NSW NATIONAL PARKS & WILDLIFE SERVICE

Ngambaa Nature Reserve

Plan of management

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Acknowledgements

This plan of management is based on a draft plan prepared by staff of the Coffs Coast Area of the NSW National Parks and Wildlife Service (NPWS), with the assistance of staff of the Northern Directorate Conservation Programs and Planning Division and Planning Group.

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Foreword

Ngambaa Nature Reserve is located approximately 10km south-west of Macksville and 16km north-west of Kempsey, on the mid-north coast of NSW. The reserve covers an area of approximately 10,560 hectares. The reserve protects a large area of the coastal range and incorporates a number of significant ridgelines and mountains, such as Mungay, Good Friday and Scotsman Mountains which are highly visible from the surrounding towns.

Ngambaa Nature Reserve protects a large number of rare and threatened flora and fauna species as well as regionally significant species and communities, including four different ironbark species of which two are rare. It also contains landscapes and sites of significance to the local Aboriginal communities; and sites and relics reflecting non-Aboriginal use of the area.

The *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A plan of management is a legal document that outlines how the area will be managed in the years ahead. The procedures for the adoption of a plan of management for a nature reserve are specified in the Act.

A draft plan of management for Ngambaa Nature Reserve was placed on public exhibition from 13 December 2002 until 28 March 2003 and attracted 21 submissions which raised 11 issues. All submissions received were carefully considered before adopting this plan of management.

The reserve will be managed to conserve its natural and cultural heritage, while providing opportunity for sustainable public use.

This plan of management establishes the scheme of operations for Ngambaa Nature Reserve. In accordance with section 76 of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

Bob Debus

Minister for the Environment

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1. Introduction

1.1 Location, reservation and regional setting

Ngambaa Nature Reserve (referred to herein as 'the reserve') was gazetted on 1 January 1999 as part of the Regional Forest Agreement process for the Upper North East of New South Wales (NSW) and covers an area of approximately 10,560 hectares.

The reserve comprises land that was previously part of Ingalba, Collombatti and Tamban state forests and is located within the Nambucca and Kempsey Local Government Areas. The reserve is approximately 10km southwest of Macksville and 16km northwest of Kempsey (see Appendix B).

Ngambaa is the Gumbaynggirr word for 'Tribe that lived between Nations' and the name of the local Warrell Creek tribe, reflecting the reserve's location on the boundary of the Gumbaynggirr and Djangadi language groups.

The reserve is one of a number of parks and reserves in the Nambucca Valley, including Dunggir National Park, Juugawaarri, Ganay, Bowraville, and Bollanolla Nature Reserves.

Collombatti, Ingalba and Tamban State Forests adjoin the reserve. Other adjoining land uses are rural landholdings predominantly used for grazing. The reserve provides an important vegetation link between the coast and the escarpment environments.

This plan applies both to the land currently reserved as Ngambaa Nature Reserve and to any future additions to the reserve. Where management strategies or works are proposed for additions that are not consistent with this plan, an amendment to the plan will be required.

This plan was amended in October 2021 following exhibition of proposed amendments in mid 2021.

1.2 Landscape

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 reserve protects a large area of the coastal range and incorporates a number of significant ridgelines and mountains such as Mungay, Good Friday and Scotsman Mountains, which are highly visible from the surrounding towns.

The geology, landform, climate and plant and animal communities of the area, plus its location, have determined how humans have used the area. The reserve has a long history of logging, which in turn has generally led to the majority of the existing road system and vegetation structure. Aboriginal resource use, grazing, clearing, recreation and other uses have also had a marked influence on the landscape (refer to sections 4.4. Aboriginal Heritage and 4.5 Historic Heritage).

Cultural values can be placed on natural areas, including aesthetic, social, spiritual, recreational and other values, they may be attached to the landscape as a whole or to individual components. 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.

2. Management context

2.1 Legislative and policy framework

The management of nature reserves in NSW is in the context of the 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 NPWS. The policies arise from the legislative background, the corporate goals of the NPWS and internationally accepted principles of park management. They relate to nature conservation, Aboriginal and historic site conservation, recreation, commercial use, research and communication. Other legislation, international agreements and charters may also apply to management of the area. In particular, the NSW Environmental Planning and Assessment Act 1979 requires the assessment and mitigation of environmental impacts of any works proposed in this plan.

Nature reserves in New South Wales

Nature reserves are reserved under the NPW Act to protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena.

Under the Act, nature reserves are managed to:

- conserve biodiversity, maintain ecosystem functions, and protect geological and geomorphological features and natural phenomena
- conserve places, objects, features and landscapes of cultural value
- promote public appreciation, enjoyment and understanding of the reserve's natural and cultural values
- provide for appropriate research and monitoring.

Nature reserves differ from national parks in that they do not have as a management principle to provide for visitor use.

Regional Forest Agreement (RFA)

Under the Upper North East NSW Regional Forest Agreement (RFA) all forest managers including State Forests of NSW (SFNSW) and the NPWS must demonstrate ecologically sustainable forest management (ESFM).

ESFM aims to maintain or increase the full suite of forest values for present and future generations across the NSW native forest estate, including:

- ecosystem biodiversity, health, vitality, productive capacity and functional processes
- soil and water productive capacity and functional processes
- long term social and economic benefit
- natural and cultural heritage values.

ESFM is an over-riding management principle and will be applied to all ecosystem types, not just forests. It will be implemented primarily through monitoring to provide feedback on management programs and directions for future adaptive management. Performance indicators of ecologically sustainable forest management have been identified. Monitoring programs will be developed using the indicators to demonstrate the impact of management actions on ecological functions. Remedial management actions will then be undertaken as required.

The principles of ESFM will be used to guide management operations and NPWS will endeavour to work with other authorities and stakeholders in implementing ESFM principles across the landscape.

3. Key values and management directions

3.1 Values of the area

Ngambaa Nature Reserve is of regional significance for its biological and landscape values and for its cultural heritage values.

Natural values include:

- a large number of rare and threatened flora and fauna species as well as regionally significant species and communities
- high quality habitat, including old growth habitat for a number of threatened fauna species
- a large area of dry forest communities close to the coast
- an important component of a continuum of forest along the coastal range and link through to the escarpment of New England
- a high diversity of Eucalyptus species, including four different ironbark species of which two are rare
- protection of part of the catchment of the Nambucca and Macleay Rivers.

Scenic values include:

- a vegetative backdrop to the surrounding towns and communities such as South West Rocks, Eungai, Bowraville, Macksville and Kempsey
- geological landscapes referred to as the Horseshoe Ranges, Bellingen-Nambucca Hills and Kempsey Hills.

Cultural heritage values include:

- Landscapes, sites and relics of significance to the local Aboriginal communities
- sites and relics reflecting non-Aboriginal use of the area.

Recreation and tourism values include:

- self-reliant recreation in a rugged and 'secluded' forest environment
- close proximity to local towns and communities such as Nambucca, Macksville, Bowraville and Kempsey.

Research and educational values include:

- diverse and significant plant and animal communities, cultural features and a variety of management issues provide numerous opportunities for research
- the spectacular landscapes, biodiversity, interesting cultural features and ready access to a variety of locations provide outstanding opportunities for community education.

3.2 Management directions

The reserve will be managed to conserve its natural and cultural heritage, while providing opportunity for sustainable public use.

This will be achieved through:

- conservation and protection of significant vegetation communities, threatened and biogeographically significant plant and animal species and geomorphological features from disturbance and inappropriate use and works
- implementation of recovery plans for threatened species

- control of introduced species particularly those species identified as noxious or priority species, as well as minimising introduced species and excluding domestic stock from the reserve
- protection and rehabilitation of disturbed areas such as areas affected by past logging
- management of fire to maintain plant and animal communities and provide for the special requirements of threatened species or application of fire regimes designed to maintain ecosystems
- conservation of significant cultural values and sites as they relate to the past land use of the reserve including Aboriginal, forestry and agricultural uses
- research and monitoring to improve knowledge of the area's resources and to evaluate and adapt management programs
- providing appropriate opportunities for ecologically sustainable recreation, tourism and educational use
- working co-operatively with other agencies and liaising with adjoining land managers and neighbours to ensure effective, efficient and cooperative management
- encouraging retention and compatible management of areas of native vegetation on neighbouring lands that link sections of reserve or join reserve land to other large naturally vegetated areas
- rationalisation of the road network in the reserve to protect conservation values while providing management trails necessary for reserve management
- reintroducing and conserving locally extinct fauna species and supporting the recovery of extant fauna species.

4. Conservation of natural and cultural heritage

4.1 Geology and landform

The mix of landscapes in the reserve is characterised by the underlying geology and geological form. The reserve has a number of very distinct and prominent ridgelines and mountains. Mungay Mountain (450m), in the southwest, dominates the reserve and its surrounding area and is believed to be significant to both indigenous and non- indigenous communities (refer sections 4.4 Aboriginal Heritage and 4.5 Historic Heritage).

Mungay Mountain forms part of a steep ridgeline which runs north east along most of the western boundary of the reserve and also includes Good Friday and Scotsman Mountains. This ridgeline is the watershed for streams flowing north and west to Taylors Arm and east to Eungai and Allgomera Creeks. A steep ridge also runs east west along the southern boundary of the reserve.

The reserve is split between three main physiographic regions known as the Nambucca-Bellingen Hills, Horseshoe Ranges and Kempsey Hills and contains a mix of gentle and very steep slopes exceeding 30 degrees. The Nambucca-Bellingen Hills extend northwards from Eungai and Stockyard Creeks (both within the reserve) and adjoin the Kempsey Hills which extend south and the Horseshoe Ranges which extend west.

The Nambucca-Hills lie on the Permian metasediments of the Nambucca Beds, the Kempsey Hills on the Permo-Carboniferous Kempsey Beds and the Horseshoe Ranges on both the Kempsey and Nambucca Beds. The Horseshoe Ranges are dominated by strongly erosional and colluvial processes (Eddie 2000).

The Kempsey and the Nambucca Beds comprise what is commonly referred to as the Nambucca Block or Nambucca slate belt (lithological units). The Nambucca Block is the eastern part of the New England Fold Belt, faulted against the Coffs Harbour Block to the north and the Hastings Block to the south and interbedded Permo- Carboniferous lithic sandstone, mudstone, pebbly sandstone, and minor conglomerate comprise the geology of the Kempsey beds. The Kempsey beds and the associated rock material are moderately resistant and less erodible than those of the Nambucca Bed. Water erosion problems are often typical as the acidic clay soils can be dispersive when wet and sometimes sodic. The upper reaches of the Nambucca Beds are dominated by Permian metasediments, fine-grained sediments with conspicuous soft micaceous sandstones and siltstones and the lower reaches consist of diamictite (Eddie 2000).

The deeply incised valleys of the upper catchments of the Nambucca and Bellingen Rivers is due to the soft and highly erodible nature of the rocks of the Nambucca Beds and the predisposition for landslides on steep slopes.

The reserve as a whole forms a significant landscape component and backdrop to the surrounding localities such as South West Rocks, Bowraville, Eungai, Macksville and Kempsey. It provides an important linking component of the hinterland and coastal environments and an aesthetically pleasing vegetative backdrop to the surrounding communities. There are a number of scenic locations within the reserve that provide a panoramic glimpse of the surrounding landscape.

Desired outcomes

- Scenic values and natural landscape features of the reserve are protected.

Strategies

- Liaise with neighbours and relevant authorities to minimise the impact of adjacent land use on the scenic values of key locations in the reserve.
- Locate and design management operations to minimise their visual impact from public access roads, lookouts and other vantage points.
- Investigate the significance of the geomorphological landscape within the reserve to the local Aboriginal community and assess opportunities for interpretation (refer also to sections 4.4 Aboriginal Heritage and 6.1 Information Provision).

4.2 Native plants

On a regional scale the reserve provides vegetation connectivity from the coast to the hinterland and escarpment habitats. Large expanses of forested state forest, private land and national parks such as Dunggir National Park link the reserve to the large protected areas of the Eastern Escarpment and the World Heritage New England National Park.

The NPWS forest ecosystem mapping for lower north-east NSW (NSW NPWS 1999) identifies 8 vegetation ecosystems within the reserve. These are:

- dry grassy tallowwood (*Eucalyptus microcorys*) / grey gum (*E. propinqua*)
- dry grassy blackbutt (*E. pilularis)* / tallowwood
- dry foothills blackbutt turpentine (*Syncarpia glomulifera*)
- dry red gum (*Eucalyptus tereticornis*) / bloodwood (*Corymbia intermedia*) / apple (*Angophora floribunda*)
- escarpment tallowwood / bloodwood
- open coastal brushbox (*Lophostemon confertus*)
- rainforest
- wet shrubby brushbox / tallowwood.

There are two broad habitat types within the reserve: grassy, dry foothills open forest association and moist foothills forest, rainforest association. The higher rainfall over the east of the reserve sustains a rich mix of forest species and rainforest is found in the moister gullies. On the drier western slopes, grassy forests of grey gum and ironbark dominate.

The reserve contains large areas of old growth grey gum and spotted gum. Large areas of dry sclerophyll forest and woodland occur within the reserve, most of which has a diverse native grass understorey. The native grasslands within the reserve remain largely unsurveyed and in some sections the grasslands have been subject to grazing.

The reserve conserves important examples of drier coastal forests (one of the highest ironbark diversities recorded) and a diverse range of habitats, from richer rainforests in the gullies such as at Cedar Park to heathy and grassy Spotted Gum Woodlands (Graham 2001).

Of the rainforest types that are found within the reserve the subtropical rainforest contains a number of important sub-alliances, which are believed to also be inadequately conserved such as *Backhousia myrtifolia/ Lophostemon confertus/ Tristaniopsis laurina*. Occurrences of this suballiance can be found on the southern facing slopes of Mungay Mountain and in the Allgomera Creek and Stockyard Creek valleys (Tedder 1998).

Eucalypt diversity in the reserve is high and four ironbark species are known to occur, two species of which, gully ironbark (*Eucalyptus ancophila*) and grey or Nambucca ironbark (*Eucalyptus fusiformis*) are considered rare (Graham 2001).

The reserve contains a 'relatively undisturbed community' of grey gum-grey ironbark- white mahogany and spotted gum-ironbark-grey gum forest types. These forest types have been identified as significant as less than 1% of these forest types are conserved in the region with the only area in the region to contain these types being the reserve (Tweedie et al 1995).

The reserve appears to represent a 'population stronghold' for the vulnerable milky silkpod (*Parsonsia dorrigoensis*). It also contains one of the few known protected area populations of the Queensland hazelwood (*Pomaderris queenslandica*), an endangered species recorded from highly isolated locations from the Hunter Valley into Queensland and which was thought extinct in NSW until the 1990s (Graham 2001).

Other species of significance, such as the small bolwarra (*Eupomatia bennettii*), represent range extensions for these species. The small bolwarra is one of the most primitive of the flowering plants and the population in the reserve represents the southern-most record of the species (Graham 2001).

A list of rare or threatened plants species recorded within the reserve is provided in Table 1. It is likely that further surveys will locate other rare, threatened and significant plant species in the reserve.

Table 1 Significant, rare and threatened plants known or likely to occur in Ngambaa Nature Reserve

Scientific name (Family)	Common name	Status#
Marsdenia longiloba	Slender marsdenia	Endangered
Pomaderris queenslandica	Queensland hazelwood	Endangered
Parsonsia dorrigoensis	Milky silkpod	Vulnerable
Eucalyptus ancophila	Gully ironbark	ROTAP
Eucalyptus fusiformis	Nambucca ironbark	ROTAP
Dodonaea megazyga	Wing Leaved hopbush	Conservation concern
Eupomatia bennetti	Small bolwarra	Conservation Concern
Species Likely to occur		
Amorphospermum whitei	Rusty plum	Vulnerable
Goodenia fordiana	Ford's goodenia	ROTAP
Marsdenia liisae	Large-flowered milk vine	ROTAP
Senna acclinis	Rainforest senna	Endangered

Source: Graham 2001.

Status is given by the schedules of the TSC Act (either endangered or vulnerable) or, for non-threatened flora, by Briggs and Leigh (1995). Those plants of conservation concern were taken from Graham 2001.

Under the provisions of the TSC Act[1], recovery plans must be prepared for all threatened species. None of the threatened plant species recorded within the reservehave had recovery plans prepared as yet. However, these are progressively being prepared and will be used to guide management of threatened species in the area.

[1] The *Threatened Species Act 1995* has been repealed. Threatened species are now covered by the *Biodiversity Conservation Act 2016* which does not require the preparation of recovery plans.

A number of the threatened flora species recorded during recent field surveys are located near the road and trail system within the reserve. These include the Queensland hazelwood and slender marsdenia. This presents an importantconsideration for management when undertaking road maintenance works and control of introduced weed species.

Some areas within the reserve, such as those areas surrounding Cedar Park, have been subject to frequent and high levels of logging and clearing in the past and sections of the understorey are infested with weed species such as lantana.

Other threats to native plant species and communities within the reserve include fire, introduced species and inappropriate human activities. Strategies to protect native vegetation have also been incorporated into other sections of this plan, including sections 5.3 Introduced Species, 5.4 Fire Management, 6 Visitor Opportunities and Education, 8 Other Uses and 9 Management Operations.

Desired outcomes

- The full range of native plant species found in the reserve is conserved.
- Vegetation structural diversity and habitat values are conserved, and are restored where subject to past logging and clearing.
- Significant and restricted plant species and communities are protected.
- Reserve neighbours support conservation of remaining areas of privately owned native vegetation adjoining or adjacent to the reserve.

Strategies

- Ensure that any new infrastructure is located to avoid the clearance of significant plant species or restricted plant communities to the greatest extent practical. Where this is not practical, ensure that impacts are minimised.
- Ensure that management operations such as road and walking track maintenance do not impact on threatened species in particular the slender marsdenia (Marsdenia longiloba) at Cedar Park and the Queensland hazelwood (Pomaderris queenslandica) along road verges.
- Undertake control programs for introduced weed species, particularly lantana at Cedar Park, to allow natural revegetation of these areas (refer also section 5.3 Introduced species).
- Allow natural regeneration of areas affected by past logging activities and if necessary undertake active regeneration using local native species.
- Implement recovery plans for threatened species when they have been prepared.
- Undertake additional vegetation surveys, in particular targeted native grassland and threatened species surveys within the reserve as well as targeted rainforest gully surveys.
- Continue to record the distribution of threatened and significant flora species.
- Liaise with neighbours, Landcare, vegetation management committees and land use authorities to encourage retention of native vegetation close to the reserve.
- Vegetation clearance during the establishment of the feral predator–free area will be minimised by using roads, trails or other previously cleared areas where feasible.

4.3 Native animals

The reserve contains habitat for a high diversity of native animals with at least 104 bird species, 41 mammal, 16 reptile and 15 amphibian species recorded in surveys to date (NPWS 2002a and Scotts 2002). The reserve is known to contain populations of 16 threatened species and a further 18 species which are considered to be of conservation concern (refer to Table 2) (Scotts 2002).

The relatively large size of the reserve provides habitat for permanent resident species as well as nomadic and migratory species. It protects habitats for fauna assemblages reliant upon dry, grassy, open foothills forests, a habitat type that remains under-represented within the formal north-east NSW reserve system (Scotts 2002).

The reserve is likely to function as a corridor for wildlife movements between the coast and the hinterland and is essential to the long-term maintenance of local and regional fauna populations.

The reserve is continuous on most boundaries with viable habitat on adjacent land tenures. On a regional scale the reserve provides connectivity from the coast to the hinterland and escarpment habitats. Large expanses of forested state forest, private land and national parks such as Dunggir National Park link the reserve to the protected areas of the Eastern Escarpment and the World Heritage New England National Park.

Over 27% of the forest contained within the reserve have been classified as candidate old growth forests (NPWS 1999). Old growth forests are important habitat areas, they provide tree hollows and fallen dead timber and provide habitat for a number of the threatened species recorded within the reserve such as the large forest owls, powerful, masked and sooty, and yellow-bellied glider. These species rely on tree hollows for nesting.

Table 2 Threatened animal species known to occur in Ngambaa Nature Reserve.

Scientific name (Family)	Common name
Endangered[#]	
Mixophyes iteratus	Giant barred frog
Vulnerable[#]	
Hoplocephalus stephensii	Stephen's banded snake
Calyptorhynchus lathami	Glossy black-cockatoo
Dasyurus maculatus	Spotted-tailed quoll
Ixobrychus flavicollis	Black bitten
Ninox strenua	Powerful owl
Ptilinopus magnificus	Wompoo fruit-dove
Ptilinopus regina	Rose-crowned fruit-dove
Tyto novaehollandiae	Masked owl
Tyto tenebricosa	Sooty owl
Miniopterus australis	Little bent-wing bat
Petaurus australis	Yellow-bellied glider
Phascogale tapoatafa	Brush-tailed phascogale
Phascolarctos cinereus	Koala
Pteropus poliocephalus	Grey-headed flying-fox
Scoteanax rueppellii	Greater broad-nosed bat

Scientific name (Family)	Common name
Conservation concern*	
Calyptotis ruficauda	
Lampropholis amicula	
Litoria pearsoniana / phyllochroa	Leaf green tree frog species complex
Litoria tyleri	Tyler's frog
Saiphos equalis	Three-toed skink
Saltuarius swaini	Leaf-tailed gecko
Aviceda subcristata	Pacific baza
Falcunculus frontatus	Crested shrike-tit
Lalage leucomela	Varied triller
Monarcha trivirgatus	Spectacled monarch
Sericulus chrysocephalus	Regent bowerbird
Todiramphus macleayii	Forest kingfisher
Tregellasia capito	Pale-yellow robin
Antechinus swainsonii	Dusky antechinus
Mormopterus sp.1/ M. norfolkensis	
Austronomus australis (syn. *Nyctinomus australis*)	White-striped mastiff bat
Rhinolophus megaphyllus	Eastern horseshoe bat
Scotorepens sp1.	Broad-nosed bat (Undescribed)

Source: NPWS 2002a and Scotts 2002.

Status is given by the schedules of the TSC Act (either endangered or vulnerable).

* Considered to be a conservation priority in the forests of NE NSW (Gilmore and Parnaby 1994).

Under the provisions of the TSC Act, recovery plans must be prepared for all threatened species. None of the threatened species recorded within the reserve have had recovery plans prepared as yet. However, there is a recovery plan being prepared for the yellow-bellied glider (NPWS in prep). The yellow-bellied glider has been described as an umbrella and/or indicator species due to its requirements for large areas of complex mature and old growth eucalypt forest and it has been suggested that this species may represent a good target species for monitoring (refer section 7 Research and Monitoring) (NPWS in prep).

Key threats to native animal species include fire, introduced species and inappropriate human activities (refer also Sections 5.3 Introduced Species and 5.4 Fire Management). Strategies to protect native animals have also been incorporated into other sections of this plan, including sections 4.2 Native Plants, 5.2 Water Quality and Catchment Management, 5.3 Introduced Species, 6 Visitor Opportunities and Education, 8 Other Uses and 9 Management Operations.

Desired outcomes

- The full range of native animal species found in the reserve is conserved.
- The habitat of all fauna species within the reserve is conserved, enhanced, protected and maintained.

Strategies

- Protect, maintain and enhance native vegetation communities in the reserve (refer section 4.2 Native Plants).
- Protect the habitats of threatened and biogeographically significant fauna species from visitor impacts, the effects of introduced species and inappropriate fire regimes (refer sections 6 Visitor Opportunities and Education, 5.3 Introduced Species and 5.4 Fire Management).
- Ensure management operations and other uses in the reserve do not threaten native animal species or habitat in the reserve (refer 9 Management Operations and 8 Other Uses).
- Continue to record the distribution of threatened and significant fauna species.
- Implement recovery plans for threatened species when prepared such as the yellow-bellied glider recovery plan.
- Explore alternatives to chemical control of weeds near watercourses to minimise impacts on amphibian species, particularly known threatened frog species habitat (refer also section 5.3 Introduced Species).

4.4 Aboriginal heritage

Aboriginal communities have an association and connection to the land. The land and water biodiversity values within a whole landscape context are the centre of Aboriginal spirituality and contribute to Aboriginal people's identity. Aboriginal communities associate natural resources with the use and enjoyment of valued 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 reserve is located on the boundary between two main Aboriginal tribal boundaries, Gumbaynggirr and Djangadi. The Gumbaynggirr tribal group is reported to cover an area from Grafton in the north to the Nambucca River in the south, and westward from the coast to the headwaters of the Nymboida River (Townsend 1993).

Clement Hodgkinson, the colonial surveyor in 1841, identified a number of tribes in and around Nambucca and Kempsey including Yarrahapinni and the Tanban (Townsend 1993).

A number of areas and sites within the reserve are understood to be significant to the local Aboriginal community. These range from sites of individual significance, such as scarred trees, to areas that hold specific spiritual significance within the landscape.

The history of Aboriginal occupation of the area is evident not only in the relics and sites that hold considerable significance but also in the names of many of the towns, rivers and other features. It can be extrapolated that Mungay Mountain, which occurs within the reserve, derives its name from the 'Munga' Tribe, described by Clement Hodgkinson in 1841. The word Nambucca is believed to be derived from the Aboriginal word, Ngambugka, and is said to mean 'winding or crooked river' or 'entrance to the waters' (Townsend 1993). Tanban, which later became Tamban means, 'spiky grass' or 'kurrajong tree' (Townsend 1993). Other locations include Collombatti, Knobby tree; and Unkya, Long River (Bradley 1994).

While the NPWS presently has legal responsibility for the protection of Aboriginal sites and places it acknowledges the right of Aboriginal people to make decisions about their own heritage. It is therefore policy that Aboriginal communities are involved in the management of Aboriginal sites, places and related issues and the promotion and presentation of Aboriginal culture and history. The reserve is split between three Local Aboriginal Land Council (LALC) areas: Thunggutti; Kempsey; and Unkya. The majority of the reserve is within the Unkya LALC area. There may also be other Aboriginal community organisations and individuals with an interest in use and management of the reserve.

Some of the native plants within Ngambaa Nature Reserve are significant to local Aboriginal people for medicinal usage, bush tucker and cultural purposes and there is a need for an agreement to cover access to and usage of the native plants for Aboriginal people.

Desired outcomes

- Aboriginal sites, places and landscapes of significance are conserved and protected from damage.
- There is cooperative and integrated management of Aboriginal places and relics with the Aboriginal community and the relevant agencies.

Strategies

- Protect all Aboriginal sites, relics and objects.
- Consult with the Thunggutti, Kempsey and Unkya Local Aboriginal Land Councils, local community representatives, local Aboriginal Elders and other representatives about park management issues affecting Aboriginal cultural heritage, including identification of sites, actions to protect objects, sites and landscapes features.
- Undertake an Aboriginal cultural heritage assessment of the reserve in partnership with the local Aboriginal Community.
- Work with the local Aboriginal community to develop an agreement that is consistent with the NPW Act and NPWS policy and permits access to and usage of the native plants within the reserve for cultural purposes.
- Undertake cultural heritage assessments prior to any new works and developments likely to impact on Aboriginal heritage values in partnership with representatives of the Aboriginal community.
- Prepare site management plans for known sites in consultation with the local Aboriginal community.
- Support Aboriginal community proposals to undertake interpretation of Aboriginal cultural values in the park.
- Seek agreement from local Aboriginal communities before providing informationon the location of any Aboriginal sites and places. Prior to any promotion of a site or place, prepare a conservation plan and undertake any management works necessary to protect the site or place.

4.5 Historic heritage

The Nambucca valley was one of the last eastern valleys in NSW to be fully explored and settled by Europeans. The difficult entrance to the Nambucca River and dense rainforest on the valley floor delayed settlement in the valley. The first Europeans to permanently settle and work in the area were the cedar-getters in the 1830s.

James Taylor, one of the first pastoralists in the area, took up a run, TRY station, between Warrell Creek and Taylors Arm in 1841. It is suggested that the name Taylors Arm was named after him (Townsend 1993).

In 1841, Colonial surveyor, Clement Hodgkinson embarked on a major exploratory journey through the upper Nambucca Catchment from his base on the Macleay River. His trip was notable for the good relations he enjoyed with local Aboriginal people. There is some debate about the precise route taken by Hodgkinson. The journal kept by Hodgkinson described the vegetation and topography of the area and it is believed that his route included the reserve.

The reserve contains a number of sites of historic interest such as a marked tree on Good Friday Mountain, dry-stone retaining walls along Taylors Arm/Greenhills Road, the remains of an old stone cairn along Seargents Road which is believe to mark a grave site and the Cedar Park day use area. The reserve is also believed to have a number of old sawmill sites, although no relics have been found.

The marked tree on Good Friday Mountain was carved by Jim Wright on Good Friday in 1926 with the inscription 'Good Friday 1926 JW'. The Wright family has a long history within the region and held a grazing lease in the former Ingalba State Forest, now Ngambaa Nature Reserve, which was passed down the family. A member of the Wright family has visited the tree, an old New England Box, every Good Friday since. Toby Wright, the grandson of Jim, erected a sign on top of Good Friday Mountain to identify the site (Toby Wright pers comm 2001).

The reserve comprises land that was previously part of Ingalba, Collombatti and Tamban State Forests. Many of the reserve roads have been named after early timber getters in the area such as Buds Crossing Road named after Bud Miles.

The Cedar Park picnic area was established in the 1960s by SFNSW. A number of introduced non-native species were planted by SFNSW when the picnic area was established. These include two fully-grown Arizona cypress trees (Cupressus arizonica) and a number of silky oak (Grevillea robusta) and poplar trees (Populus nigra). The picnic area also contains a grove of spectacular cedar trees planted in 1969. Just off Jacks Road there are the remains of an old hut used by Fred Chapman, who planted the trees in Cedar Park.

Prior to gazettal of the reserve, forest protests were held in the 1990s over the proposal to release a number of compartments for woodchipping. This brought the conservation significance of the area into the public spotlight. In 1998, local conservation groups formally submitted a proposal to the NPWS for the creation of the reserve (Tedder 1998).

Fire and human disturbance are the biggest threat to sites of historic heritage within the reserve.

Desired outcomes

- Historic features are appropriately conserved and managed.

Strategies

- Record and protect all historic sites in the reserve.
- Ensure the stonewalls along Greenhills/Taylors Arm Road are protected when undertaking road maintenance works.
- Record and document the location and history of the marked tree on Good Friday Mountain.
- Retain existing exotic trees at Cedar Park until they die but remove those species with the potential to spread. Do not replace or allow the exotic trees to regenerate and become invasive.
- Involve local historical societies and members of the community in the identification, assessment, planning and management of historic items where possible.
- Undertake a site survey and heritage impact assessment prior to undertaking management activities with the potential to damage historic places. Works will be modified or relocated where necessary to protect sites of cultural significance.
- Encourage research into the history of the reserve including surveys to locate andrecord historic places, with priority to areas threatened with human impact, development or natural deterioration.

5. Reserve protection

5.1 Soil erosion

The underlying geology of the reserve, namely the Nambucca and Kempsey Beds differ in their erosive qualities. The Kempsey Beds are moderately resistant and less erodible than those of the Nambucca Bed and the soils are acidic clays, dispersive when wet and sometimes sodic, giving rise to strong contrasts and water erosion problems. The rocks of the Nambucca Beds are soft and highly erodible, giving rise to the deep, incised valleys of the upper catchments of the Nambucca and Bellingen Rivers, intensified by the susceptibility for landslides on steep slopes (Eddie 2000).

The reserve is split between three main physiographic regions known as the Nambucca - Bellingen Hills, Kempsey Hills and the Horseshoe Ranges. Soil landscapes characteristic of these physiographic regions is described in Appendix 1. The majority of soil types found within the reserve have been classified as being highly erodible.

The erosive qualities of soils and their parent materials have important implications for management, particularly for roads, track and trail maintenance. Erosion is recognised as a natural process however a number of events can accelerate the rate of erosion within the reserve. Soils are particularly vulnerable to erosion after large fire events, especially when post fire periods coincide with months of rainfall.

There is a minor area of erosion at Cedar Park along the existing walking track, which is associated with the grade of the walk and the lack of appropriate footing to minimise water runoff. Some of the tracks and trails within the reserve are also subject to erosion where they traverse a steep gradient.

Desired outcomes

- Human induced soil erosion in the reserve is minimised.

Strategies

- Maintain all management trails in the reserve to ensure soil erosion and sedimentation is minimised in accordance with NPWS Field Management Policy 1.4 (Soil Conservation and Rehabilitation) (refer section 6.2.2 Vehicle Access and Car Touring).
- Close and rehabilitate illegal trail bike trails, and all other roads and trails no longer required (see Appendix B and refer to section 6.2.2 Vehicle Access and Car Touring).
- Undertake rehabilitation works on eroded areas where needed particularly those areas near watercourses or with the potential to impact on watercourses such the walking track at Cedar Park.
- Provide steps at Cedar Park at an appropriate grade near the creek crossing to minimise water erosion and runoff.
- Incorporate soil erosion management principles and practices into all management activities and facility design in accordance with NPWS Field Management Policy 1.4 (Soil Conservation and Rehabilitation).
- Include objectives and actions for minimising erosion arising from prescribed fires and wildfires in fire planning and management programs (refer section 5.4 Fire Management).

5.2 Water quality and catchment management

The reserve falls into two major catchments, the Nambucca and the Macleay River catchments, with the majority of the reserve lying within the Nambucca River Catchment.

Warrell Creek and Taylors Arm are the two major sub-catchments that drain the reserve and are divided by the major ridgeline that traverses the reserve from its western boundary in a northeasterly direction. This ridgeline is the watershed for streams flowing north and west to Taylors Arm and east to Eungai and Allgomera Creeks. The Warrell Creek sub-catchment is east of the ridgeline and Taylors Arm is West.

Studies by the Department of Land and Water Conservation (DLWC) on the North Coast (DLWC 1999) included an assessment of a number of the sub-catchments in which the reserve forms part.

Taylors Arm sub-catchment, part of the Nambucca River catchment, was identified as having 'potential high conservation status' due to the high diversity of schedule 1 and 2 species under TSC Act and other targeted fauna species as well as large stretches of undisturbed waterways. Bakers Creek, which has its headwaters within the reserve, flows into Taylors Arm Creek.

Warrell Creek, which also forms part of the Nambucca catchment, is also identified as having 'potential high conservation value' due to the extensive stretches of undisturbed waterways within the catchment. Eungai, Stockyard and Allgomera Creeks which traverse the reserve all flow into Warrell Creek.

Collombatti Creek and Mungay Creek sub-catchments drain a small portion of the reserve in its far southwestern corner. Collombatti Creek and Mungay Creek form part of the Macleay River catchment. Both these sub-catchments have been identified by NSW Fisheries as having conservation value because of the high species diversity in their tributaries (DLWC 1999).

The *Catchment Management Act 1989*[2] 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 boards at a local level. The reserve is within the area of the Mid North Coast Catchment Management Board.

Desired outcomes

- The reserve's catchment values and the water quality and health of reserve streams are improved.

Strategies

- Design and undertake all works in a manner that minimises water pollution and in accordance with NPWS Field Management Policy Soil Conservation and Rehabilitation (refer to section 5.1 Soil Erosion).
- Explore alternatives to chemical control of weeds near watercourses to minimise impacts on water quality.

[2] The *Catchment Management Act 1989* has been repealed. The functions of the former Catchment Management Boards are now carried out by Local Land Services.

- Liaise with local government and other authorities as needed to maintain the water quality of the reserve's catchments.
- Continue to participate as a member of the Mid North Coast Catchment Management Board.

5.3 Introduced species

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

Introduced plants and animals have an impact on the natural environment through competition for resources, predation, disturbance and transmission of diseases. Pests also have the potential to have an adverse impact on the built environment and may also have an economic impact on neighbouring properties.

The principal management strategy for the management of introduced animals and plants in the region is the NPWS North Coast Region Pest Management Strategy (NPWS 2002b) which provides management direction at a broad level, while the specific management tool for the reserve is the Pest Management Plan (NPWS 2002c). As part of this plan a weed survey was carried out along many of the reserve's roads and trails. The plan describes the density and distribution of current and potential weed species, identifies known pest animal species and provides control priorities and techniques (refer to table 3). The pest management plan also recommends monitoring the success of the plan including control techniques and numbers of pests in the reserve. It is NPWS policy that any control programs undertaken within the reserve will only be permitted following environmental assessment and in accordance with any conditions of approval to minimise potential impacts on non-target species.

Table 3 Priority introduced plant and animal species

Introduced plant species		Introduced animal species	
Common name	**Scientific name**	**Common name**	**Scientific name**
Crofton weed*	*Ageratina adenophora*	European red fox	*Vulpes vulpes*
Cassia	*Senna x floribunda*	Feral cat	*Felis catus*
Giant Parramatta grass*	*Sporobolus fertilis*	Wild dog	*Canis familiaris*
Lantana *+	*Lantana camara*	Deer	*Cervidae*
		Cattle	*Bos taurus*

* declared noxious under Noxious Weeds Act 1993 – Category current at October 1999

+ only red flowering form of Lantana is declared noxious.

The past land use of the reserve has disturbed a number of areas and resulted in weed invasion. There are some areas within the reserve that have nearly whole understoreys of lantana. Weed invasion is a particular problem where continued disturbance by reserve users is evident, such as Cedar Park. There are also a number of non-native species at Cedar Park that were planted by SFNSW when the picnic area was established. These include two fully grown Arizona cypress trees (*Cupressus arizonica*) and a number of silky oak (*Grevillea robusta*) and poplar trees (*Populus nigra*) (refer also to section 4.5 Historic Heritage). It is NPWS policy to give priority to the control of exotic species known to be increasing in abundance, extending in range or displacing native plant and animal species.

The Pest Management Plan (NPWS 2002c) addresses the management of exotic species at Cedar Park.

An important consideration for weed control within the reserve is the control of weeds near watercourses and the need to minimise impacts on amphibian species. This is particularly the case for the control of lantana at Cedar Park and its proximity to Stockyard Creek, known habitat of the endangered giant barred frog (refer also section 4.3 Native Animals).

Wild dogs have been reported in the reserve and control programs have been undertaken in response to stock loss problems on neighbouring properties.

In June 1999, NPWS in conjunction with the Rural Lands Protection Board (RLPB) undertook a large-scale wild dog and fox control program in the reserve. This program involved the establishment of mounds to bait dogs and foxes in the reserve. This was done as part of a transitional arrangement and negated the need for aerial baiting. There has since been numerous discussions with the RLPB about the establishment of a neighbour based baiting program for the reserve.

In 2001, NPWS undertook a dog survey within the reserve to assess the abundance and genetic make up of wild dogs within the reserve. This survey forms part of a program that is being undertaken for the North Coast Region, which aims at identifying the abundance of pure dingos. The survey found only a single dingo within the park.

Wild dogs can be divided into three groups, dingos, hybrids with domestic dogs, and feral dogs. Wild dogs, including dingoes, can cause substantial losses to livestock and there is an expectation by rural communities that the impact of these animals be minimised. The *Rural Lands Protection Act 1998* (RLP Act)[3] requires pest animals declared under the RLP Act to be controlled. Wild dogs, including dingoes, have been declared noxious throughout NSW and hence, the NPWS has a statutory obligation to control wild dogs on its estate. Under the RLP Act, public lands considered to contain high quality dingo habitat have been listed as dingo management areas. This includes the reserve. The RLP Act requires public land managers, such as the NPWS, to assist in the preparation of a wild dog management plan for dingo management areas. These plans are to identify methods for the control of wild dogs and the conservation of dingoes in these areas and are to be approved by the local RLPB.

Recovery Plans and Threat Abatement Plans, including 'predation by the red fox', prepared under the TSC Act also include specific control programs for introduced animals and the RLP Act identifies statutory requirements relating to management of declared noxious pest animals (NPWS 2001). In addition, the *Noxious Weeds Act 1993*[4] places an obligation upon public authorities to control noxious weeds on land that they occupy to the extent necessary to prevent such weeds spreading to adjoining lands.

Desired outcomes

- The impact of introduced species on native plants and animals is minimised.

Strategies

- Implement the recommendations from the Pest Management Plan for the reserve and review the plan annually.

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[3] The *Rural Lands Protection Act 1998* has been repealed and responsibilities relating to pests are now covered by the *Biosecurity Act 2015* and regional pest management strategies prepared by Local Land Services.

[4] The *Noxious Weeds Act 1993* has been repealed and responsibilities relating to weeds are covered by the *Biosecurity Act 2015* and regional weed management strategies prepared by Local Land Services.

- Control introduced species and eradicate them where practicable in accordance with best management practice, to deliver optimal biodiversity outcomes.
- Assist in the preparation and implementation of a wild dog management plan to be approved by the local Rural Lands Protection Board.
- Give priority for the control of introduced species to those species that:
    - are declared noxious
    - have a significant environmental impact, including damage to threatened species, catchment values and recreation values
    - may affect neighbouring lands or are considered 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.
- Assess the potential for spread of the exotic tree species at Cedar Park and retain those trees where there is no threat of spread (refer also to section 4.5 Historic Heritage).
- Explore alternatives to chemical control of weeds near watercourses to minimise impacts on amphibian species, particularly known threatened frog species habitat (refer also section 4.3 Native Animals).
- Seek the cooperation of neighbours in implementing weed and pest animal control programs. Undertake control in cooperation with the Kempsey RLPB.
- Encourage maintenance of effective fencing of boundaries with grazing properties to prevent domestic stock from entering into the reserve. Provide fencing assistance where possible and appropriate in accordance with NPWS Boundary Fencing Policy.

5.4 Fire management

Fire is a natural feature of the environment and is essential to the survival of some plant and animal communities. Inappropriate fire, however, can damage natural and cultural heritage values and endanger reserve visitors and neighbours. Management of bushfire in the reserve 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 reserve.

The old growth and rainforest areas are particularly fire sensitive and the draft Fire Management Plan for the reserve recommends that fire be excluded from these areas.

Fire also has the potential to damage some types of Aboriginal sites and historic places. Features such as scarred trees, old buildings and farming implements can be permanently damaged or lost by wildfire. Other sites can be damaged by use of heavy machinery for fire suppression activities. There are two known sites of Aboriginal importance within the reserve, Mungay Mountain and a single scarred tree located along one of the fire trails. The scarred tree is particularly sensitive to fire threat (refer to section 4.4 Aboriginal Heritage).

The carved tree on Good Friday Mountain and Cedar Park are also particularly fire sensitive (refer to section 4.5 Historic Heritage).

Fire records for the reserve are incomplete, particularly where grazing leases have existed. Five wildfires have been recorded as affecting the reserve since 1979l80. However anecdotal evidence suggests wildfires have been more common in some locations in and around the reserve.

There are also records of prescribed burning within the reserve with at least 5 recorded prescribed burns in the past 20 years. There is also anecdotal evidence of regular low intensity fires in and adjoining the reserve, which may be associated with grazing ie. burning

to create suitable feed. It is also apparent that post-logging burning was undertaken in selected areas.

The combination of wildfire and prescribed burning within the reserve has resulted in a relatively frequent fire history in some drier forest communities over recent decades. However, it also appears that some areas may be long unburned, as is the case for the rainforest areas.

The bushfire danger period for the reserve is expected to be early spring to early summer based on temperature, relative humidity and rainfall trends. These trends also show that there is relatively high rainfall during the months normally preferred for prescribed burning (i.e. autumn) and that that lower fire danger winds (winds from north-southeast) are dominant throughout the year.

Extensive areas of the reserve are classified in the medium and higher fuel groups (74%), with these areas being focused mainly around the south-east of the reserve where dry grassy blackbutt - tallowwood forests dominate. It is estimated that the negligible fuel groups, predominantly the rainforest areas, make up only 2% of the reserve.

Under the *Rural Fires Act 1997* the NPWS is a fire authority and is responsible for controlling fires on the reserve 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 Nambucca and Kempsey Bush Fire Management Committees.

A draft fire management plan has been prepared for the reserve (NPWS 2000). This identifies the bushfire threat, requirements for the conservation of native plants and animals and community protection measures in areas where it is identified that fire is a threat to property. In particular, fire management guidelines are set out for threatened fauna species recorded or predicted to occur in the reserve. These mainly involve protection of potential nesting sites and keeping fire out of the canopy.

Management will aim to maintain biodiversity by restricting fires to only part of the distribution of a vegetation community at any one time and ensuring that the fire thresholds are not exceeded.

A variety of fire management strategies have been developed including fuel reduction, fire trails, detection and cooperative arrangements. Some, or at times all, of these will be applied where appropriate to best protect life, property and natural and cultural assets. Close to boundary areas, fuel reduction programs and fire trail maintenance will be designed and implemented in cooperation with neighbours. Adequate water points for the reserve are also an important management consideration given the size and nature of the vegetation within the reserve.

The draft plan identifies a low frequency strategic pattern of burning incorporating ecological burning principles as appropriate for the park and that fire be excluded from rainforest and other fire sensitive communities. Strategic Fire Management Zones and Wildfire Control Zones have been identified within and outside the park. The FMP plan will also determine appropriate fire regimes to maintain ecosystems and the protection of neighbouring property. Annual hazard reduction programs are submitted to the district Bush Fire Management Committees.

Desired outcomes

- Fire regimes are appropriate for long-term maintenance of the reserve's plant and animal communities and biodiversity.
- Unplanned bushfires caused by humans are prevented.

- The potential for spread of bushfires on, from, or into the reserve is minimised.
- Persons and property on, or immediately adjacent to, the reserve are protected from bushfires.
- Aboriginal sites, historic places and culturally significant features are protected from damage by bushfires.

Strategies

- Finalise and implement the draft Fire Management Plan.
- Use prescribed fire to achieve a variety of fire regimes that maintain fire thresholds for each vegetation community in accordance with the Fire Management Plan.
- Seek to avoid use of heavy machinery for fire suppression in areas of rare plants, Aboriginal sites and historic places.
- Rehabilitate areas disturbed by fire suppression operations as soon as practical after the fire.
- Encourage research into the ecological effects of fire in the reserve, particularly the fire response of significant plant species and the fire requirements of these communities.
- Continue to actively participate in the Nambucca and Kempsey Bush Fire Management Committees. Maintain close contact and cooperation with fire management agencies and Rural Fire Service Fire Control Officers.
- Where appropriate, carry out fuel management in cooperation with neighbours for mutual protection.
- Undertake fuel reduction programs, trail maintenance, research and monitoring programs in accordance with the policies outlined above and the Fire Management Plan.
- Undertake further investigation of fire history in the reserve.
- Close the reserve to public use during periods of extreme fire danger if necessary.

5.5 Establishing a feral predator-free area

Feral predators have had a significant impact on Australian native animals. Australia has the worst mammal extinction rate in the world. Over 30 Australian mammal species have been driven to extinction in the past 250 years, with cats and foxes the main drivers for at least two-thirds of these losses (Legge et al. 2018). Feral cats are found throughout mainland Australia and kill 1.7 billion native animals every year. They have contributed to most of the small mammal extinctions in Australia over the last 250 years (Woinarski et al. 2018) and continue to have a significant impact on native mammals, reptiles and birds.

The effective control of cats and foxes within parks and reserves is essential for the recovery of many of our threatened and declining native animals, especially small terrestrial mammals and ground-dwelling birds. Despite extensive and ongoing efforts, there is currently no effective strategy for landscape-scale control of feral cats, and landscape-scale fox control has had mixed results.

The effective control of feral predators like cats and foxes is essential for the recovery of many of the most threatened species, especially mammals and ground-dwelling birds. To this end, there is a sound scientific basis for the establishment of feral predator–free areas as a component of any overall strategy to prevent further extinctions and promote the recovery of our most susceptible species (Legge et al. 2018). This reflects a consensus that other feral predator control measures such as baiting can deliver significant ecological benefits but are not able, in isolation, to reduce feral predator densities to a level that will promote the sustained recovery and reintroduction of our most susceptible mammals.

A network of feral predator–free areas, including islands and enclosures, has been recognised by the Australian Government's National Environment Science Program as a necessary complement to the conventional reserve system, and is required in the short to medium term to prevent extinction of predator-susceptible threatened mammal species. The establishment of a network of feral predator–free areas within the NSW national parks network will complement those established on private land. This significant and long-term commitment of the NSW Government will be implemented in parallel with the suite of existing threatened species conservation strategies across the State.

Ngambaa Nature Reserve has been selected as the preferred site for a 3000-hectare feral predator–free area in north-east New South Wales. Distribution models of threatened species and their former range have confirmed that the reserve has the potential to support the reintroduction of many species that were formerly widespread across the North Coast Bioregion. Vegetation types incorporating grassy understoreys, wet gullies, eucalypt forests and subtropical rainforest provide large areas of intact habitat that will facilitate:

- the re-establishment of the eastern bettong (*Bettongia gaimardi*) which is currently listed as extinct in New South Wales
- the establishment of new populations of locally extinct threatened species such as the eastern quoll (*Dasyurus viverrinus*), rufous bettong (*Aepyprymnus rufescens*), parma wallaby (*Macropus parma*), common planigale (*Planigale maculata*) and long-nosed potoroo (*Potorous tridactylus tridactylus*)
- conservation benefits for additional threatened animal species, including the koala (*Phascolarctos cinereus*), red-legged pademelon (*Thylogale stigmatica*), eastern pygmy-possum (*Cercartetus nanus*) and yellow-bellied glider (*Petaurus australis*).

The topography of Ngambaa Nature Reserve is suitable for the construction of a predator-proof fence. Previously logged areas in the reserve and a network of old logging trails will enable fence construction to occur with minimal disturbance to vegetation. The reserve is also relatively close to existing park management infrastructure and has relatively low levels of recreation.

Within and around the feral predator–free area, trails will be constructed and maintained to enable maintenance of the fence, management of vegetation adjacent to the fence, eradication of feral predators, monitoring of reintroduced species and management of fire. While the fence will follow existing roads and trails where feasible, the realignment of existing trails or the construction of new trails may be necessary. Other management trails may be closed and rehabilitated. New facilities may also be required on site to support the storage of materials and equipment, fence construction, eradication of predators, research and monitoring, education and other management activities. The preferred area for the feral predator–free area is shown in Appendix B. The specific location of the feral predator–free area and associated infrastructure in the reserve will be finalised after completion of an environmental impact assessment and the consideration of practical constraints.

Ngambaa Nature Reserve is reserved under the NPW Act to 'identify, protect and conserve areas containing outstanding, unique or representative ecosystems, species, communities or natural phenomena'. Once established, the feral predator–free area will reverse the long-term impact of feral predators and maintain ecosystem function within the fenced area by:

- preventing the extinction of threatened species not expected to survive in the presence of ongoing predation by feral cats and/or foxes
- achieving a measurable conservation benefit for up to 20 threatened ground-dwelling and arboreal species
- returning burrowing, carnivorous and fungivorous species that have important ecosystem roles, for example, through turning over soil, spreading native seed and fungal spores, or as native predators.

The feral predator–free area will also contribute to the protection and conservation of areas beyond the fence by:

- generating knowledge through research and innovation which can be applied to mitigate the impact of feral predators and improve conservation outcomes 'beyond the fence'
- establishing insurance populations of threatened species until effective methods for landscape control of cats and foxes is developed
- providing source populations for the restoration of species across the landscape
- promoting public awareness of, and appreciation for, the value of native wildlife.

Establishment of a feral predator–free area within the reserve will strengthen the role it plays in meeting two key management principles for nature reserves: conserving biodiversity and maintaining ecosystem function. Therefore, the proposed feral predator–free area is considered consistent with the purpose of nature reserves and complementary to their management principles under the NPW Act.

As required under the Act, any impacts associated with construction of the feral predator–free area, eradication of feral predators and the reintroduction of species will be avoided and minimised as far as practicable. Initially, measures to minimise or mitigate these impacts will be identified in an environmental assessment of the proposal which will be undertaken prior to any works. This may include actions to reduce the extent of vegetation clearance during fence construction and, where practicable, avoiding the removal of trees with important habitat value.

In addition, the following operational plans will be developed to identify and direct the management of any potential impacts:

- Translocation plans will guide the selection, reintroduction and management of all species proposed for reintroduction. They will be developed in accordance with the department's Translocation Operational Policy (DPIE 2019) and in consultation with relevant state and national species experts.
- The reserve fire management strategy will be updated to guide fire management and to minimise the risk of bushfire to infrastructure and to the welfare and survival of fauna within the feral predator–free area. This strategy will inform the Lower North Coast *Bush Fire Risk Management Plan* (LNCBFMC 2018) and associated operational plans to inform tactics arising from wildfire events within the locale.
- Pest eradication and management strategies will be developed to direct feral predator eradication programs and other pest management within the feral predator–free area.
- A monitoring and research strategy will be developed to increase knowledge about threatened species, monitor the effectiveness of reintroduction strategies and to inform the adaptive management of the program.

Strategies to support species reintroduction have already been developed through the establishment of feral predator–free areas elsewhere in New South Wales and Australia. However, it will be necessary to develop additional knowledge to guide and refine site-specific strategies for this area and for the species that have not yet been successfully reintroduced elsewhere. The establishment of a monitoring and research strategy at the start of the project will ensure that any risks to fauna species, their habitats and the reserve are avoided and minimised wherever practicable. This will also ensure that operational plans are regularly revised in line with the best available knowledge.

These operational plans and the associated environmental assessments will be developed in consultation with key stakeholders as appropriate including traditional owners, neighbours, local volunteer brigades, researchers, scientific specialists and the National Parks and Wildlife Regional Advisory Committee.

Desired outcomes

- Feral predators and other pest animals have been removed from a fenced area to establish a feral predator–free area.
- Locally extinct fauna species have been reintroduced within a feral predator–free area.
- Populations of fauna species which are vulnerable to feral predators and/or the impact of feral herbivores are recovering.
- Ecosystem health and function within the feral predator–free area are improving.

Strategies

- Undertake an environmental assessment to guide the development of operational plans and the identification and management of risks to fauna species, their habitats and the reserve.
- Construct a feral predator–proof fence and associated management facilities to facilitate eradication of feral predators and other pest animals from within the feral predator–free area, reintroduction of locally extinct mammals, recovery of extant fauna and ongoing management of the site.

6. Visitor opportunities and education

6.1 Information provision

Reserve facilities and services provide opportunities to enjoy, appreciate and understand the value of our natural and cultural heritage. Only areas that can sustain use are promoted in this way. Information provision at such places and about the area in general assists the protection of natural and cultural heritage, promotes support for conservation and increases the enjoyment and satisfaction of visitors.

The reserve has a number of natural and cultural features of interest to visitors, these relate primarily to the rugged natural terrain and nature conservation values. These features will be promoted and interpreted to visitors in a manner that protects their special values and encourages appropriate use.

The reserve will be managed to ensure that visitor use is consistent with the NPW Act, NPWS policy and the objectives of this plan of management.

Visitor use that may be consistent with a nature reserve include:

- promotion of, and education about, the area, the NPWS and the conservation of natural and cultural heritage values; and
- passive nature-based recreation.

Desired outcomes

- There is widespread community understanding and appreciation of the reserve's natural and cultural values.
- Visitors are aware of the appropriate visitor use opportunities and can easily find their way to reserve facilities.
- The reserve is a useful educational resource for local schools and community organisations.

Strategies

- Encourage minimal impact recreation through information signs and other means.
- Produce media releases and attend meetings with neighbours and community organisations to promote community understanding of reserve values and management strategies.
- Emphasise the following themes in promotion and interpretation programs:
    - Large, rugged nature of the reserve
    - High biodiversity including large number of threatened animal species
    - Spectacular example of dry forest communities.
- Distribute the reserve brochure to tourist information centres and other appropriate locations, and update the brochure as needed.
- Place orientation/interpretive signs to clearly show the location of Cedar Park day use area and the 'tourist drive' at key locations in the region such as at Bowraville, Eungai Creek, Taylors Arm, the Pacific Highway and elsewhere as appropriate.
- Explore the opportunities for the development of material and programs for interpretation of Aboriginal culture in partnership with the local Aboriginal community.
- Support and assist educational use of the reserve by schools, community groups and individuals through provision of information and programs such as walks and talks.
- Encourage NPWS 'Discovery Programs' to provide guided interpretive activities.

6.2 Visitor opportunities

6.2.1 Appropriate visitor use

The primary purposes of nature reserves are conservation of wildlife and natural environments and to provide opportunities for education and scientific research. Recreation is appropriate where it does not conflict with the conservation objectives of the area and promotes understanding and appreciation of the reserve's significance.

Visitor opportunities provided in nature reserves are generally those at the low-key end of the spectrum, in natural and undeveloped settings. Recreational uses which are ecologically sustainable and directly contribute to the visitor's understanding and appreciation of the reserve are considered appropriate.

Provision for visitor use of the reserve has been considered in a regional context. Public land managed by NPWS and other authorities in the region provides diverse opportunities for facility-based camping, visitor information centres and large picnic and day use facilities. Accordingly, it is considered inappropriate to replicate such facilities within the reserve.

Management of visitor use to be ecologically sustainable requires placing limits on the number of access points, design of facilities to ensure that numbers of visitors and the style of use is appropriate for the site, and promotion of minimal impact use. The provisions below are designed to maintain the low key, scenic, natural settings which are the special feature of the reserve and to provide for future use in a manner which protects ecological integrity and cultural heritage values.

The reserve has a number of spectacular and significant values derived from its geographical location and size including high biodiversity. Many of these values would be vulnerable to damage by particular and inappropriate activities. For this reason, recreational use of the reserve will be low key and orientated towards self-reliant recreation.

Once established, the feral predator–free area will provide a unique visitor opportunity to see the bush as it was before the arrival of feral animals: alive with small native mammals in a healthy ecosystem. Restrictions on public access to this area may be necessary during fence construction, feral predator eradication and the initial stages of reintroductions.

Desired outcomes

- Visitor use is compatible with the purposes of nature reserve and is ecologically sustainable.
- Opportunities for low key visitor use are available that encourage appreciation of the natural environment.
- Facilities are designed and managed to provide a satisfying visitor experience and minimise impacts.

Strategies

- Undertake opportunistic surveys of the number of visitors using picnic and popular informal camping areas. Monitor the condition of visitor areas, and if necessary, areas may be temporarily or permanently closed or otherwise restricted if unacceptable damage is found to be occurring to natural or cultural values.
- If necessary, implement special conditions on recreational use of the park during periods of high to extreme fire danger or in the event of bushfires (refer Section 5.4 Fire Management) or periods of high rainfall. This may include temporary closure of the park or some roads within the park.

- Opportunities to facilitate education and interpretation about the feral predator–free area will be further investigated and progressed after the feral predator–free area has been established.
- Public access to the feral predator–free area will be restricted as necessary (refer sections 6.2.2 Vehicle access and car touring, 6.2.3. Cedar Park Day Use Area and 6.2.4 Bush walking).

6.2.2 Visitor Access and Car Touring

The main access to the reserve is from Eungai Creek along Tamban Road or McKays Road or directly off the Pacific Highway along Allgomera Creek Road. Taylors Arm/Greenhills Road are public roads that also provide access to the reserve but are not part of the reserve.

SFNSW previously promoted roads in the area as ‘tourist drives’ and local tourist associations and Councils have requested that the opportunity to undertake such a drive be retained. Following consultation with the relevant parties the following roads have been identified as forming a suitable route (see Appendix B):

- Tamban Road
- Elliott's Road
- Searles Road
- Stockyard Creek Road
- Buds Crossing Road
- Jacks Road (which leads to Cedar Park)
- Wittigs Road
- Taylors Arm/Greenhills Road,
- Western Range Road,
- Collombatti Trig Road (leads to Collombatti Trig Lookout)
- Western Range Road
- Starling Road
- Kempsey Armidale Road.

This route does not involve the upgrading or creation of any new roads and uses existing roads that provide for public thoroughfare to adjoining State Forest estate and facilities. No formal facilities, such as lookouts, will be provided as part of the tourist drive. In determining the roads that will remain open to the public, consideration has been given to a range of factors including: physical constraints (such as the road alignment, slope, drainage and the erodibility of the soils); culturally sensitive areas; conservation values; fire management; park zoning; access to existing visitor facilities; public thoroughfare and access to private property.

Maintaining roads requires a major commitment of resources and some roads are in excess of management requirements for nature conservation purposes. A number of tracks and trails associated with former forestry operations have no value for visitor use or management access in the reserve. These are generally dead-end roads that do not lead to features of interest. They can have significant environmental impacts and these roads will be closed and if necessary rehabilitated.

Strategies

- Maintain the roads and management trails shown on Appendix B. Close all other roads and where necessary rehabilitate.
- Maintain Tamban Road as the main access road to the reserve. Liase with SFNSW and Council for maintenance of this road.

- Reclassify the following roads as management trails and close them to public vehicle access: Buds Crossing Road (in the reserve), Seams Road, Stockyard Creek Road (in the reserve), Wittigs Road and Jacks Road.
- Maintain park roads in the reserve for public vehicle use in accordance with Appendix B. Liaise with relevant managers to encourage the maintenance of access roads outside the reserve that provide public access to the reserve.
- New roads will not be developed other than new management trails necessary for the construction and maintenance of the feral predator-proof fence and management of the feral predator–free area.
- Prepare and implement a reserve access strategy to secure park access for public use and management purposes.
- Identify and seek to correct boundary errors and boundary encroachments through, for example, boundary adjustments under section 188C of the NPW Act.
- Monitor roads and close in wet weather if necessary.
- Provide and maintain directional signs at key intersections.

6.2.3 Cedar Park Day Use Area

The only formal visitor facilities within the reserve are those provided at the existing Cedar Park day use area.

Cedar Park predates the dedication of the reserve and was established by SFNSW. Cedar Park takes its name from the large stands of red cedar trees at the picnic area which were planted in 1969 (Forestry Commission of NSW 1988).

The picnic area is located on Jacks Road, on the banks of Stockyard Creek and consists of two clearings either side of Stockyard Creek. On the eastern side of the creek are two picnic tables, a cement barbecue and a toilet. A track leads across the creek to another picnic table and cement barbecue. A short loop-walking track leads from the picnic area through the surrounding forest. Work has been undertaken by NPWS to upgrade the toilet and walking track.

There are large areas of lantana around Cedar Park and also a number of exotic tree species (refer also sections 5.3 Introduced Species and 4.5 Historic Heritage).

Following establishment of the feral predator–free area and the reintroduction of locally extinct animals, Cedar Park is expected to be an important site for visitation to the reserve. To promote managed public visitation consistent with maintaining the feral-free area status of the fenced area in the reserve, access to Cedar Park may be managed and restricted. Once the feral predator–free area has been established, further investigations will be undertaken to determine the most appropriate type and location for visitor facilities in the reserve.

Strategies

- Control and eradicate the lantana and exotic tree species to prevent invasion. Explore various control techniques for lantana control near Stockyard Creek to protect the endangered giant barred frog (refer also to section 5.3 Introduced Species).

6.2.4 Bushwalking

Walking tracks provide visitors with the opportunity to experience the natural and remote recreational settings of the reserve and to access particular attractions.

Bush walking is undertaken throughout the reserve along vehicle access routes, informal paths and cross-country, as well as on the Cedar Park loop walking track.

Management of bush walking will need to ensure that the natural and cultural values of the reserve are protected and impacts of the walking track system are minimised.

There is currently a proposal by Kyeewa Bushwalking Group to establish a long-distance walking route to commemorate the journey of Clement Hodgkinson. The route is proposed to begin from his base on the Macleay River and travel through the upper Nambucca catchment. The route is surmised to have traversed the reserve (refer also section 4.5 Historic Heritage).

Strategies

- Following establishment of the feral predator–free area and the reintroduction of locally extinct animals, Cedar Park is expected to be an important site for visitation to the reserve. Review the walking track at Cedar Park once strategies for the provision of visitor facilities associated with the feral predator–free area have been developed.
- Review the walking track at Cedar Park once strategies for the provision of visitor facilities associated with the feral predator–free area have been developed. Cedar Park is expected to be an important site for visitation to the reserve following establishment of the feral predator–free area and the reintroduction of locally extinct animals.
- Continue to allow self-reliant bush walking throughout the reserve and on management trails.
- Encourage adherence to minimal impact bushwalking codes.
- Investigate the suitability of existing tracks and trails to form part of a long-distance walking track commemorating Clement Hodgkinson and signpost and interpret as appropriate. Do not develop any new tracks as part of the proposal.

6.2.5 Camping

Self-reliant overnight camping (pack camping) occurs at a number of locations within the reserve. Current use levels and impacts are relatively low. It is not intended to prohibit overnight pack camping within the reserve, however pack camping needs to be carefully monitored to maintain low levels of use and to determine if any issues arise such as user conflict or degradation of habitat and vegetation.

Strategies

- No formal camping facilities will be provided.
- Prohibit camping at Cedar Park day use area.
- Allow pack or bush camping throughout the reserve at locations more than 200m from vehicular access routes, watercourses, day use areas, constructed walking tracks or hazardous areas within the reserve.
- Place restrictions on pack camping if needed in the future to minimise impacts on natural or cultural values and other users and to maintain low levels of use.
- Monitor the level of pack camping within the reserve to maintain a low impact.
- Encourage minimal impact camping and 'No trace' camping ethic.

6.2.6 Cycling

For cyclists the reserve offers a number of scenic and rugged tracks, trails and roads. At present the current level of use by cyclists is low.

Strategies

- Allow cycling on roads and management trails only. Cycling will not be permitted on walking tracks or within the feral predator–free area.

6.2.7 Horse riding

Recreational horse riding occurs within the reserve, although it is believed to be infrequent and not in large numbers and mostly confined to the road system. Some of the soil types within the reserve are susceptible to erosion and horse riding can have unacceptable impacts in terms of erosion as well as increase nutrient inputs and safety concerns.

Horse riding is not considered to be an appropriate activity within nature reserves and, as such horse riding within the reserve will not be permitted. This is in accordance with NPWS Horse Riding Policy. In addition, the surrounding region provides numerous alternative opportunities for horse riding on large rural holdings and in state forests.

Strategies

- Horse riding (including recreational, commercial and organised horse riding) will not be permitted within the reserve, including along park roads and management trails or on any public roads that traverse the reserve.

7. Research and monitoring

The purpose of scientific study in the reserve is to improve understanding of its natural and cultural heritage and the processes affecting them. Research also establishes the requirements for management of particular species. NPWS research efforts must be directed towards the areas of greatest need and will concentrate on threatened and protected flora and fauna species and cultural heritage sites, particularly Aboriginal sites and relics.

Research priorities identified under the RFA will be pursued along with topics identified in this plan of management. Key areas of research and monitoring will be:

- grass surveys
- threatened flora and fauna surveys
- sites and relics of aboriginal and historic significance
- surveys for the threatened rusty plum *Amorphospermum whitei* in rainforest areas along Allgomera and Bakers creek catchments and near Western Range Road
- species-specific surveys and monitoring of target species such as the yellow-bellied glider (an umbrella and/or indicator species).

Additional research programs will be considered where they complement ESFM criteria and indicators. The results of research and monitoring will be used to guide management programs.

Research by other organisations and students may provide valuable information for management. A prospectus should be prepared to encourage involvement of other organisations in priority research areas. Some important research topics have been mentioned in earlier sections of this plan.

Desired outcomes

- Research is undertaken that enhances the information base and assists management of the reserve.
- Research causes minimal environmental damage.
- Monitoring programs are in place to detect any changes in the status of reserve resources.

Strategies

- Undertake research to provide information about the reserve's natural and cultural heritage and human use in order to facilitate management.
- Permit appropriate research by 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.
- Prepare a list of preferred research topics for the reserve, including:
    - fire history and the ecological effects of fire
    - non-Indigenous and Indigenous heritage
    - threatened species surveys
    - flora and fauna surveys
    - species-specific surveys including the yellow-bellied glider
    - pest species and the effectiveness of pest control methods.
- Encourage bird watchers or similar groups to pass on information gathered in the reserve to NPWS.

8. Other uses

Prior to the reservation of the reserve there were a number of uses that were permitted by SFNSW under licence that are not consistent with the NPW Act. These include beekeeping (apiculture) and grazing.

8.1 Bee keeping

Prior to the reservation of the reserve there were a number of occupational permits issued by SFNSW for apiary sites. The 1998 NSW Government Regional Forest Agreement allowed for the issuing of a consent under the National Parks and Wildlife (Land Management) Regulation 1995 for existing apiary sites that predate reservation of the reserve.

The NPWS Beekeeping Policy allows existing sites to continue but does not allow any new or additional sites. Under the policy any existing sites that seriously compromise the environmental or recreational values of an area may be relocated within the reserve.

The European honeybee is an exotic species that can have adverse impacts upon some native biota. Impacts upon native plants and animals depend upon the type and abundance of native species present, the climate or season, the number of hives in an area and the frequency with which the sites are used.

There are a number of short dead-end tracks that lead to apiarist sites within the reserve. These tracks run off existing management trails and public roads and are not needed for management by NPWS but are used by apiarists for access to their bee sites.

Desired outcomes

- To balance the NPWS conservation responsibilities and the needs of the apiary industry for access to NPWS managed lands.
- To provide a mechanism for the relocation of apiary sites where apiary activities may result in unacceptable environmental impacts or user conflicts with other reserve management users.

Strategies

- License all existing apiary sites within the reserve.
- Wherever possible, maintain access tracks and sites by slashing to minimise
- disturbance.
- Require a financial contribution from the apiary site consentee for maintenance of tracks required primarily for the purpose of access to apiary sites and maintained by NPWS. Where the consentee is responsible for maintenance no financial contribution will be required. This will be determined through an agreement between NPWS and the consentee.
- Develop an agreement with apiarists for management and maintenance of access tracks to their apiary sites.
- Relocate where possible apiary sites near high visitation areas to sites elsewhere within the nature reserve. This relocation process will consider access requirements to sites and likely adverse environmental impacts.
- Encourage research into the impacts of beekeeping on native flora and fauna in the planning area.

- Liaise with the apiary licence holder to minimise any business impacts associated with removal of the apiary site from within the feral predator–free area.

8.2 Grazing

Sections within the reserve have had a long history of forest grazing. There were two known grazing leases issued prior to the reservation of the reserve by SFNSW located in the north-western corner of the reserve. Grazing of domestic stock is not an appropriate activity in nature reserves and forest grazing was progressively phased out following the dedication of the reserve in 1999.

In many places the reserve boundaries are immediately adjacent to farming land. Where possible, fencing is maintained and management vehicle access is established in cooperation with neighbours. In some areas of the reserve the impact of grazing stock can be significant on important and vulnerable plant and grass communities. Exclusion of domestic livestock from these areas will be given a high priority.

NPWS encourages construction and maintenance of boundary fences with neighbours. The responsibilities and obligations of neighbours for boundary fencing are largely defined by legislation. Under the Dividing Fences Act 1991, the Crown is not bound, and therefore, NPWS has no legal responsibility to contribute to boundary fencing. However, NPWS recognises that boundary fencing can enhance conservation values and resolve management problems within the planning area.

Accordingly, despite the Crown's limited legal responsibility, NPWS contributes to priority boundary fences as funds permit.

Desired outcomes

- Unauthorised livestock are excluded from the planning area.

Strategies

- Exclude non-authorised livestock within the planning area.
- Negotiate construction and/ or maintenance of boundary fences with reserve neighbours in priority areas to exclude livestock.
- Monitor the presence and movements of domestic owned cattle in the planning area and undertake appropriate action to remove stock.
- Remove fences no longer required for management purposes, especially internal fencing of former pastoral holdings. Fence posts will be retained unless they present a hazard to reserve users or management operations.

9. National Parks and Wildlife Service management facilities and operations

The Coffs Coast Area of the NSW NPWS administers the reserve. The area office is located at Coffs Harbour and area workshops are located in Toormina and Bowraville.

Managers, rangers, sites officers, specialists and field staff undertake organisational operations within the planning area. In order to effectively deploy their duties NPWS staff and contractors utilise a variety of resources to complete tasks. Major resources for management of the reserve are located within and outside the reserve and include:

- Coffs Coast offices and workshops (Toormina and Bowraville)
- a system of ground and aerial access including the public road system and a network of management trails (refer section 6.2.2)
- fire management infrastructure such as dams, helicopter landing pads and boundary fire breaks
- boundary fencing.

A network of management trails is required to enable vehicle access for fire, weed, feral animal and public activity management (see Appendix B). Vehicle access on management trails is restricted to essential NPWS management purposes and other purposes authorised by the Regional Manager. Walkers and bicycle riders may use management trails.

Several access roads within the reserve have been identified as Ministerial roads to ensure harvesting access to adjacent state forest. These roads have been vested in the Minister for the Environment as 'Ministerial Roads'. Part 5 section 72 (3) of the Act allows for such roads to be included in plans of management. The Ministerial roads include:

- Aquarius Road
- Collombatti Creek Road
- Kurrajong Road
- An unnamed trail that runs off Long Saddle to Allgomera Creek Roads.

Desired outcomes

- Management, staffing and facilities that adequately serve the needs of park
- management with acceptable environmental impact.
- A good relationship is maintained with reserve neighbours.
- Reserve infrastructure is maintained to high visitor and environmental standard.

Strategies

- Maintain roads and management trails shown on Appendix B. Close management trails to public vehicle access. All other roads and trails not shown on Appendix B will be closed and where necessary rehabilitated.
- Continually review the need for management trails and close and rehabilitate any not needed for management purposes. Maintain close liaison with reserve neighbours to deal with matters of mutual concern.

- Liaise with neighbours, local bush fire brigades, Councils and the Rural Fire Service regarding road maintenance and access requirements for firefighting and hazard reduction works.
- Locate management infrastructure off-park or on disturbed areas on-park wherever possible and assess environmental and financial impact as part of the decision-making process.
- Liaise with SFNSW about maintenance of Ministerial roads for harvesting access to adjacent areas of state forest.
- Review the need for Ministerial roads with any changes in land tenure.

10. Plan implementation

This plan of management establishes a scheme of operations for the reserve. The plan is part of a system of management developed by the NPWS. The system includes the NPW 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 NPW 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 the reserve unless they are in accordance with the plan.

Implementation of this plan will be undertaken within the annual programs of the NPWS's North Coast Region. The 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 Table 4. 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. The 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 environmental assessment procedures. Where impacts are found to be unacceptable, activities will be modified in accordance with the plan 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 the reserve or additions to the reserve that 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.
- Undertake an assessment after 5 years of the effectiveness of managing the nature reserve in accordance with this plan and of the degree of success in achieving the plan's objectives and desired outcomes. Base the evaluation on the monitoring programs set out in this plan and any others that may be developed.

Table 4 Implementation table (summary of actions)

Section	Activity	Priority
4. Conservation of natural and cultural heritage		
4.1 Geology and landform	Minimise the impact of adjacent land use on scenic values.	Ongoing
	Locate and design management operations to minimise visual impact.	Ongoing
	Investigate the significance of the geomorphological landscape to the local Aboriginal community and assess opportunities for interpretation.	Low
4.2 Native plants	Locate new infrastructure to avoid clearing significant plant species or restricted plant communities to the greatest extent practical.	
	Ensure management facilities don't impact threatened species.	Ongoing

Section	Activity	Priority
	Allow natural regeneration of areas effected by past logging activities, and if necessary, undertake active regeneration.	Ongoing
	Undertake control programs for introduced weed species, particularly at Cedar Park.	High
	Implement recovery plans for threatened species.	Ongoing
	Undertake targeted vegetation surveys.	Low
	Record the distribution of threatened and significant species.	Ongoing
	Encourage retention of native vegetation close to the reserve.	Ongoing
	Minimise vegetation clearance during the establishment of the feral predator–free area	
4.3 Native animals	Protect the habitats of threatened and biogeographically significant fauna species.	Ongoing
	Record the distribution of threatened and significant fauna species.	Ongoing
	Implement recovery plans when prepared.	Ongoing
	Minimise impacts of weed control on amphibians, particularly known threatened frog species habitat.	Ongoing
4.4 Aboriginal heritage	Consult with Local Aboriginal Land Councils, local community representatives, local Aboriginal Elders and other representatives about cultural heritage.	Ongoing
	Protect all Aboriginal sites, relics and objects.	Ongoing
	Undertake an Aboriginal cultural heritage assessment of the reserve in partnership with the local Aboriginal Community.	High
	Work with the local Aboriginal community to develop an agreement that permits access to and usage of the native plants within the reserve for cultural purposes.	High
	Prepare site management strategies in consultation with representatives of the Aboriginal community.	High/ Ongoing
	Undertake cultural heritage assessments prior to any new works in partnership with the Aboriginal community.	Ongoing
	Support Aboriginal community proposals to undertake interpretation of Aboriginal cultural values.	Ongoing
	Prepare site management plans for known sites in consultation with the local Aboriginal community.	Medium
	Seek agreement from relevant Aboriginal community organisation prior to publicise the location of any Aboriginal sites and places.	Ongoing
4.5 Historic heritage	Record and protect all historic sites in the reserve.	Medium
	Protect stonewalls along Taylors Arm/Greenhills Road.	High
	Record the carved tree on Good Friday Mountain.	Low
	Retain existing exotic trees at Cedar Park until they die but remove invasive species.	Ongoing
	Assess historic places and sites.	Low
	Protect historic places and develop long-term conservation policies.	Low
	Involve local community in management of historic items where possible.	Ongoing
	Management activities with the potential to damage historic places will be preceded by heritage impact assessment.	Ongoing
	Encourage research into the history of the reserve.	Ongoing

Section	Activity	Priority
5. Reserve protection		
5.1 Soil erosion	Minimise soil erosion and sedimentation from road works.	Ongoing
	Close and rehabilitate illegal trail bike trails.	Medium
	Undertake rehabilitation works on eroded areas, such the walking track at Cedar Park.	High/ Ongoing
	Incorporate soil erosion management principles and practices into all management activities and facility design in accordance with NPWS Policy 1.4 (Soil Conservation and Rehabilitation).	Ongoing
	Include objectives and actions for minimising erosion arising from prescribed fires and wildfires in fire planning and management programs (refer section 5.4 Fire Management).	Ongoing
5.2 Water quality and catchment management	Minimise water pollution and undertake works in accordance with NPWS Policy Soil Conservation and Rehabilitation (refer to section 5.1 Soil Erosion).	Ongoing
	Liaise with local government and other authorities to maintain catchments water quality.	Ongoing
	Participate on the Mid North Coast Catchment Management Board.	Ongoing
	Explore alternatives to chemical control of weeds near watercourses to minimise impacts water quality.	Ongoing
5.3 Introduced species	Implement the Pest Management Plan and review annually.	High
	Control and, where practicable eradicate introduced species.	High/ Ongoing
	Assist in the preparation and implementation of a wild dog management plan.	Medium
	Prioritise control of introduced species.	High
	Control invasive exotic tree species at Cedar Park.	High
	Avoid unnecessary environmental disturbances. Minimise impacts on amphibian species, particularly threatened frog species.	Ongoing
	Seek the cooperation of neighbours and RLPB in implementing pest programs.	Ongoing
	Encourage maintenance of boundary fencing.	High
5.4 Fire management	Finalise and implement the draft Fire Management Plan.	High
	Use prescribed fire to achieve a variety of fire regimes.	Ongoing
	Minimise impact of fire suppression on rare plants, Aboriginal sites and historic places.	High/ Ongoing
	Rehabilitate areas disturbed by fire suppression.	High
	Encourage research into the ecological effects of fire.	Low
	Participate in Bush Fire Management Committees. Maintain close contact and cooperation with fire management agencies and RFS.	Ongoing
	Seek a cooperative approach with neighbours to fire protection.	Ongoing
	Reduce visitor risk.	High
	Investigate fire history in the reserve.	Medium

Section	Activity	Priority
5.5 Establishing a feral predator–free area	Undertake an environmental assessment to guide the development of operational plans and the identification and management of risks to fauna species, their habitats and the reserve.	
	Construct a feral predator–proof fence and associated management facilities to facilitate eradication of feral predators and other pest animals from within the feral predator–free area, reintroduction of locally extinct mammals, recovery of extant fauna and ongoing management of the site.	
6. Visitor opportunities and education		
6.1 Information provision	Encourage minimal impact recreation.	Ongoing
	Promote community understanding of reserve values and management strategies.	Ongoing
	Emphasise specific values of the reserve in promotion and interpretation programs.	High
	Distribute and update the reserve brochure.	High
	Place orientation/interpretive signs to Cedar Park day use area and the 'tourist drive'.	High
	Explore the opportunities for the development of material and programs for interpretation of Aboriginal culture in partnership with the local Aboriginal community.	Medium
	Support and assist educational use of the reserve.	Ongoing
	Encourage NPWS 'Discovery Programs'.	Ongoing
	Opportunities to facilitate education and interpretation about the feral predator–free area will be further investigated and progressed after the feral predator–free area has been established.	
	Public access to the feral predator–free area will be restricted as necessary.	
6.2 Visitor opportunities	Undertake opportunistic visitor surveys and monitor visitor areas. Restrict visitor access if unacceptable damage occurs at sites.	Ongoing
6.2.1 Appropriate visitor use	Opportunities to facilitate education and interpretation about the feral predator–free area will be further investigated and progressed after the feral predator–free area has been established.	
	Public access to the feral predator–free area will be restricted as necessary (refer sections 6.2.2 Vehicle access and car touring, 6.2.3. Cedar Park Day Use Area and 6.2.4 Bush walking).	
6.2.2 Vehicle access and car touring	Maintain the roads and management trails shown on Appendix B. Close all other roads and where necessary rehabilitate.	High
	Maintain Tamban and McKays Road as the main access roads to the reserve.	High
	Maintain a system of roads, as part of a tourist drive.	Ongoing
	Reclassify listed roads as management trails and close them to public vehicle access.	
	Maintain park roads in the reserve for public vehicle use in accordance with Appendix B. Liaise with relevant managers to encourage the maintenance of access roads outside the reserve that provide public access to the reserve.	

Section	Activity	Priority
	New roads will not be developed other than new management trails necessary for the construction and maintenance of the feral predator-proof fence and management of the feral predator–free area.	
	Prepare and implement a reserve access strategy to secure park access for public use and management purposes.	
	Identify and seek to correct boundary errors and boundary encroachments through, for example, boundary adjustments under the NPW Act.	
	Monitor roads and close in wet weather if necessary.	Ongoing
	Provide and maintain directional signs at key intersections.	High
6.2.3 Cedar Park Day Use Area	Control and eradicate lantana and exotic tree species to prevent invasion. Explore control techniques near Stockyard Creek.	High
6.2.4 Bush walking	Review the walking track at Cedar Park once strategies for the provision of visitor facilities associated with the feral predator–free area have been developed.	
	Encourage adherence to minimal impact bushwalking codes.	Ongoing
	Continue to allow self-reliant bush walking.	Low
	Investigate the suitability of the route followed by Clement Hodgkinson.	Low
6.2.5 Camping	No formal camping facilities will be provided.	High
	Prohibit camping at Cedar Park day use area.	Ongoing
	Allow pack or bush camping throughout the reserve.	Ongoing
	Place restrictions on pack camping if needed.	Ongoing
	Monitor the level of pack camping.	High
	Encourage minimal impact camping and ‘No trace’ camping ethic.	Ongoing
6.2.6 Cycling	Allow cycling on roads and management trails only. Cycling will not be permitted on walking tracks or within the feral predator–free area.	Ongoing
6.2.7 Horse riding	Horse riding, including recreational, commercial and organised horse riding will not be permitted in the reserve.	High
7. Research and Monitoring		
	Undertake research to facilitate management.	Ongoing
	Permit appropriate research by other organisations and individuals.	Ongoing
	Ensure research has minimal impact on reserve values.	High
	Prepare a list on preferred research projects.	Low
	Encourage birdwatchers and others to pass on information gathered in the reserve.	Low/ Ongoing
8. Other Uses		
8.1 Bee keeping	License all existing apiary sites.	High
	Maintain access tracks and sites by slashing wherever possible.	High/ Ongoing
	Seek financial contribution for maintenance of tracks required primarily for access to apiary sites.	High
	Relocate where possible apiary sites near high visitation areas.	High

Section	Activity	Priority
	Encourage research into the impacts of beekeeping.	Low
	Develop an agreement with apiarists about access tracks.	High
8.2 Grazing	Exclude non-authorised livestock from the reserve.	High
	Negotiate construction and/ or maintenance of boundary fences with neighbours.	High
	Remove fences no longer required for management purposes, other than fences with heritage values.	Medium
9. Management Facilities and Operations		
	Maintain management trails shown on Appendix B. All other trails will be closed and where necessary rehabilitated.	High
	Maintain close liaison with reserve neighbours to deal with matters of mutual concern.	High/ Ongoing
	Liaise with neighbours, local bush fire brigades, Councils and the Rural Fire Service regarding road maintenance and access requirements for firefighting and hazard reduction works.	High/ Ongoing
	Locate management infrastructure off-park or on disturbed areas on reserve wherever possible and undertake environmental and financial impact assessment.	Ongoing
	Maintain Ministerial roads for harvesting access to adjacent SF areas.	Ongoing
	Review need for Ministerial roads with any change in land tenure.	Ongoing
10. Plan implementation		
	Undertaken an annual review of progress in implementing this plan of management.	Low
	Undertake an assessment after 5 years of the effectiveness of managing the nature reserve in accordance with this plan and of the degree of success in achieving the plan's objectives and desired outcomes. Base the evaluation on the monitoring programs set out in this plan and any others that may be developed.	Low

Legend for priorities

- 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.

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Appendix A Soil landscapes characteristic of Ngambaa Nature Reserve

Soil landscape	Description	Erodibility
Colluvial		
Broads Mountain (br)	Very steep to precipitous hills with narrow crests, ridges and upper slopes on metasediments of the Nambucca Beds. Paralithic and Lithic Leptic Rudosols (Lithosols), with localised Red or Brown Kurosols (Red Podsolic Soils). Stony Soils, very steep slopes; shallow soils.	Low erodibility; very steep slopes extreme mass movement hazards, severe sheet erosion risk.
Diehappy (di)	Steep dissected hills with narrow crests, steep slopes, and occasional Colluvial footslopes on metasediments of the Nambucca Beds. Leptic Rudosols (Lithosols), with localised well-drained Brown Kurosols (Red Podsolic Soils) and well drained Red Dermosols (Brown Earths) on lower slopes. Stony Soils.	High erodibility; Steep slopes, mass movement risk, sheet erosion risk, localised gully erosion hazard.
Erosional		
Pine Creek (pn)	Rolling hills on metasediments of the Nambucca Beds. Moderately well drained, gravelly Red and Brown Kurosols (Red and Yellow Podsolic Soils) are widespread. Localised Leptic Tenosols (Lithosols) occur on some crests and sideslopes. Deep Brown or Red Dermosols (Xanthozems and Brown Earths) occur on footslopes. Stony soils.	High erodibility. Moderate sheet and gully erosion hazards.
Tamban (tb)	Rolling to steep hills. Low dissecting plateaux with broad crests and occasional steep sideslopes on lithic sandstone with interbedded musdstones of the Kempsey Beds. Soils moderately well drained Brown Kurosols (Red Podsolic Soils) and Kandosols (Yellow Earths) with Leptic Tenosols and Leptic Rudsols (Lithosols) on steeper slopes and ridges. Stony soils.	High erodibility, water erosion hazards.
Tamban Landscape Variant (tbb)	Mappable areas that have steep lower sideslopes with gradients 33-50%. Moderately well-drained, shallow to moderately deep Brown Kurosols (Red Podsolic Soils) with Brown Kandosols (Yellow Earths) on footslopes and shallow Leptic Tenosols and Leptic Rudsols (Lithosols) on steeper slopes, and ridges.	
Erosional/colluvial landscapes		
Mungay Mountain (mu)	Steep mountains with deep valleys, narrow crests and occasional Colluvial footslopes on lithic sandstones of the Kempsey Beds. Widespread shallow Lithic Leptic Rudosols (Lithosols), with deep Yellow Brown Kandosols (Yellow Earths) on footslopes and sporadic moderately deep Brown Kurosols (Red Podsolic Soils). Stony Soils.	High erodibilty. Steep slopes localised mass movement hazard, extreme erosion hazards.

Soil landscape	Description	Erodibility
Roses Knob (rk)	Steep to very steep hills as upper slopes and escarpments with narrow crests, steep slopes and occasional Colluvial footslopes on the Kempsey Beds. Leptic Rudosols with imperfectly drained Yellow Kandosols and Yellow Kurosols on steep ridges and slopes and moderately well drained Brown Kandosols on mudstones. Stony Soils.	High erodibility. Steep slopes, localised mass movement hazard, extreme erosion hazard.
Roses Knob Landscape Variant (rka)	Colluvial variant. Very steep to precipitous hills on lithic sandstones of the Kempsey Beds. Shallow Leptic Rudosols (Lithosols) comprised of weakly pedal clay loam are widespread on ridges and sideslopes, with sporadic moderately deep Brown or Yellow Kurosols (Red or Yellow Podsolic Soils) on pockets of weathered substrate associated with increased rock fracturing. Moderately deep Brown Kandosols (Brown Earths) occur on mudstones on the Macleay Range escarpment.	
Alluvial		
Aldavilla (al)	Level elevated terraces to the Macleay River and valley flats to streams draining the Kempsey Beds on late Pleistocene alluvium. Imperfectly drained Brown or Red Kurosols (Yellow or Red Podsolic Soils and Soloths) and Brown, Red or Yellow Kandosols (Red or Yellow Earths).	High erodibility. Localised steep slopes, gully erosion hazard.
Nambucca River (nr)	Narrow to moderately broad floodplain and terrace surfaces with minor depressions and drainage lines as well a narrow braided channel draining the Nambucca Beds. Moderately well drained Brown Kandosols (Prairie Soils) and Red Kandosols (Red Earths) and well-drained gravelly Stratic Rudosols (Alluvial Soils). Gravelly Soils.	High erodibility. Streambank erosion hazard.
Thumb Creek(tc)	Narrow, discontinuous valley flats below steep hills and mountains. Shallow to moderately deep stony Brown Kandosols (Prairie soils) with shallow Clastic Rudsols (Stony Alluvial soils) and gravel beds.	High erodibility, gully erosion risk, stream bank erosion hazard.

Source: Adapted from Eddie 2000.

Appendix B Map of Ngambaa Nature Reserve