



Environment,
Climate Change & Water
National Parks & Wildlife Service



Duroby Nature Reserve

Plan of Management



**DUROBY NATURE RESERVE
PLAN OF MANAGEMENT**

NSW National Parks and Wildlife Service

Part of the Department of Environment, Climate Change and Water (NSW)

December 2010

This plan of management was adopted by the Minister for Climate Change and the Environment on 10th December 2010.

Acknowledgements

The NPWS acknowledges that this reserve is in the traditional country of the Minjungbal people of the Bundjalung Nation, and acknowledges that the Githabul and Yugambeh Nations also have traditional knowledge in the area.

This plan of management is based on a draft plan prepared by staff of the Northern Rivers Region of the NSW National Parks and Wildlife Service (NPWS), part of the Department of Environment, Climate Change and Water (DECCW), and Southern Cross University student intern Emma Kirsner.

Cover photo by Lance Tarvey, NPWS.

For additional information or any inquiries about this reserve or this plan of management, contact the NPWS Tweed Area Office, PO Box 5081, South Murwillumbah NSW 2484 or by telephone on (02) 6670 8600.

© Department of Environment, Climate Change and Water (NSW) 2010: Use permitted with appropriate acknowledgment.

ISBN: 978 1 74293 057 2

DECCW: 2010/1031

FOREWORD

Duroby Nature Reserve is located approximately eight kilometres northeast of Murwillumbah, in the lower Tweed Valley on the Far North Coast of New South Wales. It was established in 2006 and has an area of 31.34 hectares.

Approximately 90% of Duroby Nature Reserve is lowland rainforest, which is listed as an endangered ecological community under the *Threatened Species Conservation Act 1995* (TSC Act). This is one of the largest areas of lowland rainforest in the lower Tweed Valley and it contains the highest number of tree species recorded in a rainforest in NSW. Thirteen plant species and five animal species listed as threatened in NSW have been recorded in the reserve, as well as nine nationally threatened plant species.

The New South Wales *National Parks and Wildlife Act 1974* requires that a plan of management be prepared for each nature reserve. A draft plan of management for Duroby Nature Reserve was placed on public exhibition from 6th November 2009 until 1st March 2010. The submissions received were carefully considered before adopting this plan.

This plan contains a number of actions to achieve the State Plan priority to “Protect our native vegetation, biodiversity, land, rivers and coastal waterways”, including implementation of recovery actions for threatened species, the encouragement of more detailed flora and fauna surveys, the preparation and implementation of a pest management strategy for the reserve, implementation of the reserve’s fire management strategy, and the encouragement of the protection and appropriate management of ecological corridors adjoining the reserve.

This plan of management establishes the scheme of operations for Duroby Nature Reserve. In accordance with section 73B of the *National Parks and Wildlife Act 1974*, this plan of management is hereby adopted.

A handwritten signature in black ink, appearing to read 'Frank Sartor', written in a cursive style.

Frank Sartor MP
Minister for Climate Change and the Environment

TABLE OF CONTENTS

1. LOCATION, GAZETTAL AND REGIONAL CONTEXT	1
2. MANAGEMENT CONTEXT	3
2.1 LEGISLATIVE AND POLICY FRAMEWORK.....	3
2.2 MANAGEMENT PURPOSES AND PRINCIPLES.....	3
2.3 STATEMENT OF SIGNIFICANCE.....	4
2.4 SPECIFIC MANAGEMENT DIRECTIONS.....	4
3. VALUES.....	5
3.1 GEOLOGY, LANDSCAPE AND HYDROLOGY	5
3.2 NATIVE PLANTS	5
3.3 NATIVE ANIMALS	6
3.4 ABORIGINAL HERITAGE.....	8
3.5 HISTORIC HERITAGE.....	8
3.6 VISITOR USE, EDUCATION AND RESEARCH.....	8
4. ISSUES	10
4.1 WEEDS.....	10
4.2 PEST ANIMALS.....	11
4.3 ISOLATION AND FRAGMENTATION	12
4.4 FIRE.....	12
4.5 CLIMATE CHANGE	13
5. REFERENCES	14
6. IMPLEMENTATION	16

1. LOCATION, GAZETTAL AND REGIONAL CONTEXT

Duroby Nature Reserve (hereafter referred to as “the reserve”) is 31.34 hectares in area and is located approximately eight kilometres northeast of Murwillumbah, in the lower Tweed Valley on the Far North Coast of New South Wales (NSW). The reserve is bounded in the south by Cranneys Road and Upper Duroby Creek Road and bisected by Hogans Road (see Map).

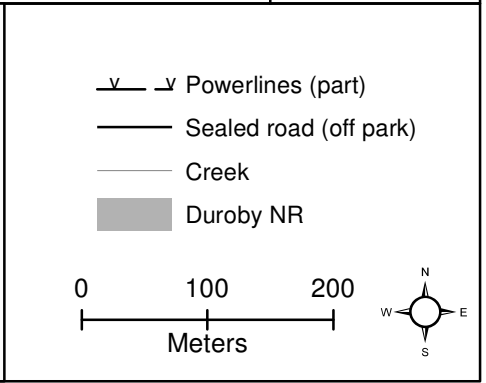
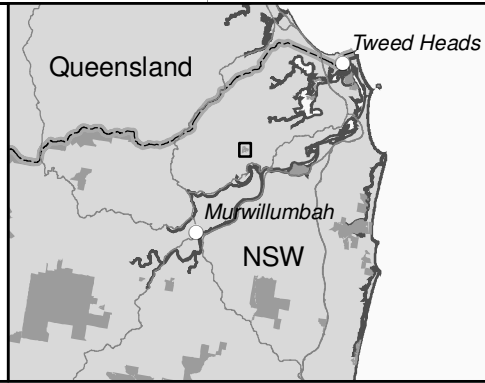
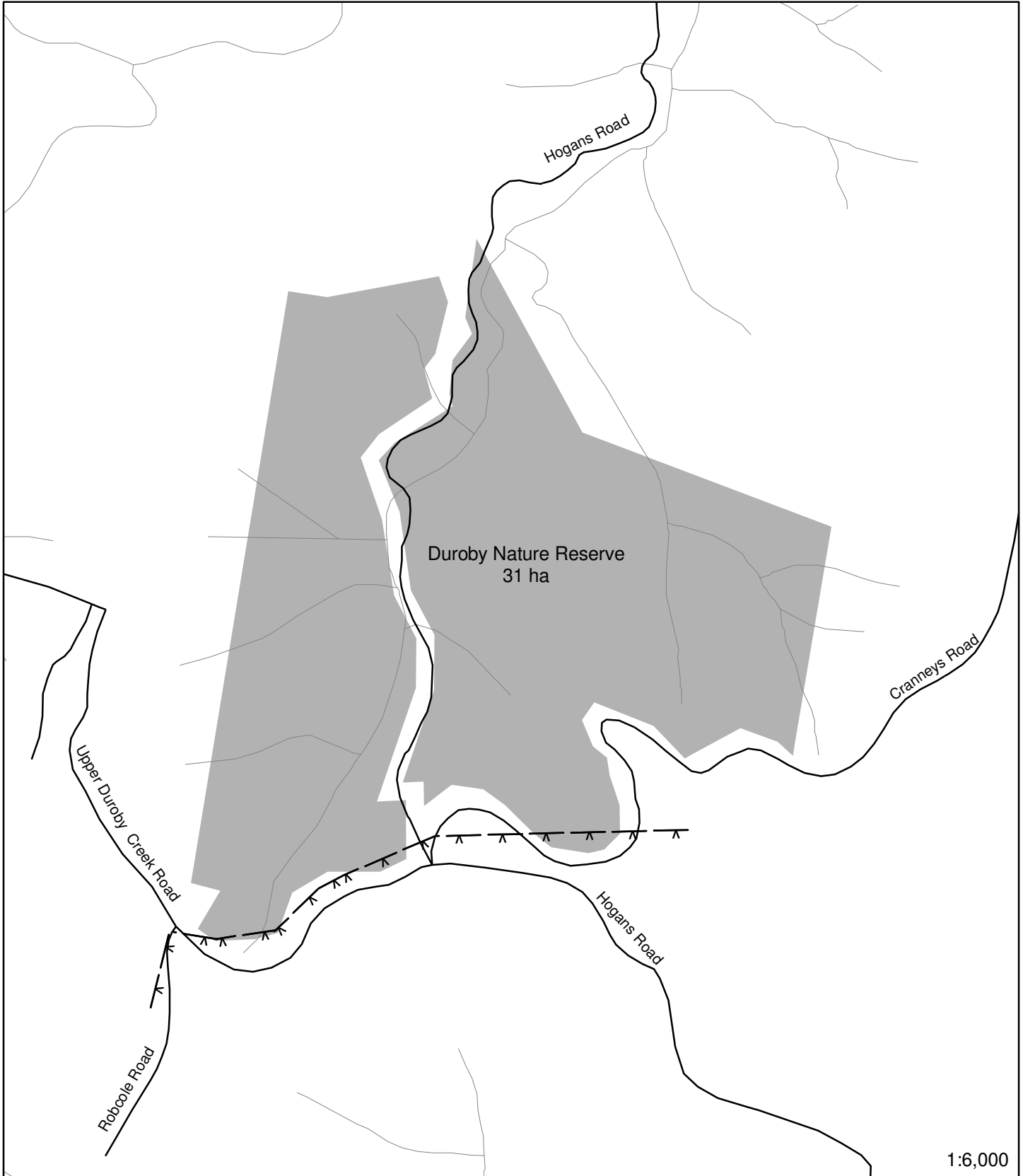
The reserve was previously a Wildlife Refuge and was known as Hogan’s Scrub. It was purchased by the NPWS in 2004 and was gazetted as Duroby Nature Reserve in November 2006. In 2009 an area of 0.05 hectares was added to the reserve.

The name Duroby is believed to be derived from “durobbe”, the Bundjalung-Yugambeh Aboriginal name of a tree also known as *Syzygium moorei* or more commonly the durobby or the coolamon (Bray, c. 1900). The durobby is the floral emblem of the Tweed Shire and, while prevalent in the reserve, is listed as vulnerable under the *Threatened Species Conservation Act 1995* (refer 3.2 Native Plants).

The reserve has a biogeographical relationship with, and forms part of, a regional system of conservation reserves that complement and enhance the World Heritage ‘Gondwana Rainforests of Australia’ (formally CERRA) on the surrounding Tweed, McPherson and Nightcap Ranges (NPWS, 2004). The reserve provides habitat for transitional species from the ranges to the coast and supports many species that are predominately restricted to higher elevations. Floyd (1990) noted that what is now the reserve had the highest number of tree species for a rainforest in NSW.

The reserve is within the Tweed Local Government Area (LGA), the Northern Rivers Catchment Management Authority (CMA), and the Tweed Byron Local Aboriginal Land Council (LALC) area. Under the *Tweed Local Environment Plan 2000* the reserve is zoned predominately as 7(l) ‘Environmental Protection (Habitat)’ with a small area of 1(a) ‘Rural’ in the northeast of the reserve (Tweed Shire Council, 2000). It is appropriate for the reserve to be rezoned as ‘8(a) National Parks and Nature Reserves’.

Land use surrounding the reserve includes grazing lands, eucalyptus plantations, orchards and rural residential. Land adjacent to the western boundary of the reserve supports vegetation contiguous with the reserve and is zoned 7(l) ‘Environmental Protection (Habitat)’ in the *Tweed Local Environmental Plan 2000* (LEP) (Tweed Shire Council, 2000). The land to the south of the reserve, although separated from the reserve by a road, also provides a vegetation link to the Rous River to the southeast and the surrounding vegetated areas to the southwest. These areas are zoned 7(l) ‘Environmental Protection (Habitat)’ and 7(d) ‘Environmental Protection (Scenic/ Escarpment)’ under the LEP.



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* (NPWS Act), the NPW Regulation, *Threatened Species Conservation Act 1995* (TSC Act) and the policies of the National Parks and Wildlife Service (NPWS).

Other legislation, international agreements and charters may also apply to the management of the area. In particular, the *Environmental Planning and Assessment Act 1979* (EPA Act) may require the assessment and mitigation of the environmental impacts of works proposed in this plan. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) also applies in relation to actions that may impact on threatened species listed under that Act.

A plan of management is a statutory document under the NPW Act. Once the Minister has adopted a plan, no operations may be undertaken within Duroby Nature Reserve except in accordance with this plan. This plan will also apply to any future additions to Duroby Nature Reserve. Should management strategies or works be proposed for Duroby Nature Reserve or any additions that are not consistent with this plan, an amendment to this plan or a new plan will be prepared and exhibited for public comment.

2.2 MANAGEMENT PURPOSES AND PRINCIPLES

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 (section 30J), 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; and
- provide for appropriate research and monitoring.

Nature reserves differ from national parks in that they do not have the provision of recreation as a management principle.

2.3 STATEMENT OF SIGNIFICANCE

Biological Values:

- Duroby Nature Reserve is the largest area of lowland rainforest in the lower Tweed Valley, aside from the floristically distinct Stotts Island (Floyd, 1977; Hunter, 1991). It supports many species that are predominately restricted to higher elevations and contains the record for a rainforest in NSW of 136 tree species. (Floyd, 1990).
- The reserve supports 13 plant and 5 animal species listed as threatened species under the TSC Act, as well as 9 species nationally threatened under the EPBC Act, and 19 plants listed as Rare or Threatened Australian Plants (ROTAPS) (refer sections 3.2 and 3.3).
- Approximately 90% of the reserve is comprised of the endangered ecological community *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*.
- The reserve is the most significant lowland rainforest in the Tweed occurring on metasediments (Floyd 1990).

2.4 SPECIFIC MANAGEMENT DIRECTIONS

In addition to the general principles for the management of nature reserves (refer section 2.2), management of Duroby Nature Reserve will focus on protecting the lowland rainforest.

Major strategies to achieve these objectives are:

- Habitat restoration and the control of introduced species within the reserve;
- Implementation of threatened species Priorities Action Statement and recovery plans;
- Maintaining a low level of use of the reserve, primarily for sustainable educational and research purposes; and
- Implementation of the Fire Management Strategy for the reserve including appropriate fire regimes to protect biodiversity.

3. VALUES

The location, landforms and plant and animal communities of an area have determined how it has been used and valued. Both Aboriginal and non-Aboriginal people place values on natural areas, including aesthetic, social, spiritual and recreational values. These values may be attached to the landscape as a whole or to individual components, for example to plant and animal species used by Aboriginal people. This plan of management aims to conserve both natural and cultural values. For reasons of clarity and document usefulness, various aspects of natural heritage, cultural heritage, threats and on-going use are dealt with individually, but their inter-relationships are recognised.

3.1 GEOLOGY, LANDSCAPE AND HYDROLOGY

The reserve is composed of metasedimentary rocks from the Silurian Neranleigh-Fernvale Group consisting of greywacke, slate, phyllite and quartzite. The topography of the reserve is undulating with steep gullies and has an altitude range of 100-160 metres.

Soils are derived principally from Palaeozoic metamorphic rocks with possible enrichment on the lower slopes and in the gullies by soils derived from the once overlying basalt from the Terranora Hills to the northeast (NPWS, 1986).

The headwaters of Duroby Creek and numerous tributaries are located within the reserve (see Map).

3.2 NATIVE PLANTS

Almost all of the reserve is comprised of lowland rainforest, with a small area (approximately 3 hectares) of dry sclerophyll forest occurring along the ridge lines. The lowland rainforest in the reserve is listed under the TSC Act as the endangered ecological community *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions* (NSW Scientific Committee, 2007). The lowland rainforest in the reserve is the largest area of lowland rainforest in the lower Tweed Valley, aside from the floristically distinct Stotts Island (Floyd, 1977; Hunter, 1991).

The reserve is extremely floristically diverse. Several flora surveys have been conducted in the reserve (Floyd, 1977, 1990; James, 1998). Floyd (1990) notes that the reserve “contains the state record (for a rainforest) of 136 species of trees.” The floristic composition of most of the reserve has been described as an intermediate between subtropical and warm temperate rainforest. Significant species include: jackwood (*Cryptocarya glaucescens*); Queensland laurel (*Anopterus macleayanus*); sassafras (*Doryphora sassafras*); rusty helicia (*Helicia ferruginea*), mango bark (*Canarium australasicum*), and the threatened species, corokia (*Corokia whiteana*).

Key species within the reserve include: brush box *Lophostemon confertus* and flooded gum *Eucalyptus grandis* that form a very tall closed forest with a closed to

open mid stratum of Bangalow palm *Archontophoenix cunninghamiana*, wait-a-while *Calamus muelleri*, climbing pandon *Freycinetia excelsia* and cudgerie *Sloanea australis* (James, 1998).

Thirteen plant species in the reserve are listed as threatened species under the TSC Act, 9 of these species are nationally threatened under the EPBC Act, and 19 species are listed as Rare or Threatened Australian Plants (Briggs and Leigh, 1996) (see Table 1). Additional threatened and significant plant species which are known to be in the area may occur in the reserve but have not yet been documented.

Table 1. Threatened and significant plant species recorded in Duroby Nature Reserve

Scientific name	Common name	Status
<i>Acacia bakeri</i>	Marblewood	Vulnerable*
<i>Archidendron muellerianum</i>	Veiny laceflower	^
<i>Ardisia bakeri</i>	Ardisia	^
<i>Austrobuxus swainii</i>	Pink cherry	^
<i>Cordyline congesta</i>	Tooth-leaved palm lily	^
<i>Corokia whiteana</i>	Corokia	Vulnerable*#
<i>Cupaniopsis newmanii</i>	Long-leaved tuckeroo	^
<i>Davidsonia johnsonii</i>	Smooth davidsonia	Endangered*#^
<i>Diospyros ellipticifolia</i> var. <i>ebenus</i>	Shiney-leaved ebony	Endangered*
<i>Endiandra globosa</i>	Black walnut	^
<i>Endiandra hayesii</i>	Velvet laurel, rusty rose walnut	Vulnerable*#^
<i>Helmholtzia glaberrima</i>	Flax lily	^
<i>Lepiderema pulchella</i>	Fine-leaved tuckeroo	Vulnerable*^
<i>Lindsaea brachypoda</i>	Creepers	Endangered*^
<i>Macadamia tetraphylla</i>	Rough-shelled bush nut	Vulnerable*#^
<i>Randia moorei</i>	Spiny gardenia	Endangered*#^
<i>Rhodamnia maideniana</i>	Smooth scrub turpentine	^
<i>Symplocos baeuerlenii</i>	Small-leaved hazelwood	Vulnerable*#^
<i>Syzygium hodgkinsoniae</i>	Red lilly pilly	Vulnerable*#^
<i>Syzygium moorei</i>	Duroby, coolamon, rose apple	Vulnerable*#^
<i>Tinospora tinosporoides</i>	Arrow-head vine	Vulnerable*#^
<i>Trichosanthes subvelutina</i>	Climber	^

* Status under TSC Act

Denotes species listed as nationally threatened under the EPBC Act.

^ Denotes species listed as a Rare or Threatened Australian Plant (ROTAP) according to Briggs and Leigh (1996)

The most significant threats to native vegetation in the reserve are weeds, illegal plant and seed collection, isolation and fragmentation of habitat, too frequent fire events and climate change.

Under the TSC Act threatened species Priorities Action Statement (PAS) have been prepared that outline the broad strategies and detailed priority actions to promote recovery of threatened species, populations and endangered ecological communities and to manage Key Threatening Processes (KTP). The PAS will be used to guide management of threatened species in the reserve. Recovery actions are included in the PAS for all of the species in the reserve listed under the TSC Act (see Table 1). A recovery plan has also been prepared for *Lowland Rainforest in the NSW North*

Coast and Sydney Basin Bioregions. Opportunities to manage threats to these species and communities include implementation of weed management strategies, appropriate fire management, interpretative signage and law enforcement, and protection of remaining habitat on public and private lands (refer section 4).

3.3 NATIVE ANIMALS

A detailed fauna survey of the reserve has not been undertaken, however, the area is expected to play an important role for bird species that migrate seasonally both latitudinally and altitudinally (Hunter, 1991) i.e. north/south, and between higher altitude areas such as the Great Divide and low altitude areas on the coast.

Five fauna species listed as threatened under the TSC Act have been recorded in the reserve: the pouched frog (*Assa darlingtoni*); Albert's lyrebird (*Menura alberti*); rose-crowned fruit-dove (*Ptilinopus regina*); wompoo fruit-dove (*Ptilinopus magnificus*) and the white-eared monarch (*Monarcha leucotis*) (see Table 2). Additional threatened animal species which are known to be in the area are also likely to occur in the reserve but have not yet been documented, including the eastern long-eared bat (*Nyctophilus biflax*) and the grey-headed flying-fox (*Pteropus poliocephalus*).

Table 2. Threatened and significant animal species recorded in Duroby Nature Reserve

Scientific name	Common name	Legal Status *
<i>Assa darlingtoni</i>	Pouched frog	Vulnerable*
<i>Menura alberti</i>	Alberts lyrebird	Vulnerable*
<i>Monarcha leucotis</i>	White-eared monarch	Vulnerable*
<i>Ptilinopus magnificus</i>	Wompoo fruit-dove	Vulnerable*
<i>Ptilinopus regina</i>	Rose-crowned fruit dove	Vulnerable*

* Status under TSC Act NSW

The most significant threats to native animals in the reserve are lack of connectivity with other areas of natural bush, too frequent fire events and loss of habitat. Opportunities to manage these threats include implementation of threatened species Priorities Action Statement (PAS) that outline the broad strategies and detailed priority actions to promote the recovery of threatened species and populations and to manage key threatening processes. The PAS will be used to guide management of threatened species in the reserve. Recovery actions are included in the PAS for all of the listed threatened species identified in table 2.

Major strategies to manage threats to these species are to focus on the promotion of undisturbed habitat and the protection of habitat from fire (refer section 4). In regard to the pouched frog the PAS also identifies the need for surveys to ensure identification and protection of roadside habitat prior to undertaking road maintenance works.

3.4 ABORIGINAL HERITAGE

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

The reserve lies within the geographical area originally occupied by the Minjungbal people of the Bundjalung Nation, while the Githabul and Yugambah Nations also have traditional knowledge in the area. The reserve falls within the area of the Tweed Byron Local Aboriginal Land Council (LALC). NPWS does not have formal records of Aboriginal heritage sites within the reserve; however no formal systematic surveys have been undertaken. The rainforest environment was likely to be a rich source of food and materials for Aboriginal people.

3.5 HISTORIC HERITAGE

Cedar cutting in the area began during the 1840s. Evidence of past timber getting within the reserve includes tree stumps with 'springboard' markings along the more accessible ridgelines.

The area that is now the reserve has a long history of conservation interest dating back to the 1970s. Following an application from the then private landowners, the area was declared 'Hogan's Scrub Wildlife Refuge' in 1979. In November 1985 the President of the Australian Senate, Senator Douglas McClelland, dedicated the Hogan's Scrub Wildlife Refuge to John Albert Hogan, one of the owners of the land who was instrumental in the preservation of the area. In 2004 NPWS purchased 31 hectares of wildlife refuge and this was gazetted as 'Duroby Nature Reserve' under the NPW Act in 2006.

3.6 VISITOR USE, EDUCATION AND RESEARCH

Hogans Road, a sealed road, bisects the reserve while Cranneys Road and Upper Duroby Road are parallel to the southern boundary. Recreational use of the reserve is minimal. There are no visitor facilities maintained in the reserve although there are remnants of derelict picnic tables, structures and trails as well as obsolete and illegible signage which predate both the immediate past owners and gazettal of the reserve.

While recreational use is not a management priority, there are opportunities to use the reserve for education and research purposes. Alternative recreation opportunities are available 5 kilometres from the reserve at the Tweed Shire Council's Bruce Chick Conservation Park which provides good facilities for day visitors including a walkway through lowland rainforest, toilets and picnic facilities.

The primary focus for the management of the reserve is the conservation of the endangered lowland rainforest and the threatened species that occur in this small remnant area. There is a history of rubbish dumping and unauthorised removal of palms, epiphytes, rare plant species and seed collection that predates gazettal of the reserve. These activities directly threaten the values of the reserve. Current signage at Hogans Road refers to the area's previous declaration as a 'wildlife refuge' and requires updating. Appropriate regulatory and interpretative signage at strategic locations along Hogans Road may assist in discouraging unauthorised activities and improve visitor awareness, understanding and appreciation of the values of the reserve.

4. ISSUES

4.1 WEEDS

Introduced plants occur in disturbed areas of the reserve, in particular in the northern and eastern boundary areas adjacent to private land, alongside road edges and in drainage lines.

A total of 30 introduced species have been recorded in the reserve (see Table 3). Dominant or highly invasive weed species include: madeira vine (*Anredera cordifolia*); camphor laurel (*Cinnamomum camphora*); coral tree (*Erythrina sykesii*); lantana (*Lantana camara*); and cat's claw creeper (*Macfadyena unguis-cati*). A number of the introduced species in the reserve are listed as Key Threatening Processes (KTPs) (see Table 3).

Table 3. Weeds recorded in Duroby Nature Reserve

Weeds	
Common Name	Scientific Name
<i>Ageratina adenophora</i> #	Crofton
<i>Ageratina riparia</i> #	Mistflower
<i>Ageratum houstonianum</i>	Blue billygoat weed
<i>Anredera cordifolia</i>	Madeira vine
<i>Bidens pilosa</i>	Farmer's friend, cobbler's pegs
<i>Cinnamomum camphora</i> #	Camphor laurel
<i>Desmodium uncinatum</i>	Silver leaved desmodium
<i>Drymaria cordata</i>	Tropical chickweed
<i>Erythrina sykesii</i>	Coral tree
<i>Hypoestes phyllostachya</i>	Freckle face
<i>Lantana camara</i> # * ^ ~	Lantana
<i>Lilium formosanum</i>	Formosan lily
<i>Macfadyena unguis-cati</i>	Cat's claw creeper
Common Name	Scientific name
<i>Melinis minutiflora</i> ~	Molasses grass
<i>Monstera deliciosa</i>	Fruit salad plant, ceriman
<i>Morus alba</i>	White mulberry
<i>Nephrolepis cordifolia</i>	Fishbone fern
<i>Ochna serrulata</i>	Mickey Mouse plant
<i>Oxalis debilis</i> var. <i>corymbosa</i>	Lilac oxalis, pink shamrock
<i>Paspalum wettsteinii</i> ~	Broad-leaved paspalum
<i>Passiflora subpeltata</i>	White passionflower
<i>Pennisetum purpureum</i> ~	Elephant grass
<i>Pinus elliotii</i>	Slash pine
<i>Schefflera actinophylla</i>	Umbrella tree
<i>Senna pendula</i> var. <i>glabrata</i>	Winter senna
<i>Senna septemtrionalis</i>	Smooth senna
<i>Setaria palmifolia</i>	Palm grass
<i>Solanum mauritianum</i>	Wild tobacco bush
<i>Tradescantia fluminensis</i>	Trad
<i>Tradescantia zebrina</i>	Striped trad

Declared noxious under *Noxious Weed Act 1993*

* Declared weed of national significance

~Key threatening process under TSC Act

^Threat Abatement Plan endorsed for this species

The Northern Rivers Region Pest Management Strategy (2008-2011) details priorities for pest management in the region, including actions listed in PAS, TAPs and site based weed control plans; it allows resources to be allocated to high priority programs. The Pest Management Strategy also identifies the requirements of other strategies such as bush regeneration plans to provide a more detailed approach. A priority the Pest Management Strategy identifies for the reserve is the control of exotic vines by the implementation of key actions of the 'exotic vines and scramblers PAS'. The control of madeira vine (*Anredera cordifolia*) and cat's claw creeper (*Macfadyena unguis-cati*) have been identified as priorities for the reserve.

A site specific plan has been prepared for the control of lantana (*Lantana camara*) in the reserve due to its impact on threatened species (NPWS, 2008). A Conservation Risk Assessment (CRA) was prepared in August 2007 for 'Habitat Restoration at Duroby Nature Reserve' (James, 2007). The CRA identified areas of high weed density, including highly invasive species within the reserve. An ongoing systematic bush regeneration program is currently being undertaken in the reserve based on the CRA.

The Tweed Landcare group and the Tumbulgum Action Group currently work in areas adjacent to the reserve and there may be opportunities for them to work in an integrated way with NPWS.

4.2 PEST ANIMALS

Although there has been no comprehensive survey of introduced species within the reserve, the Northern Rivers Region Pest Management Strategy 2008-2011 (DECC, 2007) identifies cane toads (*Bufo marinus*) and European red foxes (*Vulpes vulpes*) as the major pest animal species for the reserve. Cane toads occur in isolated populations and are known to occur along Hogans Road. Foxes are scattered throughout the reserve. Cane toads and foxes are listed as a KTP under the TSC Act.

In accordance with the Pest Management Strategy, management of cane toads will be through implementation of the Northern Branch Cane Toad Management Strategy and implementation of threat abatement strategies and actions in the PAS. PAS actions relevant to the reserve include surveys and implementation of cane toad education and awareness programs.

In regard to foxes, the Pest Management Strategy does not identify the reserve as a priority for control recognising that no threatened species are at risk in the reserve from fox predation and higher priority sites are identified elsewhere in the Northern Rivers Region.

4.3 ISOLATION AND FRAGMENTATION

Since European settlement lowland rainforest areas have been dramatically reduced in geographic distribution. The clearing of native vegetation over much of the area near the reserve has resulted in fragmentation and loss of connectivity for many of the species that occur within the reserve.

This isolation threatens the genetic diversity of populations by disrupting the pollination and dispersal of fruit and seed (Rossetto *et al.* 2004). Clearing of native vegetation is identified as a Key Threatening Process under the TSC Act.

Long term conservation of biodiversity depends upon the protection, enhancement and connection of remaining habitat across the landscape, incorporating vegetation remnants on both public and private lands. Nearby vegetated areas contribute to the habitat values of the reserve and provide ecological corridors to other vegetated areas. Maintaining the integrity of the remaining habitat within the reserve and, where possible, linking this to adjacent areas of vegetation to facilitate wildlife corridors is important in ensuring long term viability of the reserve's biological values.

Opportunities to enhance habitat values are available in the neighbouring contiguous vegetation to the west, and the land to the south that forms a vegetation link with the Rous River and surrounding vegetated areas to the south west. These areas are zoned 'environmental protection' under the Tweed LEP (Tweed Shire Council 2000).

4.4 FIRE

The primary fire management objectives of the NPWS are to protect life and property and community assets from the adverse impacts of fire, whilst managing fire regimes to maintain and protect biodiversity and cultural heritage.

Fire is a natural feature of many environments and is essential for the survival of some plant communities. However, inappropriate fire regimes can lead to loss of particular plant and animal species and communities, and high frequency fires have been listed as a key threatening process under the TSC Act.

The rainforest vegetation in the reserve is sensitive to fire. Fires are likely to cause the rainforest to retract, change species composition, and significantly impact on the rare lowland rainforest. There has been no recorded fire in the reserve, however in December 2009 a fire occurred on the western side of Hogans Road in close proximity to the reserve.

A separate (map-based) fire management strategy has been prepared for the reserve: *Duroby Nature Reserve Fire Management Strategy (Type 2) 2007* (NPWS, 2007). Under this strategy the reserve has been zoned as a Land Management Zone (LMZ). Apart from the over-riding legislative objective of protecting life and property, the primary fire management objectives for a LMZ are to conserve biodiversity and protect cultural heritage. The fire management strategy outlines the recent fire history of the reserve, key assets within and adjoining the reserve including sites of natural

and cultural heritage value, fire management zones which may include asset protection zones, and fire control advantages such as management trails and water supply points. Hazard reduction programs, ecological burning proposals and fire trail works are submitted annually to the Far North Coast Bush Fire Management Committee.

4.5 CLIMATE CHANGE

Climate change has been listed as a key threatening process under the TSC Act. Projections of future changes in climate for NSW include higher temperatures, increasing sea levels and water temperatures, elevated CO₂, more intense but possibly reduced annual average rainfall, increased temperature extremes and higher evaporative demand. These changes are likely to lead to greater intensity and frequency of fires, more severe droughts, reduced river runoff and water availability, regional flooding, increased erosion and ocean acidification.

Climate change may significantly affect biodiversity by changing population size and distribution of species, modifying species composition, and altering the geographical extent of habitats and ecosystems. The potential impact of climate change is difficult to assess since it depends on the compounding effects of other pressures, particularly barriers to migration and pressure from feral animals. Species most at risk are those unable to migrate or adapt, particularly those with small population sizes or with slow growth rates.

Programs to reduce the pressures arising from other threats, such as habitat fragmentation, invasive species, bushfires, pollution and urban expansion, will help reduce the severity of the effects of climate change.

5. REFERENCES

- Bray, J (c. 1900). Place Names List, circa 1900, Retrieved 17 November 2008 from http://www.gnb.nsw.gov.au/name_search/extract?id=MnKqXtUlan
- Briggs J D; Leigh, J H (1996). *Rare or Threatened Australian Plants* (Fourth Edition). CSIRO Publishing. ISBN 0643057986.
- Department of Environment and Conservation, (2007). *Northern Branch Cane Toad Management Strategy*. Department of Environment and Conservation, NSW.
- Department of Environment and Conservation (2009). Department of Environment and Conservation (NSW) Threatened Species website. <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile>
- Department of Environment and Climate Change NSW. (2007). Northern Rivers Region Pest Management Strategy 2008-2011. DECC, Sydney, NSW.
- Floyd, A.G (1990). *Australian Rainforests in New South Wales, Volume 2*. Surrey Beatty and Sons, Chipping Norton, NSW, in association with NPWS.
- Floyd, A. G (1977). Report on Vegetation of Hogans Scrub, North Tumbulgum. Forestry Office, Coffs Harbour
- Hunter, J (1991). Hogans Scrub Nature Reserve Proposal – conservation values, status, purchase options and management. National Parks and Wildlife Service, Tweed Area Office.
- James, H (1998). Unpublished report prepared for Department of Land and Water Conservation, Murwillumbah.
- James, R (2007). Conservation Risk Assessment for Habitat Restoration at Duroby Nature Reserve. Bushland Restoration Services for National Parks and Wildlife Service, Department of Environment and Climate Change, Tweed Area.
- NPWS (1986). Hogan's Scrub Nature Reserve Reference Statement. Unpublished report, National Parks and Wildlife Service, Tweed Area.
- NPWS (2004). *Parks and Reserves of the Tweed Caldera Plan of Management*. National Parks and Wildlife Service, Department of Environment and Conservation (NSW).
- NPWS (2007). *Duroby Nature Reserve Fire Management Strategy (Type 2) 2007*. National Parks and Wildlife Service, Department of Environment and Conservation (NSW), Northern Rivers Region, Alstonville.
- NPWS (2008). *Lantana Threat Abatement Plan Implementation at Duroby Nature Reserve*. Parks and Wildlife Group, Tweed Area.

NSW Scientific Committee (2007). *Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion - endangered ecological community listing. Final determination* DEC (NSW), Sydney.

Rossetto, M, Gross, C.L, Jones R, Hunter J (2004). *The impact of colonality on an endangered tree (Elaeocarpus williamsianus) in a fragmented rainforest.* Biological Conservation 117, 33-39

Tweed Shire Council (2000). *Tweed Local Environmental Plan 2000*. Document revised April 2008, retrieved November 2008 from <http://www.tweed.nsw.gov.au/planningdocs/pdfs/planningdocs/TLEP%202000.pdf>

6. IMPLEMENTATION

Current Situation	Desired Outcomes	Management Response	Priority*
<p>6.1 On-reserve Ecological Conservation The reserve supports a high diversity of trees species. The reserve contains the endangered ecological community <i>Lowland Rainforest in the NSW North Coast Bioregion</i>. Five fauna and 13 flora species in the reserve are listed under the TSC Act (refer 3.2 and 3.3).</p> <p>Threats to the ecological values of the reserve include: isolation and fragmentation of habitat; illegal plant collection; fire; pests; and weeds. Climate change has also been identified as a key threatening process under the TSC Act. Appropriate pest and fire management may improve the ecological resilience of species to climate change and other threats (refer 6.5 Weeds and Pest Animals and 6.6 Fire Management).</p> <p>Illegal plant collection also threatens ecological values but may be minimised by proposed updating of signage and if necessary law enforcement (refer 6.3 Visitor Use and Services).</p> <p>Recovery plans and Priority Action Statement (PAS) have been prepared for all threatened species in the reserve. Actions include promotion of undisturbed forest, weed control</p>	<p>Native plant and animal species and communities are conserved.</p> <p>Negative impacts on threatened species are stable or diminishing.</p> <p>The effects of climate change on natural systems are reduced.</p> <p>Knowledge of plants and animals and their ecological requirements are better understood.</p>	<p>6.1.1 Implement relevant strategies and actions in the PAS and recovery plans for threatened species (according to the priorities set within available resources).</p> <p>6.1.2 Liaise with Tweed Shire Council about rezoning of the reserve in the Tweed LEP to 8(a) 'National Parks and Nature Reserves'.</p> <p>6.1.3 Encourage more detailed fauna and flora survey and research in the reserve targeting threatened plant and animal species.</p>	<p>High</p> <p>Low</p> <p>Medium</p>

<p>and fire protection. Regard should also be given to protection of potential habitat of the pouched pocket frog along roadsides (refer 6.7.1).</p> <p>A Conservation Risk Assessment has also been prepared for habitat restoration in the reserve (refer 6.5.2).</p> <p>The reserve is zoned as 7(l) 'Environmental Protection (Habitat)' in the Tweed LEP with a small area of 1(a) 'Rural'. It would be appropriate to rezone the reserve 8(a) 'National Parks and Nature Reserves'.</p>			
<p>6.2 Cultural Heritage</p> <p>The reserve is within the Tweed Byron Local Aboriginal Land Council (LALC) area. It is within the traditional lands of the Bundjalung Nation and is part of the landscape of cultural importance to the Minjungbal people, while the Githabul and Yugambeh Nations also have traditional knowledge in the area.</p> <p>No formal records of Aboriginal heritage sites and no systematic surveys have been undertaken, however, it is likely that the rainforest environment was a rich source of food and materials for Aboriginal people.</p> <p>Tree stumps with springboard markings can be seen along the more accessible ridgelines and</p>	<p>Aboriginal and historic features and values are identified and protected.</p> <p>Aboriginal people are involved in management of the Aboriginal cultural values of the reserve.</p> <p>Understanding of the cultural significance of the reserve is improved.</p>	<p>6.2.1 Record historic sites, assess for heritage values and retain in situ.</p> <p>6.2.2 Consult and involve the Tweed Byron LALC, the Elders group for the Minjungbal people of the Bundjalung Nation and other relevant Aboriginal community organisations in the management of any Aboriginal sites, places and values, including future interpretation of places or values and research into heritage values.</p>	<p>Medium</p> <p>High</p>

<p>provide evidence of past timber getting.</p>			
<p>6.3 Visitor Use and Services Visitor use is not promoted due to the small size of the reserve and its high ecological values. Camping, fires and horse riding is not permitted. Derelict picnic tables, structures, tracks, and outdated signage which predate gazettal of the reserve still remain. Alternative recreation opportunities are available 5 kilometres from the reserve at the Tweed Shire Council's Bruce Chick Conservation Park which provides good facilities for day visitors. Updated signage in the reserve could improve visitor awareness, understanding and appreciation of the values of the reserve and discourage inappropriate activities such as illegal plant collection and dumping of rubbish. Law enforcement may be necessary in the event of continued illegal activities.</p>	<p>Visitor use is appropriate and ecologically sustainable. Negative impacts of inappropriate activities on reserve values are removed.</p>	<p>6.3.1 Remove derelict and outdated visitor infrastructure and signage. 6.3.2 Install interpretive signage about the reserve's values and threats and update regulatory signage at appropriate locations in the reserve.</p>	<p>Medium Medium</p>
<p>6.4 Community Programs and Education Public appreciation and understanding of the reserve's values and management programs can be facilitated through appropriate signage, interpretative information and nature based education activities (refer to 6.3.2).</p>	<p>Park neighbours support conservation of native vegetation near the park. The local community and visitors are aware of the</p>	<p>6.4.1 Liaise with neighbouring landholders and agencies to encourage the protection and appropriate management of key habitats and ecological corridors adjoining the reserve.</p>	<p>Medium</p>

<p>Remnant vegetated areas on private lands can provide a valuable contribution as part of a network of wildlife corridors.</p>	<p>significance of the park and of park management programs.</p>	
<p>6.5 Weeds and Pest Animals Thirty introduced plant species have been recorded in the reserve (see Table 3). Weed species are focused in disturbed areas in the northern and eastern boundary areas, alongside road edges and drainage lines. Cane toads occur in isolated populations such as along Hogans Road. A Cane Toad Management Strategy has been prepared for the Northern Rivers Region and the Northern Branch. The Northern Rivers Region Pest Management Strategy details priorities for pest management in the reserve including actions listed in PAS and TAP. Control of exotic vines and implementation of key actions of the exotic vines KTP PAS are identified as priorities for the reserve, in particular control of madeira vine and cat's claw creeper. A site-specific management plan has been prepared for the control of lantana in the reserve. A Conservation Risk Assessment (CRA) was</p>	<p>Introduced plants and animals are controlled and where possible eliminated. Negative impacts of weeds and pest animals on park values are stable or diminishing. Structural diversity and habitat values are restored in areas subject to past disturbance. Pest control programs are undertaken where appropriate in consultation with neighbours.</p>	<p>High High Medium</p>

<p>prepared in August 2007 for 'Habitat Restoration' and an ongoing bush regeneration program is currently being undertaken.</p> <p>The Tweed Landcare group and the Tumbulgum Action Group currently work in areas adjacent to the reserve and there may be opportunities to work in an integrated way with them.</p>			
<p>6.6 Fire Management</p> <p>Fire is a natural feature of many environments but inappropriate fire regimes can lead to loss of particular plant and animal communities. High frequency fires have been listed as a key threatening process under the TSC Act.</p> <p>The reserve is dominated by lowland rainforest sensitive to fire but does not have a history of fire ignitions. A fire in December 2009 occurred on the western side of Hogans Road in close proximity to the reserve.</p> <p>NPWS participates in the Far North Coast BFMC and maintains cooperative arrangements with local RFS brigades, fire control officers, other fire authorities and surrounding landowners in regard to fuel management and fire suppression.</p> <p>A Fire Management Strategy was prepared for the reserve in 2007. The reserve has been</p>	<p>Life, property and natural and cultural values are protected from fire.</p> <p>Fire regimes are appropriate for conservation of native plant and animal communities.</p> <p>Negative impacts of fire on natural and cultural heritage values are stable or diminishing.</p>	<p>6.6.1 Implement the Fire Management Strategy for the reserve.</p>	<p>High</p>

<p>zoned as a Land Management Zone (LMZ). Apart from the over-riding legislative objective of protecting life and property, the primary fire management objectives for a LMZ are to conserve biodiversity and protect cultural heritage. This is achieved in accordance with the identified fire regimes/thresholds in the Fire Management Strategy.</p>			
<p>6.7 Infrastructure and Maintenance Tweed Shire Council maintains Hogans Road and other roads adjacent to the reserve. There are no management trails or other NPWS management facilities or infrastructure in the reserve.</p> <p>Country Energy power lines are located along the reserve's southern boundary but do not enter the reserve.</p> <p>Straying stock have occasionally entered the reserve where there have been breaches in nearby fence lines. NPWS may provide fencing assistance to neighbours where appropriate and in accordance with NPWS policy.</p>	<p>Infrastructure and assets adjacent to the reserve are managed to minimise impacts on natural and cultural values and are routinely maintained.</p>	<p>6.7.1 Liaise with Tweed Shire Council regarding maintenance of Hogans, Cranneys and Upper Duroby Roads where these adjoin the reserve, and protection of pouched frog habitat.</p>	<p>High</p>

* **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.

Ongoing is for activities that are undertaken on an annual basis or statements of management intent that will direct the management response if an issue that arises.

