowering so as to identify migratory bird species.*
- *Undertake an autumn survey for reptiles and amphibians.*

## 4.4 PALAEONTOLOGY

At Ashford Caves Crown Reserve there at least four types and ages of cave fill, including small volumes of bone and limestone breccia beds preserved at a high level in the entrances to parts of the cave system (Harrison, 1999). Vertebrate fossils in this material have been examined by several individuals who identified thirty-two species, including some extinct taxa (Spate, 1994). The age of this material is unknown but the deposit is palaeontologically significant in that it lies geographically between better known late Tertiary and Quaternary vertebrate fossil

deposits at Wellington, NSW, and Darling Downs and Riversleigh in Queensland (Harrison, 1999). Research into bone breccias and sediment deposits in the caves have a high potential for providing information on past environmental changes, and changes in the faunal composition of the area.

**Desired Outcomes**

- Palaeontogical values, including bone deposits and sub-fossils, are protected from human disturbance unless for authorised scientific purposes.

**Strategies**

- *Encourage research into the bone deposits and cave sediments.*

- *Visitor access may be controlled if necessary to prevent the removal of bone deposits and other material from the caves.*

## 4.5 ABORIGINAL HERITAGE

The land and water biodiversity values within a landscape are central to Aboriginal spirituality and contribute to Aboriginal identity. Aboriginal communities associate natural resources with the use and enjoyment of foods and medicines, caring for the land, passing on cultural knowledge and strengthening social bonds. Aboriginal heritage and nature are inseparable from each other and need to be managed in an integrated manner across the landscape.

The planning area is in the traditional lands of the Kwiambal (pronounced Kigh-am-bal) Aboriginal people of the Ashford district. Rich in water, food and materials, the area provided a year-round living for their ancestors.

The junction of the Macintyre and Severn Rivers served as a common boundary for several Aboriginal groups. Neighbours to the Kwiambal people are the Marbul to the north-east, the Ngarrabul to the south-east, the Jukumbal to the south, the Weraerai to the west and the Bigambul and Ginniebal to the north-west.

The NPWS has legal responsibility for the protection of Aboriginal sites and acknowledges the right of Aboriginal people to be part of the decisions about their own heritage. Consultation has traditionally occurred with local Aboriginal people through Local Aboriginal Land Councils. The planning area falls within both the Ashford and Toomelah Local Aboriginal Land Councils.

A survey for Aboriginal sites in Kwiambal National Park identified fifty-five (55) Aboriginal sites, including open camp sites (artefact scatters), a scarred tree, an art site, and isolated finds and rock shelters with potential archaeological deposit. Ashford and Toomelah Local Aboriginal Land Councils were involved in the survey and the development of management recommendations regarding Aboriginal sites in the planning area (Gay, 2000).

**Desired Outcomes**

- Aboriginal cultural values associated with the area are recognised, protected and presented appropriately in partnership with the local Aboriginal people.

- The broader community has an understanding of the cultural importance of the planning area to local Aboriginal people.

- The recommendations in the 'Survey for Aboriginal Sites, Kwiambal National Park' report are observed in the future management of the planning area.

**Strategies**

- *Manage Aboriginal heritage in consultation with the Ashford and Toomelah Local Aboriginal Land Councils and other relevant local Aboriginal people.*

- *Ensure that visitor facilities are not located so as to adversely impact on known Aboriginal sites and places of significance.*

- *Undertake an archaeological survey and cultural assessment prior to all new works with the potential to impact on Aboriginal sites and places. On-going maintenance of existing infrastructure, where the land has already been disturbed, is exempted from this provided the works are confined only to previously disturbed areas (eg the grading of existing road and trail surfaces).*

- *The location of Aboriginal sites and places will not be publicised except with the agreement of relevant Aboriginal people. Prior to any promotion of a site or place, prepare a conservation study and undertake any management work necessary to protect the site or place.*

- *Interpretative and educational material about the cultural heritage of the planning area will be developed in collaboration with relevant people and organisations, including local Aboriginal people.*

- *Aboriginal people with a connection to the park will be permitted to carry out activities in the park related to maintenance of traditional links to country. Any such activities must comply with the objectives and policies of this plan of management, the NPW Act and Regulations, and have minimal environmental impact.*

## 4.6 HISTORIC HERITAGE

Ashford, 30 km south-east of the planning area, was dedicated as a village in 1860, however settlers had arrived in the area prior to 1830 (this was before the first settler arrived at Inverell) (Hunter, 1998). Explorer and botanist, Allan Cunningham rode through the area in 1827 and found a squatter's shack and cattle in this supposedly unexplored region (McMinn, 1970). An 1848 map of Inverell district squatting

stations shows that the grazing properties ‘Eena’, ‘Frazers Creek’ and ‘Wallangra’ were included in what is now the planning area.

The Ashford region was initially used for growing cereal crops, however, transportation costs made production uneconomic. Wool and cattle industries also existed in Ashford. Logging and sawmilling began around 1900. Tobacco growing, however, became the largest industry within the area, beginning in the late 1800’s, although production was halted from 1919 to 1930 because of low prices. The Ashford area was recognised as one of the largest tobacco growing areas in Australia and in 1969 and 1970 brought over 1 million dollars to the region. Tobacco growing occurred for 25 years within the area that is now Kwiambal National Park, between 1969-1994.

In the late 1800s and early 1900s the North West Slopes of NSW were overrun by the noxious weed Prickly Pear (*Optunia* Sp.), forcing landholders to vacate their leases. In 1938 and 1941 the Government re-leased these areas as Prickly Pear Leases, provided that the lessee controlled the weed. This task was made easier in the 1950’s when the Cactoblastis moth was released, giving effective biological control.

Most of the planning area was subjected to logging, which is thought to have commenced around 1900, with renewed logging occurring in the 1940’s, 1950’s and, in some areas, the 1980’s (Roberts, 1982). Mining for various minerals and sapphires occurred throughout the Ashford region (Hunter, 1998). Guano mining occurred sporadically at Ashford Caves from 1916 to the 1960’s.

There are a number of structures and features in the planning area that are of minor local historic interest, including tobacco drying sheds, woolsheds, fruit trees, storage sheds and the remains of a house. The original historic fabric of the tobacco sheds was compromised in 1974 when pink asbestos fibro sheeting was used to line the outer walls of the tobacco curing barns. Sections of the old corrugated iron storage shed attached to the larger of the two houses in the park are also lined with pink asbestos fibro sheeting. The condition of the fibro sheeting has deteriorated on both structures and poses a serious health risk.

**Desired Outcomes**

- Historic features are recorded, assessed for any significance, and if appropriate, recorded or protected, conserved and/or interpreted.

- The tobacco sheds and corrugated iron storage shed attached to the large house which contain significant quantities of pink asbestos are recorded and demolished as a matter of urgency. Demolition is to be in accordance with Workcover requirements for the safe handling and disposal of asbestos materials.

**Strategies**

- *Prepare a historic heritage management plan for the planning area to assess the significance and management requirements for any historic cultural heritage features.*

- *Demolish the tobacco sheds and corrugated iron storage shed attached to the large house as a matter of urgency, following recording of the structures.*

- *Promote public understanding and appreciation of the planning area's historic values through interpretation and education material.*

- *Retain existing lemon trees at Lemon Tree Flat Camping Area.*

# 5. PARK PROTECTION

## 5.1 SOIL EROSION

The main erosion hazard in the planning area is associated with the decomposed granite soils which are highly erodible, particularly if disturbed, and during periods of high rainfall. Accelerated erosion is most evident along roads and trails where runoff is concentrated and/or adequate drainage is not maintained.

### Desired Outcomes

- Soil erosion in the planning area is minimised.

### Strategies

- *Design and undertake all works in a manner that minimises soil erosion.*
- *Undertake rehabilitation works on disturbed areas where erosion presents a threat to the values of the planning area.*
- *Maintain adequate drainage on roads and trails in the planning area. Where necessary restrict vehicle usage on roads and trails that are prone to higher rates of erosion.*
- *Temporary access restrictions to some tracks and trails may occur during and immediately after prolonged periods of rain.*

## 5.2 WATER QUALITY AND CATCHMENT MANAGEMENT

The planning area is situated at the junction of two major rivers, the Severn and the Macintyre. These two rivers delineate most of the northern and western boundaries of Kwiambal National Park. The planning area contributes to maintaining acceptable water quality in these river systems while also providing important riparian habitat.

The two rivers in the planning area are important because of their ecological, aesthetic, recreational, functional (ie. water supply), social and economic values. Catchment disturbance and pollution in these waterways can adversely impact on river hydrology, habitat value and recreational enjoyment. Any future works and maintenance of existing infrastructure within the planning area needs to ensure the health of the rivers is maintained.

The *Catchment Management Act 1989* provides a framework for achieving cleaner water, less soil erosion, improved vegetation cover, the maintenance of ecological processes and a balanced and healthier environment. It also provides a focus to balance conservation needs and development pressures and encourages a more aware and involved community. An important means of achieving these aims is the formation and support of catchment management authorities at a local level. The

planning area is within the area of the Border Rivers/Gwydir Catchment Management Authority.

**Desired Outcomes**

- Catchment values, water quality and the health of waterways are maintained or improved.

**Strategies**

- *Design and undertake all works in a manner that minimises water pollution.*

- *Liaise with local government, the catchment management authority and other authorities as needed to maintain the water quality within the planning area's catchments.*

## 5.3 INTRODUCED SPECIES

An introduced species is defined in this plan as any plant or animal species not native to the planning area. Introduced species within the planning area, and on adjoining land, are of concern because they have the potential to adversely affect ecological values of the planning area and spread to and from neighbouring land.

### *Introduced Plants*

The *Noxious Weeds Act 1993* places an obligation upon public authorities and private landholders to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands. The NPWS maintains a range of ongoing weed control programs in the planning area. These programs will continue.

A total of 68 introduced plant species have been recorded in the planning area, primarily associated with watercourses, past cultivated areas, border areas, areas of past habitation and areas with high public usage.

The Macintyre and Severn Rivers are a major source of continuing weed introduction and dispersal throughout the planning area, bringing introduced plants from agricultural lands upstream.

Key weeds requiring active control measures include; narrow leaf cotton bush (*Gomphocarpus fruticosus*), osage orange (*Maclura pomifera*), tree of heaven (Ailanthus altissima), buchan weed (*Hirschfeldia incana*), Bathurst burr (Xanthium spinosum), coolatai grass (Hyparrhenia hirta), common thornapple (Datura stamonium), honey locust tree (*Gleditsia triacanthos*); mother of millions (Bryophyllum delogoense), spear thistle (*Cirsium vulgare*), cobbler's peg (*Bidens pilosa*), prickly pear (*Optunia* spp), and evening primrose (*Oenothera rosea*).

Coolatai grass is a newly emerging weed species on which there is limited available control information. The NPWS has commenced an experiment to monitor the

effects of fire on infestations of coolatai grass in the park. Further trials, involving combinations of control methods, will be implemented in the planning area.

### *Introduced Animals*

Five feral animal species have been recorded in the planning area; goats, pigs, rabbits, foxes and cats. The damage caused by these feral animals ,which occur across all tenures of land including the planning area, can be severe as they compete with and prey upon native animals, damage native plants and degrade natural habitats. Occasionally stock enter the planning area from neighbouring properties.

A coordinated approach to pest management, involving all park neighbours, as well as the NPWS, is vital to the success of any feral animal control program.

### Desired Outcomes

- The impact of introduced species on native plants and animals, neighbouring properties and catchment values is minimised.

- Boundary fences are adequately maintained to keep stock on adjoining private grazing properties and out of the planning area.

- Introduced species are controlled, and where possible, eradicated.

### Strategies

- *Continue implementation of the active pest management program for the planning area.*

- *Continue to control, and where practicable eradicate, introduced species from the planning area. Priority will continue to be given to the control of those introduced species mentioned above and/or those:*
  - *declared noxious, or for which a national emergency control program has been declared, or are known to be an important problem in other parks;*
  - *have a significant environmental impact, including damage to threatened species, catchment values and recreation values;*
  - *that may affect neighbouring lands or are considered to be of high priority by the community;*
  - *where management is needed to maintain benefits gained from previous control programs or to allow another high priority management program to be effective; or*
  - *where a window of opportunity occurs.*

- *Continue research and trials into the control and management of coolatai grass.*

- *Unnecessary environmental disturbances will be avoided. Where disturbance is inevitable or is planned, the likely impact of the activity will be considered in terms*

*of introduced species. Where necessary controls will be put in place to reduce such impact.*

- *Seek the cooperation of neighbours in implementing weed and pest animal control programs. Undertake control in cooperation with the Northern Slopes Rural Lands Protection Board and North West Weeds County Council.*

- *Encourage secure fencing of boundaries with adjoining grazing properties to prevent domestic stock from entering the planning area. Subject to funding, fencing assistance may be provided to neighbouring landholders by the NPWS for construction and/or maintenance of boundary fencing.*

## 5.4 FIRE MANAGEMENT

Fire has always been a major factor in the Australian environment, with fires originating from both natural and human sources. Fire regimes, comprising frequency, intensity, season of occurrence and variability, have been influenced by humans since long before European settlement. Fire was used by Aboriginal people to clear the undergrowth and make travelling easier for hunting and to increase the abundance of certain types of plant food. Mosaic patterns of vegetation of different ages were created over some areas as a consequence of the regular systematic burning.

When traditional Aboriginal burning ceased, those environments that had been modified by their activities changed again but there is no scientific consensus on the type and extent of those changes. There is very little information on the pre-European and historic fire patterns for the area surrounding the planning area, and the dynamics of fire in the Australian environment are still under scientific debate.

Fire is, however, a natural feature of the environment and is essential to the survival of some plant and animal communities but inappropriate fire regimes can damage natural and cultural heritage and endanger park visitors and neighbours. Management of fire in the planning area is a complex issue. Management must aim to achieve both long-term conservation of native plant and animal communities and ongoing protection of life and property within and adjacent to the planning area.

Fire can also damage some cultural heritage sites and places. Features such as Aboriginal scarred trees and buildings can be permanently damaged or lost by wildfire. Other sites can be damaged by use of heavy machinery used in fire suppression activities.

### *Ecological requirements*

Fire regimes are a major determinant of the distribution and abundance of plants and animals in the planning area. They also affect nutrient cycles, erosion patterns and hydrological regimes.

In recent years much research has been conducted into the affects of fire and its effects (frequency, intensity, seasonality etc.) on individual species and vegetation

communities (Hunter, 1998), however, most of this research has centred on temperate communities such as coastal forest, tablelands and alpine areas. Information on the effects of fire on species and vegetation communities is scant, anecdotal or non-existent for the western slopes and plains of NSW (Hunter, 1998).

Further research is required to develop an appropriate fire regime for the individual species and communities found in the planning area. However, general ecological research from elsewhere suggests the following requirements for biodiversity conservation:

- variability of fire intervals and area burnt is important to conserve floristic diversity and provide diversity of habitat for animals; fire at regular intervals will lead to loss of species;
- most plant species and communities require infrequent fires of moderate to high intensity to achieve regeneration but patchy burns are better for fauna as they retain shelter and food refuges; and
- fires during the breeding season are the most damaging to fauna communities because of direct killing of young and increased exposure through habitat loss.

### *Fire history*

The planning area has a low incidence of wildfire, with no major wildfires recorded in the past thirty years.

### *Cooperative arrangements*

Under the *Rural Fires Act 1997* the NPWS is a fire authority and is responsible for controlling fires in the planning area and ensuring that they do not cause damage to other land or property. An important part of the NPWS's fire management is participation in local cooperative fire management arrangements, including implementation of Bush Fire Risk Management Plans developed by District Bush Fire Management Committees. The NPWS is a member of the Inverell Bush Fire Management Committee.

### Desired Outcomes

- Persons and property on or immediately adjacent to the planning area are protected from bushfires emanating from the planning area or adjacent lands.

- The potential for the spread of bushfires on, from, or into the planning area is minimised.

- Fire regimes are appropriate to maintain, and where necessary enhance, floristic biodiversity and habitat required for threatened fauna.

- Human induced unplanned bushfires are prevented.

- Aboriginal sites, historic places and culturally significant features are protected from damage by bushfires and suppression actions.

**Strategies**

- *Prepare and implement fire management strategies for the planning area. Until these strategies are prepared, fire will be managed in accordance with NPWS policies and the Inverell Bush Fire Risk Management Plan.*

- *Fire will be managed in accordance with fire management strategies following the principles listed below:*
    - *protection of human life and property within and adjacent to the planning area;*
    - *conservation of rare, endangered and biogeographically significant plant and animal species and communities;*
    - *maintenance of plant and animal species and communities through the provision of fire regimes compatible with their conservation, and*
    - *protection of Aboriginal sites, historic places, visitor facilities and management structures.*

- *Continue to participate in the Inverell Bush Fire Management Committee and maintain close contact and cooperation with Rural Fire Service fire control officers and volunteer bush fire brigades.*

- *Undertake fuel reduction programs, trail maintenance, research and monitoring programs in accordance with the policies outlined above and proposed fire management strategies.*

- *Where appropriate, carry out fuel management in cooperation with neighbours for mutual protection from wildfire.*

- *Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.*

- *Avoid use of heavy machinery for fire suppression in areas of rare plants, Aboriginal sites and historic places. These considerations will be addressed in the proposed fire management strategies.*

- *Encourage research into the ecological effects of fire in the planning area, particularly the fire response of significant plant species and the fire requirements of the communities.*

# 6. VISITOR OPPORTUNITIES AND EDUCATION

## 6.1 INFORMATION PROVISION

Park facilities and services provide opportunities for the community to enjoy, appreciate and understand the value of our natural and cultural heritage. Information provision at such places and about the area in general assists the protection of park values, promotes support for conservation and increases the enjoyment and satisfaction of visitors.

The primary features of interest to the local community and visitors to the planning area include the:

- Severn and Macintyre rivers, falls and gorges,
- cave and karst features,
- rich cultural heritage of the area,
- diverse flora and fauna, and
- outstanding educational opportunities.

Where appropriate, these features will be promoted and interpreted to visitors in a manner that protects their special values and encourages appropriate use.

There has been environmental damage to the caves due to the lighting of fires in the caves, rubbish dumping, karst features being removed and graffiti being applied to cave walls. A high quality information display is required to educate visitors regarding the values of the caves and bats, how vulnerable the bats are to disturbance, ways to avoid disturbing the bats and the cave environment, and the value of these features to the local community and visitors to the planning area.

Visitor information about the planning area should:

- promote increased community involvement in the planning area, its conservation importance and visitor opportunities;
- orientate visitors to the planning area;
- interpret individual components of the planning area's environment in order to increase visitor and student understanding of the environment;
- promote increased public awareness of NPWS conservation responsibilities, including those to control introduced plants and animals; and
- promote the use of minimal impact recreation principles.

### Desired Outcomes

- There is widespread community understanding and appreciation of the planning area's natural and cultural values.

- Visitors and the community understand the value of the bats and caves and how not to disturb the bats and cave environment.

- Visitors are aware of the planning area's recreation opportunities and can easily find their way to planning area attractions and facility areas.

- The planning area is used by local schools and community organisations as an educational resource.

- The involvement of local schools, individuals and organisations leads to greater understanding, learning and promotion of the area.

**Strategies**

- *Develop an information display at Limestone Caves Picnic Area to educate visitors about the values of cave bats, their life cycle, times of the year that they are most vulnerable and why, and how to avoid disturbing the bats and cave environment.*

- *Maintain interpretive signage displays at Macintyre Falls Picnic Area and in the township of Ashford.*

- *Develop and install an interpretive signage display at Lemon Tree Flat Camping Area.*

- *Produce media releases and attend meetings with schools, neighbours and community organisations to promote community understanding of park values and management strategies.*

- *Continue to distribute the park brochure to tourist information centres and other appropriate locations, and to update the brochure as needed.*

- *Involve the local Aboriginal community in developing interpretation material and programs featuring Aboriginal cultural heritage.*

- *Support and assist appropriate educational use by schools, community groups and individuals through the provision of information and programs such as walks and talks.*

## 6.2 RECREATION OPPORTUNITIES

Visitor opportunities provided in planning area are more focused at the low-key end of the spectrum, in natural and undeveloped settings. Recreational uses which are ecologically sustainable and which directly contribute to the visitor's understanding and appreciation of the planning area are considered appropriate.

Recreation opportunities available in the planning area include:

- picnicking
- bushwalking
- camping
- swimming
- fishing
- photography, and
- nature study.

The planning area is receiving a growing number of visitors from south-east Queensland, particularly retirees with campervan, caravan or camper trailer outfits. These visitors tend to stay longer than one day and usually undertake the stop-over as part of a broader tour of northern NSW. The planning area also caters for visitors from the local region, who tend to make day trips on weekends and/or camp during long weekends and school holidays. Most visitors appreciate the low-key facilities and natural character of the area.

**Desired Outcomes**

- A variety of low key visitor opportunities are available to encourage appreciation of the natural and cultural environment.

- Facilities are designed and managed to provide a satisfying and safe visitor experience while minimising environmental and social impacts.

- Visitor use does not threaten park values.

**Strategies**

- *Collect appropriate visitor use information to assist future recreation management of the planning area, including information on:*
  - *park use;*
  - *the interests and attitudes of visitors;*
  - *visitor information requirements, and*
  - *the impact of visitor use on the planning area's natural and cultural values to determine sustainable levels of use and to minimise the impact of recreation use.*

  *Where relevant this information will be entered into the NPWS's computer based Visitor Data System.*

***(a) Public vehicle access***

There are two main access roads to the planning area, Coalmine Road and Limestone Road. These two roads, together with Macintyre Falls Road within the park, are dedicated public roads managed and maintained by Inverell Shire Council.

Lemon Tree Flat Road provides public 2WD vehicle access to the Severn River and terminates at the Lemon Tree Flat Camping Area. This is a park road, managed and maintained by the NPWS.

A 4WD trail in Kwiambal National Park, known as the Junction Trail, links Lemon Tree Flat Camping Area to the junction of the Severn and Macintyre Rivers. The Junction trail will be retained for use as a:

- walking track from Lemon Tree Flat Camping Area for fishers, campers and day-visitors etc;
- management trail; and
- controlled access trail for public 4WD vehicles to the junction of the rivers.

It is proposed that the Junction Trail be gated, with public 4WD access obtained by means of a permit from NPWS. Some sections of the trail are steep and prone to soil erosion and consequently will require works to alleviate erosion and gullying.

Public and park 2WD roads within the planning area are maintained to all-weather two-wheel drive standard, however, a number of causeways and creek crossings on these roads can rise quickly during heavy rainfall events and temporarily block the passage of vehicles.

It is proposed that three additional vehicle trails leading off Lemon Tree Flat Road be assessed for their suitability to be upgraded into formal park roads. If assessed to be suitable, these roads would then be maintained by the NPWS to provide access to the Severn River (see map).

**Desired Outcomes**

- Public 2WD-vehicle access is provided on a road network that is sustainable, protects the planning area values and complements regional recreational opportunities.

**Strategies**

- *Public 2WD-vehicle access will be provided in accordance with the map.*

- *Public and park 2WD roads are maintained to all-weather two-wheel drive standard.*

- *The Junction Trail (see the map) is proposed for retention as: a walking track from Lemon Tree Flat Camping Area; a management trail; and a controlled access 4WD trail for public 4WD vehicles wishing to access the junction of the Severn and Macintyre Rivers. It is proposed that the Junction Trail will be gated, with public vehicle access obtained by means of a permit. Only 4WD vehicles will be permitted.*

- *Three vehicle trails leading off Lemon Tree Flat Road will be assessed for their suitability to be upgraded into formal park roads which would be maintained by the NPWS to provide access to the Severn River (see map).*

***(b) Day use and camping areas***

The planning area contains the following visitor facility areas:
- Macintyre Falls Picnic Area in the park;
- Lemon Tree Flat Camping Area in the park, and
- Limestone Caves Picnic Area in the reserve.

Macintyre Falls Picnic Area is a popular place for both locals and visitors to the park. Facilities provided include; picnic tables, wood barbecues, pit toilets, a wet weather cooking shelter, water tank, an information display and two lookout platforms. Three walking tracks start from the picnic area (see map).

Lemon Tree Flat Camping Area is also popular, particularly during holidays and over long-weekends. There is space for tent camping and approximately six medium sized caravan/campervan sites. Facilities provided include; picnic tables, barbecues, pit toilets and a wet weather cooking shelter. A water tank is also to be provided. There is a growing number of visitors with campervans, caravans or camper trailers staying at Lemon Tree Flat Camping Area.

During peak periods there can be problems with parking and general site use at Macintyre Falls Picnic Area and the existing layout at Lemon Tree Flat Camping Area struggles to accommodate caravans/campervans, and there is also limited parking and space available for day visitors. Consequently the NPWS engaged a consultant to develop new concept plans for these areas to improve vehicle movement and parking capacity; vehicle access and convenience for parking caravans and campervans; resolve road drainage and erosion issues, and also provide better separation of day use from camping (Milne Home, 2002b). It is proposed that the maximum capacity at Lemon Tree Flat Camping Area will be 25 sites with parking for 10 vehicles in the day use area. A track-head carpark, with a four-car capacity, will also be provided at the commencement of the Junction Walking Track.

Additional facilities proposed in the Lemon Tree Flat Concept Plan include a separate wet weather cooking shelter for day visitors, water tanks for the cooking shelters, extra barbecues and picnic tables, wood storage facilities and one extra toilet.

Cooking firewood is supplied at Macintyre Falls Picnic Area and Lemon Tree Flat Camping Area. It is proposed to supplement the wood barbeques at Lemon Tree Flat with gas barbeques, and to replace the wood barbeques at Macintyre Falls with gas barbeques.

The Limestone Caves Picnic Area is also popular with visitors to the area. The existing picnic tables and toilets are in poor condition and a boundary survey shows that most of the existing facilities are located on private property outside the reserve.

**Desired Outcomes**

- Day use and camping areas are managed to provide a high quality visitor experience with minimum impact on the values of the planning area.

**Strategies**

- *Progressively upgrade Macintyre Falls Picnic Area and Lemon Tree Flat Camping and Picnic Area in accordance with the concept plans* (Milne Home, 2002a & b).

- *Replace the picnic facilities at Limestone Caves Picnic Area with new low key facilities to be located on the reserve. Fireplaces will not be provided in the new picnic area and visitors requiring these facilities will be guided to other nearby picnic areas in the park where they are provided.*

- *Provide gas barbecues in the wet weather cooking shelters at Macintyre Falls Picnic Area and Lemon Tree Flat Camping and Picnic Area. Progressively*

*remove wood barbecues at Macintyre Falls Picnic Area following installation of gas barbecues.*

- *Encourage visitors, through interpretation and promotional material, to also bring their own wood and/or fuel stoves.*

- *Monitor the environmental impact of camping and day use to ensure that these areas do not experience unsustainable levels of use.*

### *(c) Bushwalking*

There are over six kilometres of marked walking tracks in Kwiambal National Park, in addition to management trails where bushwalking can also be undertaken.

Three walks start from Macintyre Falls Picnic Area; Plunge Pool, The Beach, and Slippery Rock Tracks. Improvements have been identified for these walking tracks to improve visitor safety. It is also proposed to change the name of the "Plunge Pool Track" to the "Rock Pool Track" to avoid giving the public the impression that it is safe to plunge into the water holes.

The Junction Track starts at Lemon Tree Flat Camping and Picnic Area and leads to the junction of the Severn and Macintyre Rivers. It is proposed that this 4WD trail be developed, maintained and promoted as a walking track for fishers, campers and day-visitors to Lemon Tree Flat (refer also to 6.2(a) above). A sidetrack off the Junction Track leads to a rocky outcrop above the Severn River from which "The Dungeon", a deep river gorge that becomes a torrent after rain, can be viewed (see map).

There is potential to develop other walks within Kwiambal National Park. In particular, a walk that incorporates the Severn River Falls will be investigated to determine whether it is feasible.

**Desired Outcomes**

- Safe, enjoyable and ecologically sustainable bushwalking opportunities are provided in the planning area.

**Strategies**

- *Retain, and upgrade where necessary to ensure public safety, the existing walking tracks leading from Macintyre Falls Picnic Area.*

- *Promote the Junction Track as a sustainable, well graded walking track leading from Lemon Tree Camping Area to the Junction of the Macintyre and Severn Rivers.*

- *All management trails will be available for use by walkers.*

- *Interpretative signage will be provided at the start of the walking tracks, including safety messages.*

***(d) Other activities***

There is no existing recreational horse riding in the planning area. Horseriding is not considered appropriate in the planning area as it has the potential to accelerate erosion of the highly unstable soils and introduce weeds into and across the park.

The planning area currently experiences low levels of use from cyclists. Cycling is permitted on management trails shown on the map but is not permitted on walking tracks because of the damage created to these tracks and the danger to the general public walking on the tracks.

Adventure activities such as rock climbing and abseiling occasionally occur in the planning area. Adventure activities will only be permitted where they are safe, have minimal conflict with other visitors and do not threaten the natural and cultural values of the planning area.

**Desired Outcomes**

- Recreation activities are nature-based, safe and ecologically sustainable.

**Strategies**

- *Horse riding will not be permitted in the planning area.*

- *Cycling is permitted on public and park roads and management trails in the planning area (see map).*

- *No specific facilities or provision will be made for adventure activities such as rock climbing, abseiling or hang-gliding. Any adventure activity that is allowed will require prior written consent from the Regional Manager.*

## 6.3 COMMERCIAL ACTIVITIES

Commercial operations contribute to the regional economy and provide recreation opportunities that may not otherwise be available to park visitors. If conducted properly, commercial tours provide high quality visitor experiences, foster a greater appreciation and understanding of park values, and can allow for better management of visitor impacts and visitor safety.

Conversely, these activities have the potential to impact on park values and on the experience of other visitors due to competition for facilities and overcrowding at sites. Commercial recreation can also lead to the deterioration of some sites if not carefully managed.

At present there are no commercial tour operations in the planning area. However, some commercial recreation and environmental education opportunities may be

appropriate in the planning area. Commercial operators must be licensed to operate in national parks. All commercial operations will be managed to avoid adverse impact on environmentally sensitive areas and to reduce impacts on, and competition for, visitor facilities.

**Desired Outcome**

- All commercial activities within the planning area are licensed.
- Commercial activities follow minimum impact practices.

**Strategies**

- *Assist appropriate commercial operators who wish to undertake nature-based activities. Set licence conditions so as to minimise competition for facilities during peak periods.*

## 7. RESEARCH AND MONITORING

Research and monitoring can improve understanding of natural and cultural heritage, visitor use and the processes that affect them. This can lead to better management of our natural and cultural heritage, minimise the environmental impact of recreation and enhance visitor satisfaction.

Specific studies conducted in the planning area include; a general fauna survey (Spark, 1998), a vegetation survey (Hunter, 1998) and a survey for Aboriginal Sites (Gay, 2000). Other studies have been conducted and a full list is included in *Section 10. References.*

NPWS research efforts must be directed towards the areas of greatest need. Research by other organisations and students may provide valuable information for management.

Research and monitoring projects require prior approval from the NPWS. Any research proposals need to be assessed and managed to ensure appropriate use and mutually beneficial outcomes.

### Desired Outcomes

- Research is undertaken that enhances the information base and assists management of the planning area.

- Research causes minimal adverse environmental impact.

### Strategies

- *Prepare a research prospectus to encourage research and monitoring that will assist park management. Include the following research and monitoring topics:*
  - *The status of bats at Ashford Caves.*
  - *A cave management plan for Ashford Caves.*
  - *Introduce a program to monitor the status of the significant communities and threatened plant species and to evaluate the success of management programs.*
  - *The effects of fire on both species and vegetation communities in the planning area.*
  - *Identify and assess the significance of any historic features (refer to section 4.6 Historic Heritage).*
  - *Collect information on visitor use trends and patterns, satisfaction and impact.*
  - *Undertake additional fauna surveys when the silver-leaved ironbark and white box are flowering to identify migratory bird species that may utilise the area seasonally.*
  - *Undertake an Autumn survey for reptiles and amphibians to maximise the opportunity of detecting species which were not detected during the early summer survey conducted by Spark (1998).*
  - *Undertake target surveys for species of significance that are considered likely to occur.*

- *Permit appropriate research by local schools, other organisations and individuals and promote research that is directly useful for management purposes.*

- *Require any research structures and long term markers to be placed in locations that will minimise their visual impact and require their removal upon completion of the research.*

- *Encourage special interest groups, such as bird watchers, to pass on information gathered in the planning area.*

- *Ensure research and monitoring projects are of benefit to the knowledge of the park and/or its management and are conducted in accordance with best practice. Research findings are to be communicated to the NPWS.*

## 8. NPWS MANAGEMENT FACILITIES AND OPERATIONS

The planning area is managed by the Northern Tablelands Region of the NPWS under the Tenterfield Area. To assist in day-to-day management there is a depot located in Kwiambal National Park.

Implementation of the management programs identified in this plan requires a system of management trails in addition to that provided by the public road system. Management trails are shown on the map. The purpose of management trails is to facilitate the management of fire, weeds and feral animals. Some trails can also assist public safety, for example in search and rescue. Vehicle access to management trails is restricted to essential NPWS management purposes and other essential or emergency purposes authorised by the Regional Manager. These trails are also available for use by walkers and cyclists.

There are two houses and a works depot located in Kwiambal National Park. One house is used for permanent NPWS staff accommodation and the other is used as temporary staff accommodation and is available for use by volunteer groups and researchers undertaking work in the planning area. There is a relatively new steel shed situated on Limestone Road in Kwiambal National Park. It is proposed that this shed be relocated adjacent to the works depot for equipment storage.

There is an informal helipad adjacent to the works depot. It is proposed to bituminise a small helipad to alleviate current problems with dust when the helipad is in use.

Electricity is supplied to the houses and depot via two overhead powerlines. The lines run in a north-east direction through the park, over the Severn River and back onto private property. Telephone lines are supplied to the houses and depot via an underground line adjacent to roads.

Gazettal of the remaining acquired areas will assist in resolution of fencing issues in the planning area. There are many internal fences as well as stock grids that could be progressively removed following gazettal of the remaining acquired lands. The fence around the Ashford Caves Crown Reserve is in poor condition and requires upgrading when management responsibility is vested in the NPWS.

There is a disused rubbish tip within Kwiambal National Park. This site needs rehabilitation works.

An existing water licence from the Macintyre River has been retained by the NPWS for future options in the management of the park, including assisting in the revegetation of the former tobacco growing paddocks.

Lemon Tree Flat Camping Area and other areas beside the Severn and Macintyre rivers can be affected by occasional floods. It is proposed that NPWS is put on the State Emergency Service advice list for potential flooding in the area, to allow staff to evacuate campers/visitors from the planning area.

**Desired Outcomes**

- Management facilities adequately serve the needs of park management and have acceptable environmental impact.

- A positive working relationship is maintained with park neighbours.

- Visitor safety is ensured during incidents (eg. floods and wildfires) through incident response procedures.

**Strategies**

- *Progress the gazettal of the remaining acquired lands as part of Kwiambal National Park.*

- *Progress the gazettal of Ashford Caves Crown Reserve as a protected area pursuant to the NPA Act.*

- *Maintain the management trail network shown on the map. Close, and rehabilitate if necessary, all trails not shown on the map.*

- *The Junction Track may be used for management purposes*.

- *Management trails may be used by walkers and cyclists.*

- *.Investigate the need for, and development of, management trails along the southern and eastern boundaries of the acquired lands (see map). New management trails developed for fire protection purposes within the planning area will require appropriate environmental and cultural sites assessment and amendment to this plan if constructed within the planning area.*

- *No additional management trails will be constructed except in the following situations:*
  - *Re-alignment of an existing trail to a more environmentally acceptable location subject to an appropriate environmental and cultural sites assessment;*
  - *Protection of specific natural and cultural heritage values, property or life; and*
  - *During an emergency situation (eg. wildfire control) where there is no practical alternative. In such situations these trails will be rehabilitated as soon as practicable after the incident.*

- *Conduct an audit of existing boundary fences and develop priorities for boundary fencing.*

- *Upgrade boundary fencing around the Ashford Caves Crown Reserve.*

- *Following gazettal of remaining acquired lands, progressively remove internal fence wire, posts where practicable, and stock grids.*

- *Relocate the steel shed on Limestone Road to the work depot area for equipment storage.*
- *Seal a small helipad adjacent to the work depot to reduce dust problems.*
- *Rehabilitate the disused rubbish tip in Kwiambal National Park.*
- *Retain the water licence for future management use.*
- *Arrange for NPWS to be placed on the State Emergency Service advice list for potential flooding in the planning area.*

## 9. PLAN IMPLEMENTATION

This plan of management establishes a scheme of operations for the planning area. The plan 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, directorate and regional levels. The latter may include development of related plans such as regional recreation plans, species recovery plans, fire management plans and conservation plans.

Section 81 of the Act requires that this plan of management shall be carried out and given effect to, and that no operations shall be undertaken in relation to Kwiambal National Park (and Ashford Caves once it is declared as a protected area under the NPW Act) unless they are in accordance with the plan.

Implementation of this plan will be undertaken within the annual programs of the NPWS Northern Tablelands Region. Actions identified in the plan are those to which priority will be given in the foreseeable future. Other management actions may be developed consistent with the plan objectives and strategies.

Relative priorities for identified activities are set out in the table below. These priorities are determined in the context of directorate and regional strategic planning, and are subject to the availability of necessary staff and funds and to any special requirements of the Director-General or Minister. Implementation of the plan will be monitored and its success in achieving the identified objectives will be assessed.

The environmental impact of proposed activities will be assessed at all stages in accordance with established NPWS environmental assessment procedures. Where impacts are found to be unacceptable, activities will be modified in accordance with the plan and NPWS policies.

This plan of management does not have a specific term and will stay in force until amended or replaced in accordance with section 73B of the Act. The plan applies both to the land currently reserved and to any future additions. Where management strategies or works are proposed for additions (or the existing area) are not consistent with the plan, an amendment to the plan will be required.

### Strategies

- *Undertaken an annual review of progress in implementing this plan of management.*

- *After 5 years from the date of adoption of this plan, undertake an audit to determine the effectiveness of managing the planning area in accordance with this plan and of the degree of success in achieving the plan's objectives and desired outcomes.*

## Implementation Table

| Priority | Summary of key actions | Plan reference |
|---|---|---|
| **High** | Determine the status of cave bats at Ashford Caves, and whether the site is still used by maternity colonies. | 4.3 |
| | Develop a cave management plan and visitor use strategy to ensure ongoing protection of cave bats. | 4.3 |
| | Provide information on the bats and cave access requirements at the reserve. | 4.3 |
| | Undertake an archaeological survey and cultural assessment prior to all new works with the potential to impact on Aboriginal sites and places. | 4.5 |
| | Demolish the tobacco sheds and corrugated iron storage shed attached to the large house as a matter of urgency, following recording of the structures. | 4.6 |
| | Undertake rehabilitation works on disturbed areas where erosion presents a threat to the values of the planning area. | 5.1 |
| | Maintain adequate drainage on roads and trails in the planning area. | 5.1 |
| | Continue implementation of the active pest management program for the planning area. | 5.3 |
| | Continue to control, and where practicable eradicate, introduced species from the planning area. | 5.3 |
| | Continue research and trials into the control and management of coolatai grass. | 5.3 |
| | Prepare and implement fire management strategies for the planning area. | 5.4 |
| | Continue to participate in the Inverell Bush Fire Management Committee and maintain close contact and cooperation with Rural Fire Service fire control officers and volunteer bush fire brigades. | 5.4 |
| | Undertake fuel reduction programs, trail maintenance, research and monitoring programs. | 5.4 |
| | Develop an information display at Limestone Caves Picnic Area to educate visitors about the values of cave bats. | 6.1 |
| | Develop and install an interpretive signage display at Lemon Tree Flat Camping Area. | 6.1 |
| | Public 2WD-vehicle access will be provided in accordance with the map. | 6.2 (a) |
| | Public and park 2WD roads are maintained to all-weather two-wheel drive standard. | 6.2(a) |
| | Replace the picnic facilities at Limestone Caves Picnic Area with new low key facilities located on the reserve. | 6.2 (b) |
| | Retain, and upgrade where necessary to ensure public safety, existing walking tracks at Macintyre Falls Picnic Area. | 6.2 (c) |

| | | |
|---|---|---|
| | The Junction Trail is proposed for retention as: a walking track; a management trail, and a controlled access 4WD trail for public 4WD vehicles. It is proposed that the Junction Trail will be gated, with public vehicle access obtained by means of a permit. Only 4WD vehicles will be permitted. | 6.2(a) |
| | Promote the Junction Track as a sustainable, well graded walking track leading from Lemon Tree Camping Area to the Junction of the Macintyre and Severn Rivers. | 6.2(c) |
| | Progress the gazettal of the remaining acquired lands as part of Kwiambal National Park. | 8.0 |
| | Progress the gazettal of Ashford Caves Crown Reserve as a protected area pursuant to the NPA Act. | 8.0 |
| | Upgrade boundary fencing around the Ashford Caves Crown Reserve. | 8.0 |
| | Rehabilitate the disused rubbish tip in Kwiambal National Park. | 8.0 |
| | Arrange for NPWS to be placed on the State Emergency Service advice list for potential flooding in the planning area. | 8.0 |
| | | |
| **Medium** | Rehabilitate the tobacco field along the Macintyre River using indigenous species. | 4.2 |
| | Encourage the natural revegetation of disturbed areas and take steps to assist revegetation where needed. | 4.2 |
| | Introduce a program to monitor the status of the significant communities and threatened plant species and to evaluate the success of management programs. | 4.2 |
| | If considered necessary to protect the bats and cave environment, visitor access to the cave may be controlled. | 4.3 |
| | Encourage further research into the status and management of invertebrates at the caves. | 4.3 |
| | Continue to record the distribution of threatened and significant fauna species. | 4.3 |
| | Undertake targeted surveys for threatened species likely to occur in the planning area. | 4.3 |
| | Undertake additional fauna surveys when the silver-leaved ironbark and white box are flowering so as to identify migratory bird species. | 4.3 |
| | Undertake an autumn survey for reptiles and amphibians. | 4.3 |
| | Visitor access may be controlled if necessary to prevent the removal of bone deposits and other material from the caves. | 4.4 |
| | Interpretative and educational material about the cultural heritage of the planning area will be developed in collaboration with relevant people and organisations, including local Aboriginal people. | 4.5 |
| | Prepare a historic heritage management plan for the planning area. | 4.6 |
| | Promote public understanding and appreciation of the planning area's historic values through interpretation and education material. | 4.6 |

| | | |
|---|---|---|
| | Encourage secure fencing of boundaries with adjoining grazing properties to prevent domestic stock from entering the planning area. | 5.3 |
| | Where appropriate, carry out fuel management in cooperation with neighbours for mutual protection from wildfire. | 5.4 |
| | Maintain interpretive signage displays at Macintyre Falls Picnic Area and in the township of Ashford. | 6.1 |
| | Produce media releases and attend meetings with neighbours and community organisations to promote community understanding of park values and management strategies. | 6.1 |
| | Continue to distribute the park brochure to tourist information centres and other appropriate locations, and to update the brochure as needed. | 6.1 |
| | Involve the local Aboriginal community in developing interpretation material and programs featuring Aboriginal cultural heritage. | 6.1 |
| | Support and assist appropriate educational use by schools, community groups and individuals. | 6.1 |
| | Collect appropriate visitor use information and enter data into the NPWS's computer based Visitor Data System. | 6.2 |
| | Three vehicle trails leading off Lemon Tree Flat Road will be assessed for their suitability to be upgraded into formal park roads. | 6.2(a) |
| | Progressively upgrade Macintyre Falls Picnic Area and Lemon Tree Flat Camping and Picnic Area in accordance with the concept plans. | 6.2(b) |
| | Provide gas barbecues in the wet weather cooking shelters at Macintyre Falls Picnic Area and Lemon Tree Flat Camping and Picnic Area. | 6.2 (b) |
| | Encourage visitors, through interpretation and promotional material, to bring their own fuel stoves. | 6.2 (b) |
| | Monitor the environmental impact of camping and day use to ensure that these areas do not experience unsustainable levels of use. | 6.2 (b) |
| | Interpretative signage will be provided at the start of the walking tracks, including safety messages. | 6.2 (c) |
| | Prepare a research prospectus to encourage research and monitoring that will assist park management. | 7.0 |
| | Encourage special interest groups, such as bird watchers, to pass on information gathered in the planning area. | 7.0 |
| | Maintain the management trail network shown on the map. Close, and rehabilitate if necessary, all trails not shown on the map. | 8.0 |
| | Investigate the need for, and development of, management trails along the southern and eastern boundaries of the acquired lands. | 8.0 |

| | | |
|---|---|---|
| | Conduct an audit of existing boundary fences and develop priorities for boundary fencing. | 8.0 |
| | Following gazettal of remaining acquired lands, progressively remove internal fence wire, posts where practicable, and stock grids. | 8.0 |
| | Relocate the steel shed on Limestone Road to the work depot area for equipment storage. | 8.0 |
| | Retain the water licence for future management options. | 8.0 |
| | | |
| **Low** | Encourage research into the bone deposits and cave sediments. | 4.4 |
| | Retain existing lemon trees at Lemon Tree Flat Camping Area. | 4.6 |
| | Assist appropriate commercial operators who wish to undertake nature based activities. | 6.3 |
| | Seal a small helipad adjacent to the work depot to reduce dust problems. | 9.0 |

**Legend**

**High** priority activities are those imperative to achievement of the objectives and desired outcomes. They must be undertaken in the near future to avoid significant deterioration in natural, cultural or management resources.

**Medium** priority activities are those that are necessary to achieve the objectives and desired outcomes but are not urgent.

**Low** priority activities are desirable to achieve management objectives and desired outcomes but can wait until resources become available.

## 10. REFERENCES

Australian Speleological Federation (1985) *Australian Karst Index*. Australian Speleological Federation, Sydney.

Dwyer, P.D. (1966) *Observations on the Eastern Horse-shoe Bat in North-Eastern New South Wales.* Helictite., **4(4)**: 73-82.

Eberhard, S. and Spate, A. (1995) *Cave Invertebrate Survey: Toward an Atlas of NSW Cave Fauna*. Unpublished report for the New South Wales National Parks and Wildlife Service.

Flood, P.G. and Aitchison, J.C. (1993) *Understanding the New England geology: the comparative approach.* Pp. 1-10 In P.G Flood and J.C. Aitchison (eds*) New England Oregen Eastern Australia*. Department of Geology and Geophysics, University of New England, Armidale.

Flood, P.G., Aitchison, J.C., and Lennox, P.G. (1994) Limestone-capped seamounts within the late Paleozoic accretionary prism of the New England Oregen, Eastern Australia. *Geological Survey of Australia Abstracts,* **36**: 110-111.

Gay, L. (2000) *Survey for Aboriginal Sites, Kwiambal National Park.* Unpublished report for the New South Wales National Parks and Wildlife Service.

Hall, L.S. (1982) *The effect of cave microclimate on winter roosting behaviour in the bat, Miniopterus schreibersii blepotis., Aust. J. Ecol*., 7: 129-136.

Harrison, K. (1999) *Anthropogenic extension of bat habitat in New England (NSW). A mine of their own.* A thesis submitted as partial fulfilment of the requirements for the degree of BSc (Hons) in the School of Earth Science Macquarie University.

Hunter, J. (1998) *Vegetation Survey of the Proposed Kwiambal National Park.* Unpublished report for the New South Wales National Parks and Wildlife Service.

IUCN (1994) *Guidelines for Protected Area Management*. International Union for the Conservation of Nature and Natural Resources.

ICOMOS (1998) *The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (The Burra Charter).* Australia ICOMOS (International Council on Monuments and Sites.

Lishmund, S.R., Dawood, A.D., and Langley, W.V. (1986) *The Limestone Deposits of New South Wales.* Mineral Resources 25, Geological Survey of New South Wales, Sydney.

McArdle, S.L. (2002) *Invasion of Coolatai Grass (Hyparrhenia hirta (L.) Stapf): Impacts on species richness and management implications*. A NR 490 project report submitted in partial fulfilment of the requirements for the Bachelor of Natural Resources at the University of New England, Armidale.

McMinn, W.G. (1970) *Allan Cunningham: Botanist and Explorer*. Melbourne University Press, Melbourne.

Milne Home, R.G.H. (2002a) *Macintyre Falls Picnic Area, Facilities Upgrade Report and Plan*. Unpublished report for the NSW National Parks and Wildlife Service.

Milne Home, R.G.H. (2002b) *Lemon Tree Flat Camping and Picnic Area, Facilities Upgrade Report and Plan*. Unpublished report for the NSW National Parks and Wildlife Service.

Moore, B.P. (1964) *New cavernicolous Carabidae (Coleoptera) from mainland Australia.* Journal of Entomological Society of Queensland, **3**: 69-74.

Richards, G.C. (1979) *Maternity Sites for Cave Bats in NSW*. CSIRO Division of Wildlife Research.

Roberts, G. (1982) *Macintyre Falls National Park Proposal*. Unpublished report for the New South Wales National Parks and Wildlife Service.

Spark, P. (1998) *Fauna Survey Report for Kwiambal National Park.* Unpublished report for the New South Wales National Parks and Wildlife Service.

Spate, A. (1994) *Karst Reconnaissance – Northern Region*. Unpublished report for the New South Wales National Parks and Wildlife Service.

Watson, J., Hamilton-Smith, E., Gillieson, D. & Kiernan, K. (Eds) (1997) *Guidelines for Cave and Karst Protection*, IUCN.