Office of Environment & Heritage
NSW National Parks & Wildlife Service

Metro South West Region

Draft Regional Pest Management Strategy

Part B: 2012-2015

This plan should be cited as follows:

Office of Environment and Heritage. (2011). Draft Metro South West Regional Pest Management Strategy Part B: 2012-2015. OEH, Sydney, NSW

For further information contact:
Regional Operations Coordinator
South West Region
Metro Branch
National Parks and Wildlife Service
Office of Environment and Heritage
Department of Premier and Cabinet
PO Box 144
Sutherland
NSW 1499
Telephone: 02 9542 0648

The New South Wales National Parks and Wildlife Service (NPWS) is part of the Office of Environment and Heritage (OEH). Throughout this strategy, references to NPWS should be taken to mean the NPWS carrying out functions on behalf of the Director General of the Department of Premier and Cabinet, and the Minister for the Environment.

© Copyright Office of Environment and Heritage on behalf of State of NSW

With the exception of photographs, the Office of Environment and Heritage and State of NSW are pleased to allow this material to be reproduced in whole or in part for educational and non-commercial use, provided the meaning is unchanged and its source, publisher and authorship are acknowledged. Specific permission is required for the reproduction of photographs (OEH copyright).

Published by:
Office of Environment and Heritage
59–61 Goulburn Street, Sydney, NSW 2000
PO Box A290, Sydney South, NSW 1232

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
See also www.environment.nsw.gov.au/pollution

Phone: (02) 9995 5000 (switchboard)
Phone: 131 555 (environment information and publications requests)
Phone: 1300 361 967 (national parks, climate change and energy efficiency information and publications requests)
Fax: (02) 9995 5999
TTY: (02) 9211 4723
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

ISBN 978 1 74293 408 2
OEH 2011/0896
December 2011

Contents

Summary

The vision for the NPWS Regional Pest Management Strategy is to minimise adverse impacts of pests on biodiversity, protected areas and the community. This strategy achieves this through identifying and focusing on the highest priority programs, ensuring that actions are achievable and delivering measurable outcomes.

Metro South West Region incorporates a diverse area of greater Sydney managing 33 conservation reserves. Part B of the Regional Pest Management Strategy prioritises specific pest management programs into critical, high, medium and lower categories. Some critical priorities for pest management in Metro South West Region include:

- Cane toad control at Taren Point to prevent infestation of Towra Point Nature Reserve
- Reduce deer herbivory in Royal National Park
- Wild dog control in the Nattai Reserves
- Bitou bush in coastal reserves
- African olive invading Cumberland Plain Woodland

The pest management priorities for Metro South West Region align with State and local priorities under the *Noxious Weeds Act 1993* and the *Rural Lands Protection Act 1998.* Priorities also align with the NSW Invasive Species Plan and take on a whole of landscape cooperative approach to implementation.

DRAFT

Acronyms

The following acronyms are used throughout this document.

Acronym	Expanded Text
AMS	Asset Maintenance System
BMAD	Bell Miner Associated Die Back
BPWW	Biodiversity Priorities for Widespread Weeds
CAP	Catchment Action Plan
CBD	Central Business District
CMA	Catchment Management Authority
DECCW	NSW Department of Environment, Climate Change & Water
EEC	Ecological Endangered Community
KPI	Key Performance Indicator
KTP	Key Threatening Process under the TSC Act
LHPA	Livestock Health and Pest Authority
MER	Natural Resource Management Monitoring, Evaluation and Reporting
NPW Act	*National Parks and Wildlife Act 1974*
NPWS	NSW National Parks and Wildlife Service
NRM	Natural Resource Management
NSW	New South Wales
OEH	Office of Environment and Heritage
PAS	Priorities Action Statement
PMP	Park Management Program
POM	Plan of Management
PWG	Parks and Wildlife Group, the internal name within OEH for NPWS
PWIS	Pest and Weed Information System
RLP Act	*Rural Lands Protection Act 1998*
ROP	Regional Operations Plan
RPMS	Regional Pest Management Strategy

DRAFT

SOP	Standard Operating Procedure
TAP	Threat Abatement Plan
TSC Act	*Threatened Species Conservation Act 1995*

DRAFT

1. Introduction

Pest management within the Office of Environment and Heritage (OEH) is guided by two core planning instruments:

- *NSW 2021 – A Plan to Make NSW Number One* sets out performance targets, including a specific priority action within *Goal 22 Protect Our Natural Environment* which is to *address core pest control in National Parks through the delivery of NPWS Regional Pest Management Strategies and improve educational programs and visitor access*.
- The *NSW Invasive Species Plan* provides specific goals, objectives and actions in relation to Invasive Species management.

This document is Part B of the Metro South West Region Pest Management Strategy and contains the regionally specific components of the strategy including the Region's prioritised pest programs.

Part A of the strategy provides the broader planning framework for the management of pests by NPWS. It documents the corporate environment, legislation and policy context and describes the logic used for identifying, prioritising and monitoring pest management programs. It also establishes Service-wide pest management goals, objectives and actions.

Part B describes the local circumstances within the Region and applies the Part A framework to prioritise specific pest management programs. These priorities will be included in annual Regional Operations Plans (ROPs) and implemented through works orders scheduled in the Assets Maintenance System (AMS). AMS is the system which generates and schedules work orders used by the department when undertaking park management activities. It also broadly identifies pest distribution and associated impacts across the Region.

2. Regional overview

Metro South West Region lies to the south and west of the Sydney CBD. The Region includes approximately 105,600 hectares of reserved land in 5 protected area categories: Nature Reserve (14), National Park (8), State Conservation Area (6) and Regional Park (5). There are also 3 gazetted Aboriginal Places.

The predominant geomorphologic features of the Metro South West reserves are sandstone plateaux with deeply incised valleys, the Cumberland Plain, coastal wetlands, bays, beaches, major rivers (Hacking, Georges, Wollondilly, Nepean, Hawkesbury) and coastal escarpments. The Metro South West Region reserves are part of the Circle of Reserves around Greater Sydney, Continuous Reserves from the Hunter to the Victorian Border and vital corridors linking theses conservation zones to the Great Eastern Range. They also comprise of Prospect Reservoir, 25% of the Warragamba Drinking Water Catchment and span the entire length and breadth of the Cumberland Plain. The Plain was generally very fertile and was the preferred location for intensive agriculture for the outer Metro Area. Over time, this former land use has been replaced by urban development. As a result, much of its surviving biodiversity is fragmented, small in area of distribution and now listed as endangered communities.

Together the reserves of the Region exhibit a rich cultural history beginning with long occupation by Aboriginal people. Some reserves, such as Cattai and Scheyville

DRAFT

National Parks, reflect the evolution of occupation, ownership and land management from Aboriginal occupation, through the contact and European settlement of the earliest years of the nineteenth century and now in the twentieth century reflect the modern recreational, environmental and educational values which have come to dominate the landscape.

The Region has 2 visitor centres and 5 Area offices (Kurnell, Audley, Picton, Parramatta and Scheyville). Approximately 3,500,000 park visitors visit our reserves each year with an average length of stay in excess of 3 hours.

Within the next 25 years, the current and proposed reserves of the western periphery of the Region will provide recreational open space and intensively managed high visitation precincts, vital to the health and well being of the many hundreds of thousands of residents who will in time occupy future suburbs in the North West and South West Growth Centres.

Visitors to the Regions reserves are more likely to be residents rather than tourists, and it is known that many visitors choose a particular NPWS park due to its convenience and closeness to home. As a result, the mix of park visitors reflects the cultural diversity in the communities of the Region. The population of the region is characterised by diverse socio-economic communities with approximately 180 different ethnic groups and over 140 spoken languages (figures for Greater Sydney Area from BVMP 2008).

In general these reserves are:

- Relatively small giving rise to a limited number of visitor precincts that experience extremely high seasonal visitation rates (Bents Basin State Conservation Area, Rouse Hill Regional Park, Cattai National Park, Royal National Park, Kamay Botany Bay National Park and Georges River National Park)
- Renown for their extensive historic values. Agnes Banks Sand Deposits (Mulgoa Nature Reserve), Audley historic recreational complex (Royal National Park), Cattai Estate (Cattai National Park) and Scheyville National Park are all included on the State Heritage Register as places of State significance
- Subject to international conservation agreements (JAMBA and CHAMBA) for the protection of wetlands and migratory birds (Towra Point Nature Reserve)
- World and National Heritage significance including the Nattai and Thirlmere Lakes National Park components of the Greater Blue Mountains World Heritage Area and two National Heritage listed National Parks (Royal National Park and Kamay Botany Bay National Park)
- Part of vital drinking water catchments including the Nattai Wilderness, the East Warragamba and Prospect Reservoir, representing one quarter of Sydney's water catchments
- Historically significant containing Cooks Landing Place (Kamay Botany Bay National Park being the place of first contact between Aboriginals and British explorers) and Royal National Park (the first National Park gazetted in Australia and the second in the world) and Scheyville National Park (immigrant farm and military training college).

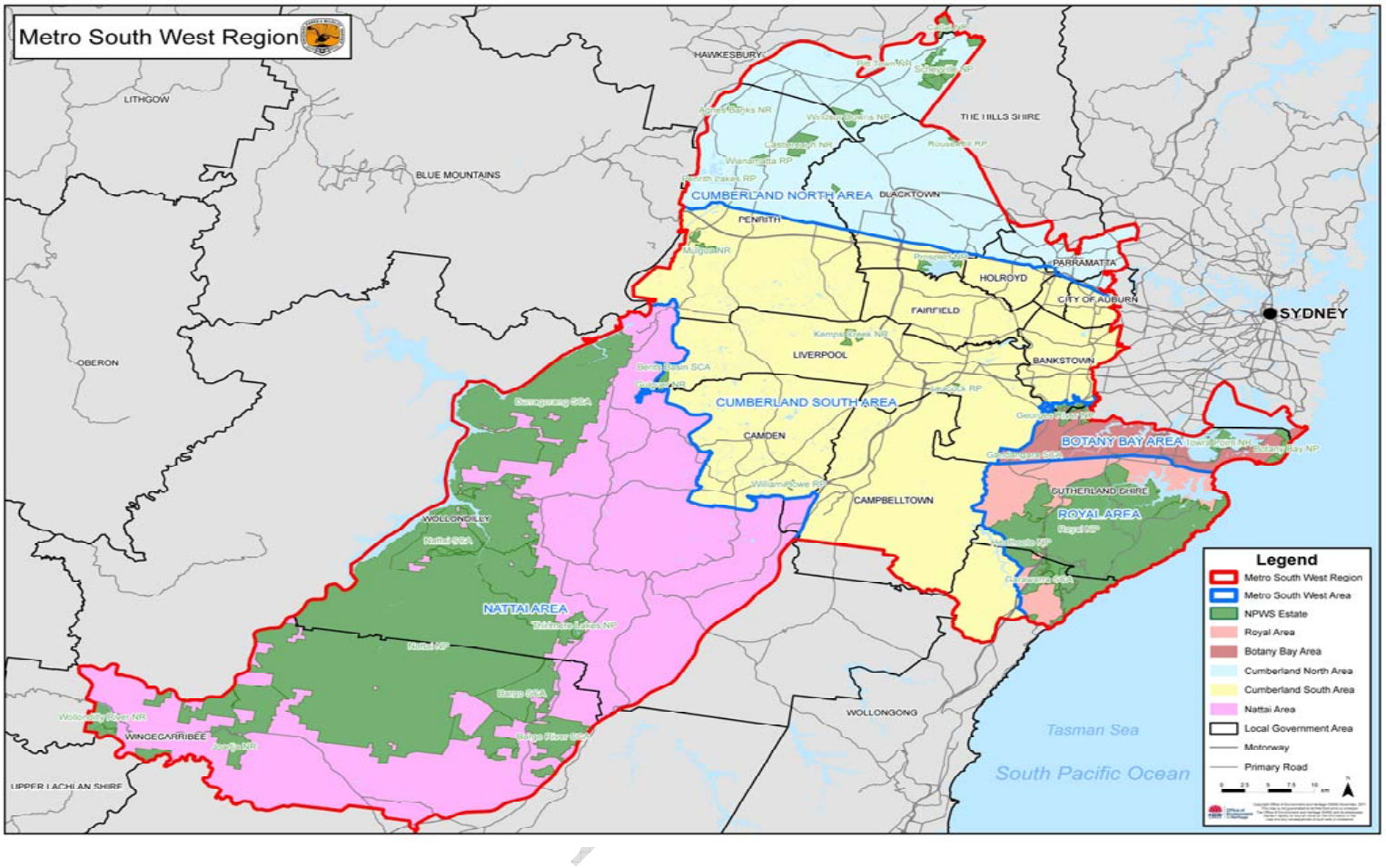
DRAFT

Over the past five years the region has been successful in implementing or participating in a number of significant conservation based pest management programs. Theses include:

- A collaborative eradication program targeting cane toads in the Taren Point industrial area
- On going deer control in Royal National Park
- Fox control across the Kurnell Peninsular providing protection for successful breeding events of Little Terns and other migratory shore birds
- Wild Dog and Pig control across the Nattai reserves
- Bitou and Lantana control in Towra Point Nature Reserve and Kamay Botany Bay National Parks.
- Mapping of African Love Grass and African Olive in Western Sydney reserves.

DRAFT

3. Regional map



4. Regional prioritisation

The following key factors are considered when determining priorities for pest management within the Region. However, a precautionary approach using risk management (as described in the risk management policy) will be applied where there is uncertainty about the impacts of the pest to the asset. The feasibility of effective control will also be a consideration.

Critical Priority

C-TSC (Threatened Species Conservation):

Programs targeting pests which are, or are likely to be, significantly impacting on threatened species/populations/communities. These include the highest priorities identified in the Threat Abatement Plans, Priority Action Statements and Biodiversity Priorities for Widespread Weed e.g. undertake fox control at the Towra Point priority site for Little Terns as identified in the Fox Threat Abatement Plan;

C-HD (Health and Disease)

Programs that target pests which impact significantly on human health or are part of a declared national emergency e.g. outbreak of foot and mouth disease or control of feral pigs in the catchment area of a domestic water supply reservoir;

C-EC (Economic)

Programs targeting pests that impact significantly on economic enterprises e.g. wild dog control where there is potential for significant stock losses as identified in Wild Dog Management Plans;

C-NE (New and Emerging)

Programs addressing new occurrences or suppressed populations of highly invasive pest species with potential for significant impacts on park values (subject to risk/feasibility assessment), programs to control Class 1 and 2 noxious weeds;

High Priority

H-IH (International Heritage)

Programs that target pests that impact significantly on World Heritage or international heritage values, e.g. control of pigs and goats impacting on World Heritage values of Greater Blue Mountains World Heritage Area; pest control in RAMSAR wetlands;

H-CH (Cultural Heritage)

Programs targeting pests that impact significantly on important cultural heritage values e.g. control of feral goats where they are inhabiting an area containing Aboriginal rock art; control of rabbits undermining an historic building;

Medium Priority

M-WNH (Wilderness and National Heritage)

Programs that target pests that impact significantly on Wilderness, Wild Rivers, national heritage values or other important listed values e.g. control of willows along a declared Wild River or within a Wilderness area;

DRAFT

M-RA (Recreation and aesthetic values)

Programs that target pests that impact significantly on recreation, landscape or aesthetic values, e.g. control of blackberry on the margins of camping areas; control of weeds in an area of natural beauty that is visited frequently;

M-CP (Cooperative programs)

Cooperative programs (not covered in higher priorities above) targeting pests that impact significantly on park values or agricultural production (including the control of Class 3 noxious weeds or implementation of other endorsed state or regional plan), e.g. control of bitou bush across boundaries as part of a regional control plan prepared by a regional weeds advisory committee and supported by NPWS.

Lower Priority

L-LP (Localised programs)

Programs targeting pests that have localised impacts on natural ecosystems or agricultural lands that promote community skills, awareness and involvement with parks, e.g. participation in a new bush regeneration project with a local community group for control of Class 4 noxious weeds;

L-PP (Previous programs)

Previous programs targeting pests that have localised impacts on native species and ecosystems, and that can be efficiently implemented to maintain program benefits, e.g. the maintenance of areas treated previously for serrated tussock to continue keeping them weed free.

In some circumstances, new programs may be introduced, or priority programs extended to target pests where a control “window of opportunity” is identified e.g. where burnt areas become more accessible for ground control of weeds; where drought makes control of feral pigs and feral goats more efficient because they congregate in areas where water is available; or when a new biocontrol agent becomes available.

Future priorities for pest control will need to reflect changes in the distribution, abundance or impacts of pests that may occur in response to environmental changes including climate change. NPWS is supporting research to understand the interaction between climate change, pests and biodiversity.

DRAFT

5. Table of prioritised regional pest programs

Live versions of this table will be kept on OEH intranet and updated annually over the 4 year period of the strategy.

Reserve(s)	Site name	Target pest	Asset(s) at risk	Aim of Control	Action(s)	Priority
Bents Basin SCA, Gulguer NR, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, William Howe RP, Towra Point NR		African Olive	Multiple EEC's with emphasis on Cumberland Plain Woodland	Asset protection	Ground Spraying	C-TSC
Georges River NP, Bents Basin SCA, Cattai NP, Kamay Botany Bay NP, Towra Point NR		Alligator Weed	Multiple EEC's	Asset protection	Foliar Spraying	C-TSC
Bents Basin SCA, Gulguer NR, Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, William Howe RP, Towra Point NR		Asparagus Fern	Multiple EEC's	Asset protection	Bush Regeneration Techniques	C-TSC
Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Nattai NP, Prospect NR, William Howe RP, Royal NP, Thirlmere Lakes NP, Towra Point NR		Bitou/Bone Seed	Multiple EEC's	Asset protection	Foliar Spray & Bush Regeneration Techniques	C-TSC

DRAFT

Bents Basin SCA, Gulguer NR, Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, William Howe RP, Scheyville NP, Towra Point NR, Wianamatta RP		Blackberry	Multiple EEC's	Asset protection	Ground spraying	C-TSC
Towra Point NR		Cane Toad		Eradication	Surveys & Hand Collection	C-NE
Nattai NP, Wollondilly River NR		Cattle	Multiple EEC's	Eradication	Shooting	C-TSC
Royal NP, Towra Point NR, Kamay Botany Bay NP, Cattai NP, Scheyville NP		Deer	Multiple EEC's	Containment or Asset protection	Shooting programs	C-TSC
Towra Point NR		Fox	Little Terns & other threatened shorebirds	Asset protection	Baiting	C-TSC
Nattai NP, Joadja NR		Goat	Multiple EEC's	Asset protection	Shooting	C-TSC
Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Nattai NP, Prospect NR, William Howe RP, Royal NP, Scheyville NP, Thirlmere Lakes NP, Towra Point NR, Wianamatta RP		Exotic Grasses	Multiple EEC's	Asset protection	Various	C-TSC

DRAFT

Royal National Park	Jibbon	Green Cestrum	Kurnell Dune Forest	Asset protection	Basal Bark & Foliar Spray	C-TSC
Cattai NP, Gulguer NR, Heathcote NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Nattai NP, Prospect NR, Royal National Park, William Howe RP, Wollondilly River NR		Lantana	Multiple EEC's	Asset protection	Foliar Spray, Biological Control	C-TSC
Bents Basin SCA, Gulguer NR, Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, William Howe RP, Scheyville NP		Ludwigia	Multiple EEC's	Asset protection	Foliar Spray, Biological Control	C-TSC
Pitt Town NR	Pebbly Hill Road	Moth Vine	Cumberland Plain Woodland	Asset protection	Cut & Paste	C-TSC
Georges River NP, Kamay Botany Bay NP, Towra Point NR, Bents Basin SCA, Garrawarra SCA, Gulguer Nature Reserve, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, Royal NP, Scheyville NP, William Howe RP		Mother of Millions	Multiple EEC's, Stock	Asset protection	Foliar Spraying	C-TSC

DRAFT

Royal NP	Forest Path	Myrtle Rust	Moist Eucalypt Forest on Shale	Containment	Map, quarantine, then implement appropriate control	C-NE
Kemps Creek NR		Phytophthora spp	Cumberland Plain Woodland	Assest Protection	Phosponate application	C-NE
Burragorang SCA, Joadja NR, Nattai NP & SCA, Wollondilly River NR		Pig	Multiple EEC's	Asset protection	Shooting	C-TSC
Nattai National Park & SCA, Wollondilly River NR		Prickly Pear	Multiple EEC's	Asset protection	Foliar Spraying	C-TSC
Georges River NP, Kamay Botany Bay NP, Towra Point NR, Bents Basin SCA, Garrawarra SCA, Gulguer Nature Reserve, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, Royal NP, Scheyville NP, Wianamatta RP, William Howe NR		Privet spp	Multiple EEC's	Asset protection	Foliar Spraying	C-TSC
Towra Point NR	Causeway	Rabbit	Swamp Oak Floodplain Forest, Kurnell Dune Forest	Asset protection	Shooting, Biological Control, Trapping	C-TSC
Agnes Banks NR	Northern Addition	Robinia	Agnes Banks Woodland	Asset protection	Ground Spraying	C-TSC

DRAFT

Georges River National Park	Yeramba Lagoon	Salvinia		Containment	Harvesting, Bio Control, Foliar spraying	C-NE
Royal National Park	Marley	Sea Spurge		Containment	Folia Spraying	C-NE
Royal National Park, Cattai National Park		Senegal Tea	Freshwater Wetlands	Eradication	Folia Spraying	C-NE
Bents Basin SCA, Gulguer NR, Kemps Creek NR, Leacock RP, Nattai NP, Scheyville NP,		St Johns Wort	Multiple EEC's	Asset protection	Foliar Spraying	C-TSC
Cattai NP, Kemps Creek NR, Leacock RP, Nattai NP, Royal National Park, Wollondilly River NR		Tree of Heaven	Multiple EEC's	Asset protection	Foliar Spraying	C-TSC
Bents Basin SCA, Gulguer NR, Kamay Botany Bay NP, Kemps Creek NR, Leacock RP, Mulgoa NR, Prospect NR, William Howe RP, Towra Point NR, Wianamatta RP		Vines & Scramblers	Multiple	Asset protection	Various	C-TSC
Scheyville NP	Longneck Lagoon	Water Hyacinth	Freshwater Wetlands	Asset protection	Foliar Spray, Hand Pulling	C-TSC
Joadja NR, Nattai NP, Wollondilly River NR		Wild Dog	Livestock	Containment	Baiting, M-44, Trapping	C-EC
Bents Basin SCA, Cattai NP, Gulguer NR, Kemps Creek NR, Leacock RP,		Willows	Multiple	Asset protection	Various	C-TSC

DRAFT

Nattai NP, Prospect NR, Scheyville NP, Wollondilly River NR						

DRAFT

6. Consultation

The Metro South West Region Regional Pest Management Strategy was developed through consultation with the community and internal staff. A Pest Management Strategy Stakeholder Forum was conducted at Bents Basin on the 16th September 2011. A diverse range of community representatives were in attendance including members of local Councils, Livestock Health and Pest Authorities, The Game Council, Universities, Catchment Management Authorities, rural land holders and several other stakeholder groups. Key issues raised from this forum were:

- The need for a “nil tenure” approach across the landscape on pest management programs (refer to Goal 2 Objective 2.2 in Part A);
- Communication from NPWS to the community on both the impacts of pest species and notification of the programs being conducted (refer to Goal 3 Objective 3.2 in Part A);
- Continual review of methodologies and evaluation of programs to ensure best practice (refer to Goal 3 Objective 3.4 in Part A);
- The suggestion that critical priority pest management programs be those that prevent the establishment of new pest populations (refer to Goal 1 Objective 1.1 in Part A);
- The need for appropriate and long term resources to be available for pest management programs (refer to Goal 3 Objective 3.1 in Part A);
- Focus of a reduction in the mortality rate of non target species

Workshops were conducted with each operational Area with Rangers and Field Staff in order to accurately identify and prioritise pest management programs within that Area. Following the preparation of the draft Pest Management Strategy, the document was placed on public exhibition and comments were invited from the community, other government agencies and stakeholder groups.

DRAFT

7. Pest species overviews

Information about high profile pests for this region is summarised below. More details regarding the distribution, impacts and management options for these and other pest species can be found in other reference documents including the following web pages:

http://www.dpi.nsw.gov.au/agriculture/pests-weeds/vertebrate-pests/general-information/pest-animal-survey

http://environment.gov.au/biodiversity/invasive/publications/humane-control.html

http://www.invasiveanimals.com/

http://www.environment.gov.au/biodiversity/invasive/ferals/index.html

http://www.environment.nsw.gov.au/threatenedspecies/KeyThreateningProcessesByDoctype.htm

http://www.dpi.nsw.gov.au/agriculture/pests-weeds/weeds/profiles

http://www.weeds.org.au/WoNS/

http://www.rirdc.gov.au/programs/national-rural-issues/weeds/weeds_home.cfm

http://www.weeds.gov.au/

DRAFT

Bell Miner Associated Dieback (BMAD)

Distribution and abundance

Bell Miner Associated Dieback (BMAD) is found in a number of eucalypt forest types between Victoria and southern Queensland. The current spatial distribution of BMAD throughout NSW is not known in detail. Significant areas of forests within the MSW region are at risk or have already been affected by BMAD. Areas of BMAD are suspected to occur in Leacock Regional Park, Scheyville and Nattai National Parks and Mulgoa Nature Reserve.

Impacts

'Forest eucalypt dieback associated with over-abundant bell miners and psyllids' has been determined as a KTP under the Threatened Species Act. The condition is associated with the establishment of bell miner colonies and an over abundance of sap sucking psyllid insects in the forest canopy. The persistence of psyllids in the canopy leads to dieback and eventual death of the affected trees. The impacts of BMAD include loss of biodiversity, economic and recreational values. Forests affected by BMAD can become severely degraded with the loss of a significant proportion of overstorey species and in many cases subsequent invasion of the understorey by weeds, particularly lantana.

Avifauna are known to be affected by the presence of over-abundant bell miners. A number of eucalypt species such as *Eucalyptus dunnii, E. saligna*, *E. grandis, E. siderophloia, E. acmenoides, E. punctata, E. paniculata*, are vulnerable to BMAD. EECs that are affected or potentially threatened by BMAD include Blue Gum High Forest of the Sydney Basin Bioregion, Blue Mountains Shale Cap Forest of the Sydney Basin Bioregion, White Gum Moist Forest of the North Coast Bioregion and Grey Box – Grey Gum Wet Sclerophyll Forest of the North Coast Bioregion. The group of fauna at highest risk of BMAD are the eucalypt dependent arboreal species and large forest owls. Koala, greater-squirrel, yellow-bellied glider and brush-tailed phascogale may all be at risk of decline due to poor forest health.

The risk and danger of tree and limb fall is also an issue in some areas affected by dieback and in some areas the visual and recreational qualities of known tourist sites are threatened by the loss of tree canopy and ecological integrity.

Priorities for control

Control priorities are currently limited to identifying the presence of BMAD and assessing the impact of BMAD at particular sites. Where the impact is significant, or could potentially become significant, site management plans may be prepared.

Control

Control of BMAD is a difficult challenge and in the absence of empirical evidence to confirm the causes. Current operational activities to prevent spread and assist ecosystem recovery include weed control and fire management. The use of fire to manage lantana and manipulate bell miner habitat is the more useful tool available for mitigating BMAD impacts at present. Actions outlined in the Draft Statement of Intent for this KTP will be implemented by NPWS.

Monitoring

Monitoring of the location size of BMAD affected areas, and the outcomes of management actions on ecosystems will continue and will be used to assist with adapting future management. Communities at risk of BMAD and new reports of

DRAFT

BMAD will be assessed and mapped. The state wide BMAD Working Group will provide advice and direction for future management.

DRAFT

Cane Toad *(Bufo marinus)*

Distribution and abundance

Cane toads are large, robust amphibians which are native to Central and South America. They are extremely hardy animals and voracious predators of insects and other small prey. These are the qualities that led to their introduction to Australia as a means of controlling pest beetles in the sugar cane industry in 1935, before the use of agricultural chemicals became widespread.

Since their release, cane toads have dispersed across northern and eastern Queensland, the top end of the Northern Territory and they have recently arrived in northern WA. They are also present in northern NSW and their dispersal along flooded creek lines in the arid south-west of Queensland has raised concern that the toads will eventually spread to South Australia via river systems such as the Cooper.

In February 2010 a population of cane toads was discovered in the Taren Point industrial area. NPWS officers along with staff from Sutherland Shire Council developed a Plan of Action and commenced an intensive eradication program. These efforts appear to have contained the localised spread of the toads and will now focus on eradicating the remaining individuals.

Impacts

Cane toads have an impressive array of highly toxic chemical defenses available to them at almost all stages of their lives. The toxins occur in their skin and organs and can be secreted by large glands at the back of the animal's head when it is threatened. As a result, toads will poison many predators that attempt to eat them.

Much anecdotal and some documented evidence exists regarding cane toad impacts on native predators, including quolls, snakes, goannas and freshwater crocodiles, all of which may be lethally poisoned when they attempt to eat toads. Although some may recover, many individual predators die when they are first exposed to cane toads and populations soon start to decline. *(Australian Government Policy on Cane Toads, March 2010).*

Priorities for Control

Critical priority: prevention of cane toads entering Towra Point Nature Reserve is of the highest priority. Current infestation exists within 2 kms of the reserve. NPWS is working closely with Sutherland Shire Council to eradicate this infestation.

Monitoring

NPWS staff undertake routine night time surveys of Towra Point Nature Reserve and Kamay Botany Bay National Park. NPWS staff also participate in a variety of joint control programs with Sutherland Shire Council and report to a joint working group on all cane toad related issues. The working group includes Sutherland Shire council, Department of Primary Industries, Sydney University and specialists from the Office of Environment and Heritage including National Parks and Wildlife Service. Currently NPWS is contributing to a research project "Ecology, impact and control of cane toads on the southern invasion front" by means of financial support in an effort to maximise the prospects of eradicating this infestation.

DRAFT

Deer (Family Cervidae)

Distribution and abundance

Deer were introduced into Australia by acclimatisation societies in the late 19th and early 20th centuries to enhance the aesthetics of the local environment and provide sport. Several of these populations survived and formed the basis of larger, well established wild deer populations. Deer were also introduced by farmers in the late 20th century through the release of animals during poor climatic and economic conditions and through their escape from poorly-maintained farms. In addition, hunters and hunting agencies have released deer into the wild in the late 20th century for trophy development. As a consequence, Fallow, Red, Sambar, Chital, Rusa and Hog deer have formed wild populations in many habitats, ranging from arid woodland to rainforest.

Impacts

The five species of feral deer currently established in NSW are primarily grazers, but all species browse opportunistically on the buds, shoots and leaves of trees and shrubs (Bentley 1978). Deer may also strip bark from woody plants and browse on reproductive structures (Akasi and Nakashisuka 1999, Keith and Pellow 2004, Flora and Fauna Guarantee Scientific Advisory Committee 2004). All deer species are classed as 'intermediate mixed grazers' (Whitehead 1972) indicating that they can feed on a combination of shrub, understorey and grass species depending on availability. Consumption of a wide variety of native plant species by Rusa and Sambar deer has been recorded in south-eastern Australia (Hamilton 1981, Stockwell 2003, Keith and Pellow 2004, Moriarty unpubl. data, Flora and Fauna Guarantee Scientific Advisory Committee 2004) and, based on studies from overseas (e.g. Veblen et al. 1992, Fuller and Gill 2001, Rooney 2001, Coomes et al. 2003), it is likely that the other species of feral deer in NSW also consume a wide range of plant species.

Rusa Deer have been shown to alter the structure, species abundance and composition of grassland communities (Hamilton 1981). In addition, patches of sandstone heath, woodland, and littoral rainforest at locations within the Royal National Park with high deer density, have 30-70% fewer plant species than patches with low deer densities (NPWS 2002).

Grazing and trampling by deer could alter the composition and structure of Ecological Endangered Communities (EEC's) including Littoral Rainforest, Sydney Freshwater Wetlands, Montane Peatlands and Swamps, River-Flat Eucalypt Forest on Coastal Floodplains, and Swamp Sclerophyll Forest on Coastal Floodplains.

Grazing and trampling by deer could alter the composition and structure of the habitats of threatened fauna, including:

- *Isoodon obesulus* (Southern Brown Bandicoot)
- *Potorous longipes* (Long-footed Potoroo)

Based on this and further information, the NSW Scientific Committee has made a final determination to list herbivory and environmental degradation caused by feral deer as a key threatening process in Schedule 3 of the Threatened Species Conservation Act, 1995.

Priorities for Control

Critical Priority programs are those affecting ecological endangered communities such as littoral rainforest, endangered populations or threatened species throughout Royal National Park, Towra Point Nature Reserve, Kamay Botany Bay National Park, Gulguer Nature Reserve, Cattai and Scheyville National Park.

Control

In Royal National Park ground shooting programs are currently operating. The program allows for the implementation of complimentary methods including fertility control and baiting should the technology or social acceptance become available.

Monitoring

Monitoring includes maintaining records of all operations and a tally of all animals removed from the reserve, plus establishment of exclusion plots, records of accidents etc.

DRAFT

Red Fox *(Vulpes vulpes)*

Distribution and abundance

The European Red Fox is an adaptable and elusive predator common in rural and urban areas throughout southern Australia. It occurs across a range of habitats and the main determinants of its population size and distribution appear to be food supply, disturbance of natural habitats and refuge availability.

The fox is predominantly carnivorous, and is largely opportunistic in its selection of prey. It also scavenges and, during warmer months, consumes wild fruit. It has been identified as a vector of weed species such as Bitou Bush Chrysanthemoides monilifera rotundata.

Impacts

The introduction of the European Red Fox has been linked to regional declines and extinctions of a broad suite of medium-sized non-flying mammals ground-nesting birds and freshwater turtles. In MSWR, the fox is currently threatening numerous endangered and vulnerable species in MSWR including but not limited to the Little Tern *Sterna albifrons*, Brush-tailed Rock-wallaby *Petrogale penicillata*, and Southern Brown Bandicoot *Isoodon obesulus*.

The Scientific Committee, established under the TSC Act, has made a final determination to list *predation by the European red fox* as a key threatening process in Schedule 3 of that Act.

Predation by the European red fox is also listed as a key threatening process under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Priorities for control

Critical priority: Towra Point Nature Reserve is listed as priority site for fox control in the NSW Fox Threat Abatement Plan (NPWS 2010). The site has been identified as an important breeding site for Little Terns and other threatened shore nesting birds. Wollondilly is listed as a priority monitoring only site in the NSW Fox Threat Abatement Plan (NPWS 2010). The site targets brush-tailed rock wallabies/

Control

Intensive 1080 baiting is being undertaken across Towra Point Nature Reserve and other government and private lands at Kurnell. This cooperative program involves NPWS, Sutherland Shire Council, other government lands owners and private lands across the Kurnell Peninsular.

Monitoring

Monitoring of threatened shorebirds, brush-tailed rock wallabies and foxes is conducted in line with the NSW Fox Threat Abatement Plan (NPWS 2010).

DRAFT

Feral Goat *(Capra hircus)*

Distribution and abundance:

Feral goats, *Capra hircus* (Linnaeus 1758), are descended from domestic stock introduced to Australia at various times since 1788 (Henzell 2000). Feral goats are distinguished from domestic goats by not being permanently restrained by fences or subject to husbandry (Environment Australia 1999). 'Competition and land degradation by Feral Goats' is currently listed as a key threatening process under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Feral goats occur in most regions of Australia, with the majority of their distribution in the arid and semi-arid pastoral regions of Queensland, Western Australia, South Australia and NSW (Parkes et al. 1996). Dingos and feral dogs are their chief predators and, where wild dogs are not actively controlled, they have been observed to limit the distribution of feral goats (Parkes et al. 1996).

In MSW Region feral goats have substantial populations in the Nattai reserve system and smaller populations in the Gulguer, Kemps Creek Nature Reserves and Leacock Regional Park.

Impacts

Feral goats present a potential threat to plant communities given the large number of plant species that are palatable to them and their ability to browse and graze in inaccessible areas such as in trees or in dense thickets (Squires 1980; Henzell 1993; Parkes et al. 1996). Moreover, the floristic composition of plant communities may be altered as a result of intense browsing by feral goats (Harrington 1986 – in DEC 2005).

Feral goats can cause significant habitat degradation. Removal or destruction of vegetation together with trampling by ungulate herbivores decreases soil stability and contributes to erosion (Henzell 1993; Eldridge 1998).

Feral goat activity can significantly alter the habitat of native fauna and flora e.g. accumulated Feral goat droppings may degrade the habitat of the endangered Broad-headed Snake, Hoplocephalus bungaroides (Murphy 1996). Competition between Brush-tailed Rock Wallabies and feral goats for refuge areas has been noted by Bayne (unpub.) and postulated by Short and Milkovits (1990).

Concerns about the impacts of feral goats has led to the NSW Scientific Committee listing competition and habitat degradation by feral goats as a key threatening process under the TSC Act.

Competition and land degradation by feral goats is also listed as a key threatening process under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Priorities for Control

Critical priority programs include those where feral goats are impacting upon Brush-tail Rock-Wallabies and Broad-headed Snake populations. Further critical priority areas include where feral goats are impacting upon water quality in Special Areas (Warragamba Special Area).

Control

Current control methods for feral goats include aerial shooting, ground shooting, mustering and trapping. Cooperative programs with neighbours are essential to the success of programs especially where populations are transient and numbers are sustained by populations on neighbouring lands.

Monitoring:

DRAFT

All sightings of feral goats are to be recorded in an Area log, including all animals controlled, the date, the location and the number of animals sighted. Where threatened species/ecological community programs are occurring Area staff will liaise with NPWS Threatened Species Unit to implement appropriate monitoring programs for those threatened species/ecological communities.

DRAFT

Feral Pig (*Sus scrofa*)

Distribution and abundance

Feral pigs, *Sus scrofa* (Linnaeus 1758), are descended from domestic stock introduced to Australia by European settlers, and possibly from introductions to northern Australia from Timor and New Guinea (Choquenot et al. 1996; Pavlov 2000). Feral pigs are found across continental Australia with the highest densities in NSW, Qld and through northern Australia to the Kimberley region. In 2002, feral pigs were estimated to inhabit 61% of the area of NSW and the ACT (West and Saunders 2003). *Predation, habitat degradation, competition and disease transmission by feral pigs* is currently listed as a key threatening process under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

In MSWR feral pigs are distributed throughout the Nattai reserves. Individual pig sightings occur from time to time in Royal NP and Towra Point NR.

Feral pigs have a high reproductive potential (Choquenot et al. 1996). Piglets attain sexual maturity at approximately seven months (Pavlov 2000) and females may produce two litters of six piglets every 12 to 15 months (Menkhorst 1995).

Impacts

Feral pigs present a significant threat to native species and ecological communities as a result of their behaviour and feeding habits. Feral pig wallowing and rooting causes direct disturbance to habitats (Hone 2002) and water quality in the Warragamba Special Areas. Further, disturbance of habitats by feral pigs may also facilitate the invasion and spread of weeds and thus affect the composition of plant communities (DEH 2003b).

Feral pigs are active predators of native birds, reptiles, (including their eggs), frogs and soil invertebrates such as earthworms, as well as the underground storage organs of plants and the fruiting bodies of fungi. Further, direct predation by feral pigs may have contributed to declines in populations of some frog species (Richards et al. 1993).

Feral pigs have been implicated as potential vectors of disease. In particular, feral pigs may be responsible for spreading Phytophthora cinnamoni, a root-rot fungus responsible for die-back in native vegetation (DEH 2003b). There is evidence that feral pigs can carry the fungus on their hooves (Kliejunas and Ko 1976), and that the spread of the fungus is associated with soil disturbance and reduction of litter cover by pigs (Brown 1976). Further, chewing and other damage to tree trunks may facilitate infection of vegetation by the fungus and other diseases.

Priorities for control

Critical priority programs include those where feral pigs are likely to significantly impact on threatened species and endangered ecological communities, including:

- The Nattai reserve system
- New invasions of pigs into any reserve

Control

Control programs will utilise a variety of control options including baiting, shooting (including aerial) and trapping.

Cooperative programs, working with neighbours and the local LHPA, are essential to ensure effectiveness, particularly where infestations may be supported by populations on neighbouring lands.

Monitoring

DRAFT

Monitoring will be primarily achieved through the assessment of pig damage to vegetation, frog habitat and other sensitive areas. This assessment will be undertaken thorough both ground and aerial surveys, with observed damage mapped to guide future control operations.

Anecdotal sightings of pigs and pig damage, and the outcomes of all control efforts, will be recorded and mapped.

DRAFT

Rabbit (*Oryctolagus cuniculus*)

Distribution and abundance

The European Rabbit *Oryctolagus cuniculus* was successfully introduced into Australia in 1858. It has since spread broadly across the southern two thirds of the continent, and its area of occupancy is now approximately 4.5 million square kilometres (Myers et al. 1989).

Rabbits are present in most reserves across MSWR but their densities fluctuate across the landscape and seasonally.

Impacts

There is evidence that feral rabbits impact negatively on indigenous species via competition for resources, alteration of the structure and composition of vegetation, and land degradation. Competition and land degradation by feral rabbits is listed as a key threatening process on Schedule 3 of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

Feral rabbits are grazers that prefer green grass and herbage. They may also feed on seeds and browse and, during drought, the bark and roots of shrubs. Several indigenous species overlap in diet with the feral rabbit, and are impacted negatively by competition for food with the feral rabbit. Threatened species that suffer in dietary competition with the feral rabbit include the Brush-tailed Rock Wallaby *Petrogale penicillata* (Short & Milkovits 1990).

Grazing by feral rabbits reduces survival and recruitment of several species of threatened plants. These include *Acacia carneorum, Grevillea kennedyana, Cynanchum elegans, Thesium australe* and *Lepidium hyssopifolium* (Cropper 1987; Auld 1990, 1993; Griffith 1992; Matthes & Nash 1993). Grazing by feral rabbits appears also to have marked effects on the structure and composition of vegetation communities in many areas (Williams et al. 1995), and a number of endangered ecological communities including the *Acacia loderi* endangered ecological community.

By removing above-ground and below-ground vegetation, feral rabbits contribute to erosion and loss of topsoil by wind and rain. This form of land degradation reduces the chance of successful establishment of indigenous plants, and increases the susceptibility of many indigenous vertebrates to predation from feral predators (Morton 1990; Dickman 1993).

Priorities for control

Critical priority programs include those where rabbits impact on threatened species or Endangered Ecological Communities including:

- Little Tern and Pied Oyster Catcher breeding grounds in Towra Point NR.
- Brush-tailed Rock Wallaby habitat in the Nattai reserves

Control

Integrated control will be effected through:

- Poisoning using 1080, pindone and where resistance is low, rabbit haemorrhagic disease virus
- Ground shooting;
- Biocontrol
- Harbour destruction where possible, and fumigation in other locations; and,
- Rehabilitation of degraded areas

Monitoring

DRAFT

Monitoring will be conducted using spotlight counts, or through the maintenance of exclusion plots to determine the impact of rabbits on the vegetation. Operational monitoring will be achieved through recording staff time utilised during the program, and the cost/effectiveness of materials and the program.

DRAFT

Wild Dog (*Canis lupus spp.*)

Distribution and abundance

Wild dogs are present in the Nattai reserves from Burragorang to Bargo River. Many of these reserves are included under Schedule 2 of the Wild Dog Pest Control Order and subsequently control measures form part of the Southern Highlands Wild Dog Management Plan 2010-2014.

Impacts

Wild dogs, including dingoes, can cause substantial losses to livestock enterprises, especially sheep and goat grazing operations. These impacts are scattered along the eastern edge of water catchment lands in the Nattai Area of MSWR.

The impacts of wild dogs on native species appear to be greatest on large mammals. Regulation of large herbivores by wild dogs in fragile arid and semi-arid environments may benefit biodiversity by reducing the impacts of overgrazing.

In contrast, predation by wild dogs may have negative impacts on some threatened species. While no known major impacts on biodiversity have been recorded in the MSWR, wild dogs have been identified as a potential threat to Brush-tailed Rock-wallaby (BTRW) populations in the region.

Wild dogs, including dingoes, have been declared as a pest animal under the Rural Lands Protection Act and they must be controlled on Crown lands (see Section 3.3). Although the dingo is unprotected under Schedule 11 of the *National Parks and Wildlife Act 1974*, it is a native animal, and there is a community expectation for it to be conserved both on NPWS managed lands and within NSW generally.

Priorities for control

Critical Priorities for wild dog control on reserves in MSWR are based primarily on the level of livestock predation reported by adjoining landholders, in accord with the relevant wild dog management plans. Control will be focused on areas of reserves such as the southern end of the Nattai reserves where there are current and/or historic records demonstrating significant impact on livestock from wild dogs emanating from the reserves. There will be close liaison with the Cumberland Livestock Health and Pest Authority (LHPA) and land holders when developing control programs.

Control

A fully integrated suite of control techniques will be used to manage wild dogs within MSWR. These measures are identified in detail in the Southern Highlands Wild Dog Management Plan 2010-2014. Control programs will be undertaken in partnership with the Cumberland LHPA and individual landholders and consist of a 2 tiered management approach. The first being a strategic control program aimed at preventing future livestock predation, which includes:

- Ground baiting;
- Trapping.

The second tier will be initiated should dog attacks on livestock be reported. Then a reactive program will be initiated within 24 hours of the report in accordance with the Wild Dog Management Plan. NPWS response will include:

- Ground baiting;

DRAFT

- Trapping using either NPWS staff (trained trappers) or contract trappers;
- “Howling up” and shooting

Monitoring

Stock losses caused by wild dogs in MSWR are recorded and communicated to the Cumberland LHPA. Such measures are essential in planning and evaluating the effectiveness of control programs included in wild dog management plans.

DRAFT

Alligator Weed (*Alternanthera philoxeroides*)

Distribution and abundance

Originally confined to Georges River National Park in MSWR new infestations have recently be discovered in Towra Point Nature Reserve and the foreshore of Kamay Botany Bay National Park. In Georges River NP it occurs primarily within Yeramba Lagoon but scattered infestations also occur along the length of the Georges River.

Impacts

Alligator weed produces masses of creeping and layering stems over land and water. It is an aggressive invader that responds to high nutrient levels and is a major threat to wetlands, rivers and irrigation systems especially the turf industry on the Hawkesbury-Nepean floodplain.

New plants regenerate readily from plant fragments which facilitate rapid spread and increases the difficulty of control. Alligator weed is a Weed of National Significance and in MSWR is declared Class 2 or Class 3 under the *Noxious Weeds Act*. Alligator weed has a long history in the Sydney Basin where it is seen as a major threat in the Hawkesbury-Nepean and Georges River catchments.

Priorities for control

Critical Priority: All infestations are a critical priority for control. Any new incursions detected in any park will be a critical priority for control.

Control

NPWS is working with local control authorities, DPI and the Sydney Weeds Committee coordinating a regional control program utilising herbicides, mechanical removal and biological control as part of a collaborative integrated control program.

Monitoring

NPWS will record and map all occurrences of alligator weed on its lands and will monitor its distribution in response to control.

NPWS will liaise regularly with the local control authority and DPI regarding alligator weed.

DRAFT

Blackberry (*Rubus fruticosus* species aggregate)

Distribution and abundance

Know in all Australian States and Territories except the Northern Territory. In NSW it is a major problem for pastures and native forests (Parson & Cuthbertson 1992) Blackberry is found throughout MSWR and historically been the focus of intensive control programs. In order to maximise the investment in previous control works, programs in the Nattai and Dharawal reserves are of priority.

Impacts

Blackberry readily invades grassy woodlands, bushland, roadsides, pastures and riparian areas growing well in sun and shade and tolerating frosts, drought and fire, although dense shade can curtail its growth. Blackberry displaces native plants and destroys animal habitats by forming thickets providing excellent harbour for feral animals such as rabbits, pigs and goats. In turn many of these feral animals have a negative impact on water quality in the Special Areas. Blackberry thicket can exclude other vegetation along riparian areas eventually resulting in the destabilisation of banks.

Blackberry can be spread large distances by birds and feral animals such as foxes as well as along creek lines by water flow.

Priorities for control

Critical Priority Infestations in the Nattai reserves which are located within the Sydney water catchment scheduled 1 or 2 lands. Control of these infestations is a requirement under the joint plan of management with the Sydney Catchment Authority.

Control

Seedlings and small plants should be dug out when soils are moist otherwise roots are likely to fragment. Herbicide treatments include scrape and paint methods for small infestations and aerial spot spraying, vehicle spraying, knapsack spraying and splatter gun application for larger infestations.

Monitoring

Monitoring of large infestations of blackberry are to include annual photographs of sites including pre and post control photographs and sizes of regeneration areas treated. Liaison with the Department of Agriculture is to continue in relation to monitoring of biological control agents. Where threatened species/ecological community programs are occurring liaise with NPWS Threatened Species Unit to implement appropriate monitoring programs for those threatened species/ecological communities.

DRAFT

Bitou bush/Boneseed (*Chrysanthemoides monilifera*)

Distribution and abundance

Chrysanthemoides monilifera spp. Rotundata was first recorded in New South Wales near Newcastle in 1908 and was extensively planted for dune stabilisation between 1946 and 1968. It has spread rapidly and is now found on 90% of the sandy coast of New South Wales, covering an area in excess of 70,000ha.

Most bitou bush invasion is confined to the first 500 m of the coastline across MSWR, with Kamay Botany Bay National Park and Towra Point Nature Reserves having the most significant infestations. Boneseed is also present in isolated patches across the Cumberland Plain.

Impacts

Bitou bush is a highly competitive weed that smothers native plant communities and destroys natural habitat and food sources for native animals. It threatens over 180 native plant species, populations and ecological communities in NSW. Bitou bush invades dunes, coastal heathlands, grasslands, woodlands and forests (DEC 2006). Bitou bush can also disturb cultural heritage sites by destroying the fabric of the site.

The dense monoculture of *Chrysanthemoides monilifera* which develops after invasion threatens local vegetation at all sites which are affected. This may result in local and regional declines of many plant communities, possibly to the extant that they become endangered. The changed structure of the habitat may adversely impact on both native vertebrate and invertebrate fauna and may favour the proliferation non-indigenous species.

Bitou bush is a Weed of National Significance, and is declared Class 4 under the *Noxious Weeds Act 1993* across the region. The invasion of native plant communities by bitou bush is listed as a key threatening process under the NSW *Threatened Species Conservation Act 1995*, and a threat abatement plan (the bitou TAP) has been prepared.

Priorities for control

The Bitou Bush TAP identifies a number of priority sites for control in the MSWR. Bitou bush control programs have commenced in many of these sites; including:

<u>Critical Priority</u>

Kamay Botany Bay NP – Regular aerial spray

Towra Point NR – A detailed weed management plan has been prepared for this reserve

Royal National Park has a few isolated infestations

Boneseed in reserves across the Cumberland Plain

Control

Bitou bush is controlled using an integrated approach. A number of different techniques are utilised including, physical removal, cut & paint technique, herbicide treatment from backpack, vehicle and helicopter. Two biocontrol agents, the tip moth (*Comostolopsis germana*) and seed fly (*Mesoclanis opolana*) have also effectively established.

Monitoring

Bitou bush density and distribution mapping will be undertaken as part of the Towra Point NR weed management plan over the course of the next 5 years. All other control works will be captured using AMS.

DRAFT

Exotic vines and scramblers

Distribution and abundance

Exotic vines and scramblers are widespread, and locally abundant, in the eastern part of NSW. This group of plants include many species but are not limited to the following: Potato Vine, Madeira Vine, Asparagus Fern, Bridal Creeper, Climbing Asparagus, Balloon Vine, Cape Ivy, English Ivy, Coastal Morning Glory, Morning Glory, Japanese Honeysuckle and Cat's Claw.

Impacts

Exotic vines and scramblers may act as transformer species (Richardson *et al*. 2000), altering the nature of the environment where they become dominant. Rainforests are susceptible to invasion by exotic vines particularly after canopy disturbance (Floyd 1989). Exotic vines and scramblers may smother existing vegetation, both in the ground layer and canopy (e.g. Groves and Willis 1999, Greenberg *et al.* 2001, Kriticos *et al.* 2003, Timmins and Reid 2000). This alters the light climate in the invaded community and may suppress regeneration of native species. The sheer weight of exotic vines may cause breakage of branches in the canopy, and in some cases total canopy collapse (Harden and Fox 1988, Harden *et al*. 2004). Some species form dense ground cover carpets that suppress native species (for example *Tradescantia fluminensis* and *Vinca major*).

In sclerophyll communities, exotic vines and scramblers are more mesic than the native species, and may change the nature of the fuel and thus alter fire behaviour and regime. Invasion by exotic vines and scramblers can also alter other biotic aspects of communities such as the abundance and diversity of plant-dwelling invertebrates (Ernst and Cappuccino 2005). Dense smothering blankets or thickets of exotic vines and scramblers may also restrict movement of some native fauna and adversely affect their ability to access water or other resources (while sometimes favouring other fauna by providing protective shelter and/or food).

Exotic vines and scramblers such as *Asparagus* spp. form masses of tuberous roots that may alter the biota of the soil and litter, changing rates of litter decomposition and nutrient cycling and compete for water and mineral nutrients with other plant species (Raymond 1996, Groves and Willis 1999, Timmins and Reid 2000, Willis *et al.* 2003). They may also create a humid microclimate at ground or lower trunk level, favouring pathogenic attack and altering soil moisture and nutrient fluxes. Riparian vegetation is particularly prone to infestation by vines such Cat's claw, *Macfadyena unguis-cati* due to high water and nutrient availability.

Invasions and establishment of exotic vines and scramblers has been listed as a key threatening process by the NSW Scientific Committee as it adversely affects threatened species, populations and ecological communities, or could cause species, populations and ecological communities that are not threatened to become threatened.

Priorities for Control

Critical Priorities for control are where endangered ecological communities are directly affected including:

- Cumberland Plain Woodland
- Littoral Rainforest
- Moist Shale Woodland in the Sydney Basin Bioregion
- Mount Gibraltar Forest in the Sydney Basin Bioregion
- Shale-sandstone Transition Forest
- Swamp-Oak Floodplain

DRAFT

Control

Due to the wide nature of the species included. Control is varied. However, a common method with many vines is to scrape and paint the stems, or cut and paint.

Monitoring

Photo points for larger infestations combined with regular inspections are recommended.

DRAFT

Lantana (*Lantana camara)*

Distribution and abundance

Lantana has spread along the east cost of Australia, from southern NSW north to Cape York Queensland and from sea-level up to 600m elevation. It has invaded at least 4 million hectares, mainly in NSW and Queensland (CRC Weed Management 2003).

Lantana readily invades disturbed sites and communities. Various types of sclerophyll woodlands, sclerophyll forest, rainforests and dry rainforests are all susceptible to Lantana establishment (Driscoll and Quinlan 1985; Lamb 1988; Fresham *et. al. 1994; Gentle and Duggin 1997a),* although in communities with a naturally dense canopy' Lantana colonisation may be heavily dependant on, and limited to, disturbance zones, edges and canopy breaks. There is a strong correlation between Lantana establishment and disturbance (Stock and Wild 2002; Stock 2004)' with critical factors being disturbance-mediated increases in light and available soil nutrients (Gentle and Duggin 1988) and in rainforest, the competitive advantage of seedlings relative to many native species (Stock 2004).

Impacts

Most variations of lantana in Australia are toxic to domestic livestock (sheep and cattle) to some degree. Toxicity seems to be related to genetic factors, not environmental ones (Everist 1974, citing Seawrite 1965 and unpublished work by L.S Smith). Toxins may occur in leaves, flowers, fruit and sap and include triterpene acids (lantadenes A and B) and their reduced forms. Some toxic reactions have been recorded in humans, especially children. Palatability and toxicity to native herbivores do not appear to have been documented.

Lantana is "regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread and economic and environmental impacts" (CRC Weed Management 2003). It is one of the initial 20 *Weeds of National Significance* declared under the National Weeds Strategy and a National Lantana Strategic Plan has been adopted (ARMCANZ ANZECC & FM 2001). It is recognised in most states and Territories of actual or potential occurrence as a serious weed of agriculture or environment or both and in NSW has been listed as a Key Threatening Process, as it adversely affects threatened species, populations and ecological communities.

Priorities for Control

Critical Priorities: Lantana has been identified as a threat to the following endangered ecological communities across MSWR. (P. Downey pers comm.., D. Keith pers. Comm.) and hence considered to be of critical priority for control:

- River-flat eucalyptus forest on coastal floodplains
- Swamp Oak floodplain forest
- Blue Gum High Forest
- Western Sydney Dry Rainforest
- Sydney Turpentine-Ironbark Forest

Control

Seedlings and small plants can be easily pulled out. Cut and paint methods can be used for individual plants and spraying utilised for larger infestations. Due to the widespread nature of most Lantana infestations, control programs will develop

DRAFT

specific control strategies to suit each specific site. Where suitable, rust will also be released as a biological control method.

Monitoring

Monitoring of large infestations of Lantana is to include annual photographs of sites including pre and post control photographs and sizes of regenerations areas to be treated.

DRAFT

Perennial Grasses

Distribution and abundance

Perennial grasses are found throughout MSWR, however they are viewed to have the impacts in Royal, Heathcote, Kamay Botany Bay NP, and the Nattai reserves.

Impacts

A number of exotic perennial grasses including *Cenchrus ciliaris* (Buffel Grass), *Hyparrhenia hirta* (Coolatai Grass), *Eragrostis curvula* (African Lovegrass), *Nassella neesiana* (Chilean Needlegrass) and *Nassella trichotoma* (Serrated Tussock) invade and may dominate native plant communities competing with, and displacing, many native species. Some other perennial grasses (in alphabetical order) that invade smaller areas of native plant communities include *Agrostis capillaris* (Browntop Bent), *Andropogon virginicus* (Whisky Grass), *Chloris gayana* (Rhodes Grass), *Cortaderia spp*. (Pampas Grasses), *Ehrharta erecta* (Panic Veldgrass), *Melinis minutiflora* (Molasses Grass), *Panicum repens* (Torpedo Grass), *Paspalum urvillei* (Vasey Grass), *Pennisetum clandestinum* (Kikuyu), *Phalaris aquatica* (Phalaris), *Setaria sphacelata* (South African Pigeon Grass), *Sporobolus fertilis* (Giant Parramatta Grass), *Sporobolus natalensis* (Giant Rats Tail Grass) and *Urochloa mutica* (Para Grass).

Other exotic perennial grasses not specified may, or have the potential to, adversely affect native plant communities and native species. Perennial grasses readily invade disturbed areas and healthy bushland. Further concerns about the impacts of exotic perennial grasses have led the NSW Scientific Committee to list *Invasion of native plant communities by exotic perennial grasses* as a key threatening process under the TSC Act.

Priorities for Control

Critical priority programs include those where grasses are impacting upon threatened species and endangered ecological communities. Examples include:

- New infestations of Coolatai grass in Georges River, Heathcote and Royal National Parks
- Cumberland Plain Woodland

Control

Foliar application of an appropriate herbicide is recommended, but hand pulling and careful bagging of the entire plant (seed head and rhizome) is an option with small infestations.

Ongoing research in partnership with the University of Western Sydney and Greening Australia is developing restoration techniques involving the planting of seedlings to manage exotic grasses across ecosystems for the Cumberland Plain.

Monitoring

Photo points for larger infestations combined with regular inspections are recommended.

DRAFT

Senegal Tea *(Gymnocoronis spilanthoides)*

Distribution and abundance

Also known as Temple Plant, Senegal Tea originates from Europe and is a sprawling aquatic shrub with rough-edged shiny dark green leaves and hollow stems which assist it to float. The plant produces running stems in water or mud and often forms mats along edges of water courses. A perennial plant, it is dormant in winter and dies in exposed areas, re-shooting from protected crows in spring.

It produces conspicuous white ball-shaped flowers approximately 1.5cm in diameter, flowering in late spring/summer.

The species is not wide spread in Sydney with only 3 or 4 known infestations. Two known infestation occur in MSWR. The largest is found in the upper Hacking River at Audley within Royal National Park whilst a smaller patch is known in Cattai National Park. All infestations will be managed as a new occurrence as this species is highly invasive and there is a very good possibility of long term eradication.

Impacts

Senegal Tea is an aggressive, invasive plant. Its stems can grow up to 15cm per week. It can form floating mats, blocking irrigation ditches, shallow dams and other waterways. If permitted to spread, it will invade and degrade natural wetlands, competing strongly with slower growing native plants and affecting wetland birds and other animals dependant upon them.

Priorities for control

Critical Priority As this weed species has significant potential to spread throughout greater Sydney and given the limited nature of current infestations, all known infestations are considered new and require critical prioritisation.

Control

NPWS is working with local control authorities, DPI and the South Western Regional Weeds Committee coordinating a regional control program utilising herbicides as part of a collaborative control program.

Monitoring

Each spring the previous year's treatments are inspected to determine if any regrowth is evident. Should it occur, a subsequent treatment program is initiated for the remainder of the growing season.

DRAFT

Myrtle Rust (*Uredo rangelii)*

Distribution and abundance

Myrtle rust is a plant disease caused by the exotic fungus *Uredo rangelii*. It was first detected in Australia on 23 April 2010 on the NSW Central Coast. It has established in coastal NSW from the Clyde River north into Queensland (Figure 1). Myrtle rust is likely to spread rapidly to the extent of its biological range as the spores are dispersed readily by wind. Eradication is unfeasible.

Uredo rangelii belongs to a group of closely-related fungi known as the guava or eucalyptus rust complex. The complex includes the fungus *Puccinia psidii* which has had severe impacts on eucalypt plantations in Brazil and has been found in other parts of the Americas, Hawaii and Japan. *P. psidii* was considered as a potential biocontrol agent in the Florida everglades for the invasive plant *Melaleuca quinquenervia*, but it has since been found to attack some native American species, including a threatened species.

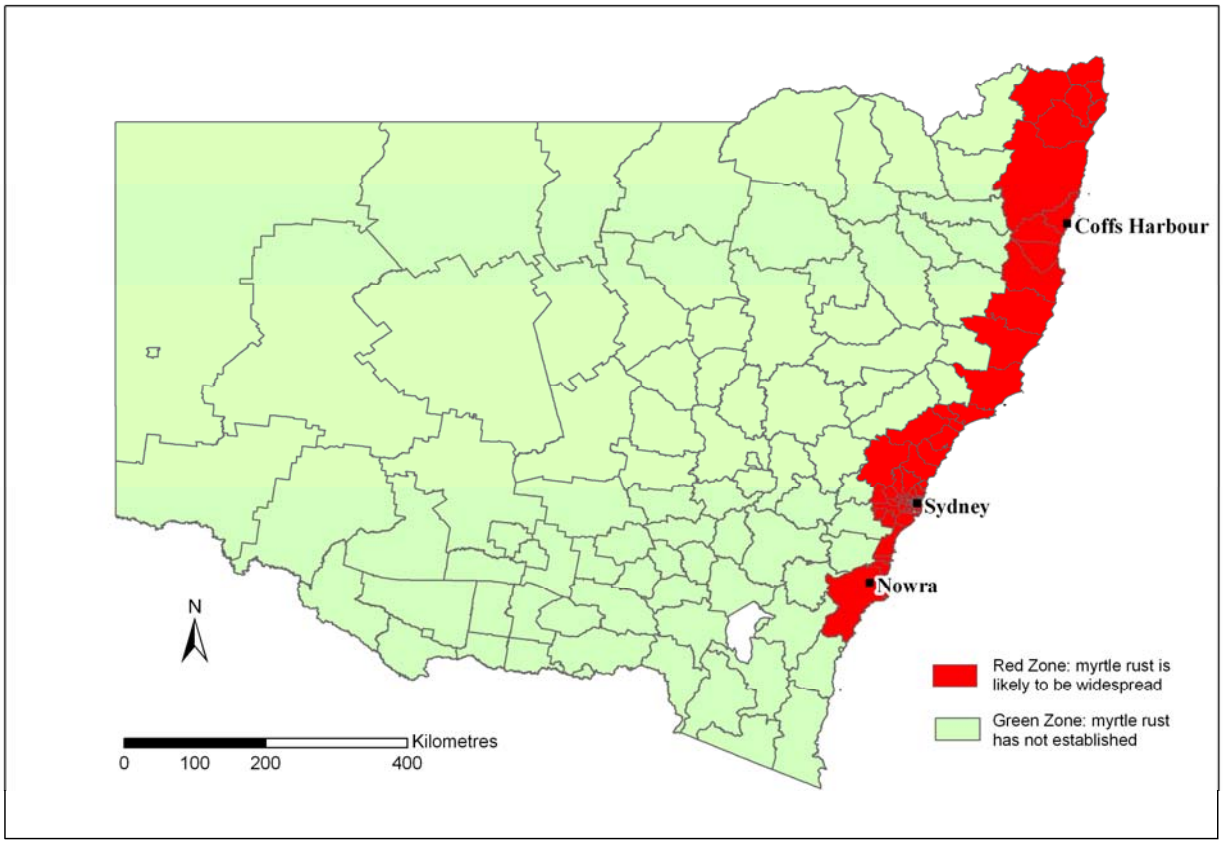


Figure 1: Approximate distribution of myrtle rust *Uredo rangelii* as of 24/01/2011. The red zone is comprised of local government areas where rust has been detected and is likely to be widespread. The green zone is comprised of local government areas where rust has not established. Data from NSW Department of Primary Industries (http://www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust). Local government boundaries from the Land and Property Management Authority.

Impacts

Myrtle rust affects plants in the family Myrtaceae, including the genera Eucalyptus, Angophora, Callistemon, and Melaleuca. Infection occurs on young growing shoots, leaves, flower buds and fruits. It produces masses of powdery bright yellow or orange-yellow spores on the infected areas. Leaves may become buckled and twisted and die as a result of infection.

The likely impacts of myrtle rust on biodiversity in Australia are unknown. Like *P.*

psidii, infection with myrtle rust may cause significant mortality among younger plants and hence reduce recruitment into adult populations. This may contribute to the decline and extinction of species, which is of immediate concern for those species already at high risk, i.e. threatened species. Reduced recruitment may also have severe impacts on the structure and function of the many natural ecosystems that depend on Myrtaceae. As at 28 March 2011, myrtle rust had been detected in 68 species of Myrtaceae, spanning 27 genera. Severe infection had been observed in relatively few species (most notably scrub turpentine *Rhodamnia rubescens* and native guava *Rhodomyrtus psidoides*) but the number of species so affected may increase as new strains of rust evolve. All five threatened species of Myrtaceae exposed to myrtle rust under laboratory test conditions became infected.

The 'Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae' is listed as a KTP under the TSC Act

Priorities for control

The *Management Plan for Myrtle Rust on National Parks* outlines how myrtle rust will be managed on national park estate in NSW, including the potential impacts of myrtle rust on threatened species. The plan also provides guidance to managers of other bushland and threatened species sites.

The objectives of the Plan are to:

1. Slow the establishment of myrtle rust on national park estate.
2. Minimise the impacts of myrtle rust on threatened species and ecological communities on national park estate.

Control

The *Management Plan for Myrtle Rust on National Parks* includes 8 action areas to manage Myrtle Rust on the NPWS estate:

1. Identify high value assets at risk
2. Limit the spread of myrtle rust
3. Monitor the spread of myrtle rust
4. Manage infections
5. Research the impacts of myrtle rust
6. Training, extension and external communication
7. Record the incidence of myrtle rust
8. Liaise and report on the spread and impacts of myrtle rust

Specific actions for Metro South West Region are map the extent of the current infestation within Royal National Park and implement quarantine procedures to prevent further spread and develop a detailed control program.

Monitoring

Presence/absence data will be entered into the Biological Survey Subsystem of the Wildlife Atlas from monitoring threatened species and sentinel sites.

If any fungicide control works are required, daily record sheets will kept for all control programs in accordance with the Pesticides Act. Before and after photos are also taken during the course of implementation of works. Where treatment is proposed, GPS locations are taken of work site locations including the extent of myrtle rust distribution and control implemented. Sites are re-visited periodically for follow-up treatment and maintenance.

DRAFT

Plant Pathogen (*Phytophthora spp)*

Distribution and abundance

Phytophthora cinnamomi is believed to have evolved in south-east Asia and was first described by a Dutch expert of plant disease in 1922. Whilst dieback was not discovered in Australia until 1922, it is believed that it was probably introduced in to Western Australia prior to the 1900's when quarantine procedures where not in place.
Phytophthora is only known to exist in 1 location within MSWR, being Kemps Creek Nature Reserve however other infestations are suspected and require further investigation.

Impacts

Phytophthora is listed as key threatening process under both State and Federal legislation. A national threat abatement plan for Phytophthora was prepared in 2001. Phytophthora is a soil-borne pathogen belonging to the water mould group. It grows best in tropical conditions and is parasitic - requiring a living host on which to feed. This fungus is known to attack nearly 1000 plant species throughout the world and is one of the most widespread plant pathogens known. The spores of the fungus (zoospores and chlamydospores) spread rapidly through water and moist soil or via transfer in particles of infected soil, lodging on plant roots, eventually killing the host plant (Shearer and Bailey, 1989).

Management Objectives

One of the National Threat Abatement Plan (2001) objectives is preventing further species and ecological communities becoming threatened. By identifying affected areas and appropriate management, this will aim to achieve this objective.

- Prevent the spread of Phytophthora from current known locations to non–infected areas;
- Identify presence/absence of Phytophthora by conducting surveys and sampling areas of poor tree health or dieback and
- Identify and implement appropriate containment and hygiene protocols for affected areas. Ascertain if Phytophthora occurs in any other parks in the Region.

Control Priorities

Priorities will be determined as confirmed reports are established, e.g: Kemps Creek Nature Reserve. Once confirmed, development and implementation of a containment strategy for affected areas will be developed to prevent further spread throughout the park.

Control Techniques

Appropriate controls will need to be determined on a site to site basis. This may include: signage, wash down bays/techniques, aerial spraying of phosponate or the controlled use and the trial use of commercial phosphite to treat individual eucalypts through stem injection for example if appropriate.

A strategy to reduce public access to infected areas and catchments may also be required.

Monitoring

Develop best practise guidelines for managing areas with Phytophthora (including

DRAFT

standardised monitoring forms for sampling potential Phytophthora sites). Soil sampling in areas adjoining containment boundaries to monitor any movement. Strategic and opportunistic checking of dieback in known areas.

DRAFT

8 Pest distribution tables

The following pest distribution tables give an overview of significant pest species for each reserve within the Region. The data derived from a combination of systematic surveys, consultation with staff and other agencies and through planning processes. The tables are not comprehensive lists of all pest species within the Region.

● Denotes established widespread populations throughout a reserve

○ Denotes scattered populations throughout a reserve

⊙ Denotes isolated populations restricted to a small geographic area of a reserve

# Denotes isolated population adjacent a NPWS reserve

	BMAD	Cane Toad	Cat	Cattle	Deer	European Bee	Fox	Goat	Indian Myna	Pig	Wild Dog	Rabbit
BOTANY BAY AREA												
Ganangarra State Conservation Area			○				●					
Georges River National Park			○			⊙	●		○			
Kamay Botany Bay National Park			○		⊙	⊙	●		○			
Towra Point Nature Reserve		#	⊙		⊙		●					⊙
CUMBERLAND NORTH AREA												
Agnes Banks Nature Reserve			⊙				●					
Castlereagh Nature Reserve			⊙				●					
Cattai National Park			⊙		⊙		●					○
Pitt Town Nature Reserve			⊙				●					
Rouse Hill Regional Park			⊙			⊙	●					○
Scheyville National Park	⊙		⊙		⊙		●		⊙			○
Wianamatta Regional Park			⊙				●					
Wianamatta Nature Reserve			⊙				●					○
Windsor Downs Nature Reserve			⊙				●					○

DRAFT

CUMBERLAND SOUTH AREA												
Bents Basin State Conservation Area			○		●	○	●		●			○
Gulguer Nature Reserve			○		●	○	●	⊙	●			○
Kemps Creek Nature Reserve			○			○	●	⊙	●			○
Leacock Regional Park	●		○			○	●	⊙	●			○
Mulgoa Nature Reserve	⊙		○			○	●		●			○
Prospect Nature Reserve			○			○	●		●			○
William Howe Regional Park			○			○	●		●			●
NATTAI AREA												
Bargo River State Conservation Area			○				●					○
Bargo State Conservation Area			○				●				○	○
Burragorang State Conservation Area	⊙		○		⊙		●	○		○	●	○
Joadja Nature Reserve			○		⊙		●	●		○	○	○
Nattai National Park	⊙		○	○	⊙	⊙	●	●		●	●	●
Nattai State Conservation Area			○			⊙	●	○		●	●	○
Thirlmere Lakes National Park			○			⊙	●			○	○	○
Wollondilly River Nature Reserve			○	⊙	⊙	⊙	●	●		○	○	○
ROYAL AREA												
Heathcote National Park			○			⊙	●		●			⊙
Garrawarra State Conservation Area			○		●	⊙	●	⊙	●			⊙
Royal National Park			○		●	⊙	●	⊙	●			⊙

DRAFT

● Denotes established widespread infestation throughout a reserve

○ Denotes scattered infestation throughout a reserve

⊙ Denotes isolated infestation restricted to a small geographic area of a reserve (encompassing new weed incursions)

	African Box Thorn	African Olive	Alligator Weed	Aloe Vera	Arum Lilly	Asparagus Fern	Bamboo	Bito/Bone Seed	Blackberry	Box Elder	Broom	Camphor Laurel	Cape Ivy	Cassia	Coral Trees	Cotoneaster	Crofton	Egeria	Giant Reed	Gleditsia	Grasses	Green Cestrum	Kei Apple	Khaki Weed	Lantana	Ludwigia	Mist Flower	Mother of Millions	Ochna	Oleander	Palms	Pampas	Pattersons Curse	Planation Trees	Privet	Pellatory	Polygala	Prickly Pear	Robinia	Salvinia	Sea Spurge	Senegal Tea	St Johns Wort	Stinking Roger	Thistle	Trad	Trea of Heavon	Trumpet Flower	Vines	Water Hyacinth	Wild Cotton	Wild Tabacco	Willows	Yucca
BOTANY BAY AREA																																																					
Georges River National Park	⊙	○	●			○	⊙	⊙	⊙			⊙		⊙	⊙	○	○				○	⊙			○			⊙		⊙	⊙			○	●		⊙							○	●		⊙	○						⊙
Ganangarra State Conservation Area																	⊙				⊙																																		
Kamay Botany Bay National Park		⊙	⊙		⊙	○		●	⊙					⊙			○				●	⊙			○			⊙		⊙		⊙												○	○			○					
Towra Point Nature Reserve	○	○	○	⊙		●		●	⊙				⊙	⊙	⊙		○		⊙		●	⊙			●			⊙	⊙	⊙	⊙	○			⊙	⊙		⊙							○	○			○					
CUMBERLAND NORTH AREA																																																					
Agnes Banks Nature Reserve												⊙									○										⊙						⊙																	
Castlereagh Nature Reserve																					⊙				⊙				⊙				⊙																⊙				
Cattai National Park		●	⊙			⊙		⊙	○	○		⊙		⊙		⊙				○	●	●			●			○	⊙						●			○	○	⊙		⊙			○	●	⊙		●			○	⊙	
Pitt Town Nature Reserve																				○	●	⊙													⊙																				
Rouse Hill Regional Park	⊙	●										⊙									●														⊙					⊙				⊙		●			●					
Scheyville National Park	○	●		⊙		⊙	⊙		●		⊙					⊙					●	○			○			○	⊙			⊙	⊙		⊙		⊙		⊙			⊙		○	⊙			●	⊙	⊙	⊙	⊙	
Wianamatta Nature Reserve																					●										⊙																							

DRAFT

Wianamatta Regional Park		●							⊙												⊙											⊙			⊙										⊙									
Windsor Downs Nature Reserve		⊙						⊙													○										⊙				⊙					⊙														
CUMBERLAND SOUTH AREA																																																					
Bents Basin State Conservation Area		●	○			⊙				⊙		⊙		⊙			○		⊙	●	●	⊙				○	○	⊙							●			⊙					⊙		○	●			●				⊙	
Gulguer Nature Reserve		○	○			⊙				⊙		⊙		⊙			⊙			●	●	⊙				⊙	○	⊙				⊙			⊙			⊙					⊙		⊙	○			⊙				⊙	
Kemps Creek Nature Reserve		●	○		○	⊙		⊙		⊙		⊙		⊙			○		⊙		●	⊙	⊙			○	○	⊙	⊙			⊙			○	⊙		⊙					⊙	⊙	○	●	⊙		⊙		⊙		⊙	
Leacock Regional Park	○	●	⊙		⊙	⊙		⊙		⊙		⊙		⊙		⊙	○	⊙	●		●	○				●	●	⊙	○	⊙	⊙	○	●		●			⊙	●				⊙		●	●	●		●		○		○	⊙
Mulgoa Nature Reserve		●				⊙		⊙	⊙	●		⊙		⊙			○				●	⊙				●	○	⊙				○			●			⊙							○	●		⊙	●					⊙
Prospect Nature Reserve		●			⊙	⊙	⊙	●	⊙	●		⊙		⊙			○				●	⊙				○	●	⊙				○			●			⊙							○	○			⊙				⊙	
William Howe Regional Park	○	●				⊙		⊙		⊙		⊙		⊙			○				●	⊙				●	○	⊙				○	●		●			⊙							●				⊙		○			
NATTAI AREA																																																					
Bargo River State Conservation Area									○												⊙																								○				⊙					
Bargo State Conservation Area									○												⊙																								○				⊙					
Burragorang State Conservation Area	⊙	⊙							○						⊙		○				○				⊙							⊙		⊙										○	○				●		○			
Joadja Nature Reserve									○												⊙																								○				⊙					
Nattai National Park								⊙	●			⊙									●			⊙		⊙						⊙	⊙	⊙				●					●	○	○		⊙		●		○	⊙	○	
Nattai State Conservation Area									○								○				⊙					⊙									⊙			⊙						○	○	⊙			●		○			
Thirlmere Lakes National Park								⊙	⊙			⊙									⊙				⊙									⊙	⊙										○				⊙					

Wollondilly River Nature Reserve									○												●			⊙		⊙								⊙				⊙						○	○		⊙		●		○		○	
ROYAL AREA																																																						
Heathcote National Park			⊙		⊙				⊙					○	⊙	⊙	●				○					⊙						⊙			⊙											○			⊙					
Garrawarra State Conservation Area					⊙				⊙					⊙	⊙		●				○				●			⊙		⊙		⊙			⊙										⊙	●			⊙					⊙
Royal National Park	⊙	⊙			○	⊙		⊙	⊙					⊙	⊙	○	⊙	○			○	○			○	⊙		○	⊙	⊙	○	⊙			○			⊙			⊙	○		⊙	○	●	⊙		⊙					○

DRAFT

9 References

Agriculture & Resource Management Council of Australia & New Zealand, Australian & New Zealand Environment & Conservation Council and Forestry Ministers, (2000) *Weeds of National Significance Alligator Weed (Alternanthera philoxeroides)) Strategic Plan*. National Weeds Strategy Executive Committee, Launceston

Akasi N, Nakashisuka T (1999) Effects of bark stripping by sika deer (*Cervus nippon*) on population dynamics of a mixed forest in Japan. *Forest Ecology and Management* 113, 75-82.

ARMCANZ ANZECC&FM (2001) [Agriculture & Resource Management Council of Australia & New Zealand, Australian and New Zealand Environment & Conservation Council and Forestry Ministers]. Weeds of National Significance Lantana (*Lantana camara*) Strategic Plan. (National Weeds Strategy Executive Committee: Launceston).

Auld, B.A. and Medd, R.W. 1987. Weeds - an illustrated botanical guide to the weeds of Australia. Inkata Press: Melbourne, Australia.

Auld, T.D. (1990). Regeneration in populations of the arid zone plants Acacia carnei and A. oswaldii. Proceeding of the Ecological Society of Australia 16: 267-72.

Auld, T.D. (1993). The impact of grazing on regeneration of the shrub Acacia carnei in arid Australia. Biological Conservation 65: 165-76.

Bentley A (1978) 'An introduction to the deer of Australia.' (Forests Commission Victoria: Melbourne).

Bentley A (1995) 'Fallow Deer, *Dama dama*; Red Deer, *Cervus elaphus*; Rusa Deer, *Cervus timorensis*; Sambar Deer, *Cervus unicolor*; Chital, *Axis axis*; and Hog Deer, *Axis porcinus*. In 'The Mammals of Australia'. (Ed. R Strahan) pp. 732-742. (Reed Books: Sydney) .

Brown BN (1976) Phytophthora cinnamoni associated with patch death in tropical rainforests in Queensland. Australian Plant Pathology Society Newsletter 5, 1-4.

Choquenot D, McIlroy J, Korn T (1996) 'Managing vertebrate pests: Feral Pigs.' (Australian Government Publishing Service: Canberra).

Coomes DA, Allen RB, Forsyth DM, Lee WG (2003) Factors Preventing the Recovery of New Zealand Forests Following Control of Invasive Deer. *Conservation Biology* 17, 450-459.

CRC Weed Management (2003) Weeds of National Significance. Weed Management Guide – Lantana (Lantana camara). (CRC for Australian Weed Management, and Commonwealth Dept of Environment and Heritage: Canberra).

Cropper, S. (1987). Ecological notes and suggestions for the conservation of a recently discovered site of Lepidium hyssopifolium. Biological Conservation 41:267-278.

Department of Environment and Conservation (NSW) (2005). Draft Recovery Plan for the Brush-tailed Rock-wallaby Petrogale penicillata. DEC: Sydney.

Day MD, Wiley CJ, Playford J, Zalucki MP (2003) Lantana: current management status and future prospects. (Australian Centre for International Agricultural Research: Canberra).

Department of environment & Conservation (2006) *NSW Threat Abatement Plan – Invasion of native plant communities by Chrysanthemoides monilifera (bitou bush and boneseed)* Department of Environment and Conservation (NSW) Hurstville

DRAFT

Department of Environment, Climate Change and Water (2010). Department of Environment, Climate Change and Water NSW Corporate Plan 2010 Update (2010). A healthy environment for life.

Department of the Environment and Heritage (2003b) 'Draft threat abatement plan for predation, habitat degradation, competition and disease transmission by Feral Pigs.' Department of Environment and Heritage, Canberra.

Department of the Environment and Heritage and the CRC for Australian Weed Management, 2003. Weeds of National Significance: Weed Management Guide – Orange hawkweed

Department of the Environment and Heritage and the CRC for Australian Weed Management, 2003. Weeds of National Significance: Weed Management Guide – Serrated tussock

Department of the Environment and Heritage and the CRC for Australian Weed Management, 2003. Weeds of National Significance: Weed Management Guide – Blackberry

Department of Primary Industries 2008-2015 (2008). NSW Invasive Species Plan. Orange

Department of Environment, Water, Heritage and the Arts (2009). Australian Government Policy on Cane Toads.

Dickman, C.R. (1991). Use of trees by ground-dwelling mammals: implications for management. In: *Conservation of Australia's Forest Fauna*. Lunney, D. (Ed.). Royal Zoological Society of New South Wales, Mosman, pp. 125-136.

Dickman, C.R. (1993). The biology and management of native rodents of the arid zone in New South Wales. NSW National Parks and Wildlife Service Species Management Report No. 12.

Driscoll PV, Quinlan G (1985) Utilization of *Lantana camara* by birds and small mammals in Brisbane Forest Park. Proceedings of a workshop on Resource and Recreation Management in Brisbane Forest Park. (Queensland Institute of Technology: Brisbane).

Eldridge DJ (1998) Trampling of microphytic crusts on calcareous soils and its impact on erosion under rain-impacted flow. Catena 33, 221-239.

Environment Australia (1999) 'Threat abatement plan for competition and land degradation by Feral Goats.' Environment Australia, Canberra.

Ernst CM, Cappuccino N (2005) The effect of an invasive alien vine, *Vincetoxicum rossicum* (Asclepiadaceae), on arthropod populations in Ontario old fields. *Biological Invasions* 7, 417-425.

Everist SL (1974) Poisonous plants of Australia. (Angus and Robertson Publishers: London).

Fensham RJ, Fairfax RJ, Cannell RJ (1994) The invasion of *Lantara camara* L. in Forty Mile Scrub National Park, north Queensland. *Australian Journal of Ecology* 19, 297-305.

Flora and Fauna Guarantee Scientific Advisory Committee (2004) Preliminary recommendation on a nomination for listing degradation and loss of terrestrial habitats caused by feral deer.

Floyd AG (1989) The vine weeds of coastal rainforests. In 'Proceedings of the 5th Biennial Noxious Plants Conference'. pp 1109-115. (New South Wales Department of Agriculture and Fisheries: Sydney).

DRAFT

Fuller RJ, Gill RMA (2001) Ecological impacts of increasing numbers of deer in British woodland. *Forestry* 74, 193-199.

Garnett, S. (editor) (1992). Threatened and extinct birds of Australia. Royal Australasian Ornithologists Union and Australian National Parks and Wildlife Service, Melbourne.

Gentle CB, Duggin JA (1997a) *Lantana camara* L. invasions in dry rainforest – open forest ecotones: the role of disturbances associated with fire and cattle grazing. *Australian Journal of Ecology* 22, 298-306

Gibbons, P. 1999. Habitat tree retention in wood production forests. PhD Thesis, Australian National University, Canberra.

Greenberg CH, Smith LM, Levey DJ (2001) Fruit fate, seed germination and growth of an invasive vine – an experimental test of 'sit and wait' strategy. *Biological Invasions* 3, 363-372.

Griffith, S.J. (1992). Draft Species Recovery Plan: Thesium australe. NSW National Parks and Wildlife Service.

Hamilton CA (1981) Rusa Deer in the Royal National Park: diet, dietary overlap with *Wallabia bicolor*, influence on the vegetation, distribution and movements. MSc thesis, University of Sydney, Sydney.

Groves RH, Willis AJ (1999) Environmental weeds and loss of native plant biodiversity: some Australian examples. *Australian Journal of Environmental Management* 6, 164-171.

Harden GJ, Fox MD (1988) Wingham Brush regeneration assessment. Report 9. (Royal Botanic Gardens Sydney).

Harden GJ, Fox MD, Fox BJ (2004) Monitoring and assessment of restoration of a rainforest remnant at Wingham Brush, NSW. *Austral Ecology*, 29, 489-507.

Harrington GN (1986) Herbivore diet in a semi-arid Eucalyptus populnea woodland. 2. Feral Goats. Australian Journal of Experimental Agriculture 26, 423-429.

Henzell R (1993) The ecology of Feral Goats. In 'Proceedings of the national workshop on Feral Goat management: planning for action'. (Ed. D. Freudenberger) pp. 9-16. (Bureau of Resource Sciences: Canberra)

Henzell R (2000) Goat Capra hircus Linnaeus 1758. In 'The Mammals of Australia'. (Ed. R Strahan) pp. 728-30. (Reed Books: Sydney)

Hone J (2002) Feral pigs in Namadgi National Park, Australia: dynamics, impacts and management. Biological Conservation 105, 231-242.

Keith D, Pellow B (2004) Effects of Javan rusa deer (*Cervus timorensis)* on native plant species in the Jibbon-Bundeena area, Royal National Park, New South Wales. *Proceedings of the Linnean Society of NSW*, in press.

Kliejunas JT, Ko WH (1976) Dispersal of Phytophthora cinnamoni on the island of Hawaii. Phytopathology 66, 457-460.

Kriticos DJ, Sutherst RW, Brown JR, Adkins SW, Maywald GF (2003) Climate change and biotic invasions: a case history of a tropical woody vine. *Biological Invasions* 5, 145-165.

Lamb R (1988) Ecological and perceptual changes to scrubland associated with lantana invasion. Caring for Warringah's bushland. (Shire of Warringah, Sydney).

Lamp ,C & Collet, F (1999) *Field Guide to Weeds of Australia*, Inkata Press

Lindenmayer, D.B., Cunningham, R.B., Nix, H.A., Tanton, M.T. and Smith, A.P. (1991). Predicting the abundance of hollow-bearing trees in montane forests of southeastern Australia. *Australian Journal of Ecology*, 16: 91-98.

DRAFT

Lumsden, L. and Bennett, A. (2000). Bats in rural landscapes: a significant but largely unknown faunal component. In: *Balancing Conservation and Production in Grassy Landscapes*. Barlow, T. and Thorburn, R. (Eds.). Environment Australia, Canberra.

Matthes, M. and Nash, S. (1993). Cynanchum elegans: Conservation Research Statement and Species Recovery Plan. NSW National Parks and Wildlife Service.

Menkhorst PW (1995) Goat Capra hircus Linnaeus 1758. In 'Mammals of Victoria: distribution, ecology and conservation'. (Ed. PW Menkhorst) pp. 261-262. (Oxford University Press: Melbourne)

Moriarty A (2004a) The liberation, distribution, abundance and management of wild deer in Australia. *Wildlife Research* 31, 291-299.

Moriarty A (2004b) 'Wild deer herds in Australia's urban fringe: issues, management and politics. In 'Urban Wildlife more than meets the eye'. (Ed. D Lunney and S Burgin) pp 179-185. (Royal Zoological Society of New South Wales: Sydney).

Morton, S.R. (1990). The impact of European settlement on the vertibrate animals of arid Australia: a conceptual model. Proceedings of the Ecological Society of Australia 16: 201-213.

Murphy MJ (1996) A possible threat to the Broad-headed Snake Hoplocephalus bungaroides: degradation of habitat by the Feral Goat Capra hircus. Herpetofauna 26, 37-38.

Myers, K., Parer, I. And Richardson, B.J. (1989). Leporidae. Pages 917-931 in Fauna of Australia, volume 1B, Mammalia. (Eds D.W. Walton and B.J. Richardson). Australian Government Publishing Service: Canberra.

NPWS (2000) Predation by feral cats – key threatening process declaration http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20008

NPWS (2010). Draft Threat Abatement Plan for Predation by the Red Fox (Vulpes vulpes). Department of Environment, Climate Change and Water. Sydney..

NPWS (2004a) Herbivory and environmental degradation caused by feral deer - key threatening process declaration http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20012

NPWS (2004b) Competition and habitat degradation by feral goats - key threatening process declaration http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20017

NPWS (2004c) Predation, habitat degradation, competition and disease transmission by Feral pigs (**Sus scrofa**) - key threatening process declaration http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20020

NPWS (2006a) Competition and grazing by the feral European rabbit – key threatening process declaration http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20024

NPWS (2006b) Invasion of native plant communities by exotic perennial grasses http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/threat_profile.aspx?id=20018

NSW DPI (2006) Weed Control Order Number 20

DRAFT

http://www.dpi.nsw.gov.au/__data/assets/pdf_file/60327/Noxious_Weeds_Declarations.pdf

Oldroyd, B.P., Lawler, S.H. and Crozier, R.H. (1994). Do feral honeybees (*Apis mellifera*) and regent parrots (*Polytelis anthopeplus*) compete for nest sites? *Australian Journal of Ecology* 19: 444-450.

Parkes J, Henzell R, Pickles G (1996) 'Managing vertebrate pests: Feral Goats.' (Australian Government Publishing Service: Canberra)

Parsons, W.T & Cuthbertson, E.G (1992) *Noxious Weeds of Australia*, Inkata Press

Paton, D.C. (1996). Overview of feral and managed honeybees in Australia: distribution, abundance, extent of interactions with native biota, evidence of impacts and future research. ANCA, Canberra.

Pavlov PM (2000) Pig, Sus scrofa Linnaeus, 1758. In 'The Mammals of Australia'. (Ed. R Strahan) pp. 715-717. (Reed Books: Sydney).

Pyke, G.H. (1999). The introduced honeybee *Apis mellifera* and the Precautionary Principle: reducing the conflict. *Australian Zoologist* 31: 181-186.

Raymond KL (1996) Geophytes as weeds: bridal creeper (*Asparagus asparagoides*) as a case study. In 'Proceedings of the Eleventh Australian Weeds Conference'. (Ed. RCH Shepherd) pp 420-423. (Weed Science Society of Victoria: Frankston).

Richardson DM, Pyusek P, Rejmánek M, Barbour MG, Panetta FD, West CJ (2000) Naturalisation and invasion of alien plants: concepts and definitions. *Diversity and Distributions* 6, 93-107.

Richards SJ, McDonald, Alford RA (1993) Declines in populations of Australia's endemic tropical frogs. Pacific Conservation Biology 1, 66-77

Rooney TP (2001) Deer impacts on forest ecosystems: a North American perspective. *Forestry* 74, 201-208.

Saunders, D.A., Smith, G.T. and Rowley, I. (1982). The availability and dimensions of tree hollows that provide nest sites for cockatoos in Western Australia. *Australian Wildlife Research* 6: 205-216.

Seawright AA (1965) Studies of Lantana poisoning. Unpublished thesis, Veterinary School, University of Queensland.

Short, J. and Milkovits, G. (1990). Distribution and status of the Brush-tailed Rock-wallaby in south-eastern Australia. Australian Wildlife Research 17: 169-179.

Soderquist, T.R. (1999). Tree hollows in box-ironbark forest. Forests Service Technical Report Series 99-3. Dept. of Natural Resources and Environment, Melbourne.

Soderquist, T.R., Traill, B.J., Faris, F. and Beasley, K. (1996). Using nest boxes to survey for the brush-tailed phascogale *Phascogale tapoatafa*. *Victorian Naturalist* 113: 256-261.

Squires VR (1980) Chemical and botanical composition of the diets of oesophageally fistulated sheep, cattle and goats in a semi-arid Eucalyptus populnea woodland community. Australian Rangelands Journal 2, 94-103.

Stock D (2004) The dynamics of *Lantana camara* L. invasion of subtropical rainforest in southeast Queensland. Unpublished PhD thesis, School of Environmental and Applied Sciences, Griffith University, Queensland.

Stock DH, Wild CH (2002) The capacity of Lantana (*Lantana camara* L.) to displace native vegetation. In '13th Australian Weeds Conference - papers and proceedings.' (Eds Spafford-Jacob E, Dodd J, and Moore JH), pp. 104-107. Plant Protection Society of WA Inc. (Perth, WA).

DRAFT

Stockwell M (2003) Assessing the levels and potential impacts of browsing by Sambar deer (*Cervus unicolor*) in the upper Yarra catchment, Victoria. BSc(Hons) thesis. Monash University.

Swarbrick JT, Willson BW, Hannan-Jones MA (1995) The biology of Australian weeds 25. *Lantana camara* L. *Plant Protection Quarterly* 10, 82-95.

Timmins SM, Reid V (2000) Climbing asparagus, *Asparagus scandens* Thunb.:A South African in your forest patch. *Austral Ecology* 25, 533-538.

Trainor, R. (1995). Sweet danger. *The Bird Observer* April 1995: 7-9.

Veblen TT, Mermoz M, Martin C, Kitzerberger T (1992) Ecological Impacts of Introduced Animals in Nahuel Huapi National Park, Argentina. *Conservation Biology* 6, 71-83.

West P, Saunders G (2003) 'Pest animal survey 2002: an analysis of pest animal distribution and abundance across NSW and the ACT.' NSW Agriculture, Orange.

Whitehead GK (1972) 'Deer of the world'. Constable: London.

Williams, K,. Parer, I., Coman, B., Burley, J. and Braysher, M. (1995). Managing vertebrate pests: rabbits. Australian Government Publishing Service: Canberra.

Willis AJ, McKay R, Vranjic JA, Kilby MJ, Groves RH (2003) Comparative seed ecology of the endangered shrub, *Pimelea spicata* and a threatening weed, Bridal Creeper: smoke, heat and other fire-related germination cues. *Ecological Management and Restoration* 4, 55-65.

Wilson G, Dexter N, O'Brien P, Bomford M (1992) 'Pest animals in Australia – a survey of introduced wild mammals'. (Bureau of Rural Sciences and Kangaroo Press: Sydney).

Wood, M.S. and Wallis, R.L. (1998) Potential competition for nest sites between feral European Honeybees (*Apis mellifera*) and Common Brushtail Possums (*Trichosurus vulpecula*). *Australian Mammalogy* 20: 377-381.

DRAFT

8. Appendices

8.1 Appendix 1 – PAS Actions for Metro South West Region

PWG Strategic Plan Goal	Service theme	Area/ Unit	Activity or Action description	Reserve Name(s) (where relevant)	Performance Target
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Little Tern:*** Control encroaching vegetation, to allow for suitable nesting habitat, as part of the intensive management of nesting, resting and fledgling feeding sites.	Towra Pt NR	Annual pre-nesting season vegetation management undertaken.
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Little Tern Pied Oystercatcher, Fox TAP*** Undertake fox control at the Towra Point priority site for the Little Tern (also Pied Oystercatcher).	Towra Pt NR	Fox Control Implemented at Towra Pt
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Fox TAP:***Measure the response of the Little Tern population to fox control at the Towra Point priority site.	Towra Pt NR	Little tern population monitored
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Little Tern:*** Undertake annual monitoring of individual colonies (sites will vary year to year).	Towra Pt NR	Annual Monitoring takes place.
Goal 1 Native veg, biodiversity,	Threatened Species	Botany Bay	***The Shorebird Community at Taren Point:*** Investigate and/or provide funding for habitat maintenance eg mangrove weeding.	Towra Pt NR?	Habitat maintained

DRAFT

land					
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland North	***Acacia bynoeana (Ab), Acacia pubescens (Ap) Allocasuarina glareicola (Ag) Dillwynia tenuifolia (Dt), Grevillea juniperina subsp. juniperina (Gj) & Marsdenia viridiflora subsp. viridiflora (MEP), Persoonia nutans (Pn) Pultenaea parviflora (Pp), Tetratheca glandulosa (Tg) Cumberland Land Snail (CSL):*** Prepare & implement site-specific POMs for high priority sites or incorporate site specific threat abatement measures for the species into Plans of Management for on-park sites.	Agnes Banks NR (Ab, Dt, Pn, Pp), Castlereagh NR (Ab, Ag, Dt, Gj, Pn, Pp), Cattai NP (Tg), Scheyville NP (Ap, Dt, Gj, Pp), Windsor Downs NR (Ap, Dt, Pn, Pp), Wianamatta RP (Cranebook Ab, Dt, Gj, Pn, Pp & ADI - Dt, Gj, MEP, Pn, Pp); CLS - all C Nth reserves except Pitt Town NR	Appropriate management actions incorporated into site management plans
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland South	***Acacia pubescens (Ap), Dillwynia tenuifolia (Dt) Pimelea spicata (Ps):*** Ensure plans of management for national parks, community lands and other public lands include appropriate actions for species' protection, such as weed and animal control and fire management. Site management statements will be prepared for populations on DEC estate & threat abatement measures to be implemented (Ps)	Kemps Ck NR (Dt), Prospect NR (Ap, Ps)	Appropriate management actions incorporated into site management plans

DRAFT

Goal 1 Native veg, biodiversity, land	Threatened Species	Royal	***Herbivory and environmental degradation caused by feral deer, Prostanthera densa:*** Implement best practice guidelines for deer management in Royal National Park. Continue control program at Royal NP and other priority areas; manage new populations.	Royal NP	Best practise guidelines implemented for deer management
Goal 1 Native veg, biodiversity, land	Threatened Species	Royal	***Feral deer KTP:*** Measure deer and vegetation response to management programs eg. Deer Plan for Royal NP.	Royal NP	Deer response & vegetation response to deer management programs is monitored.
Goal 1 Native veg, biodiversity, land	Threatened Species	Royal	***Woronora Beard-heath***: Prepare and implement site management statements to address threats at sites on DEC lands	Heathcote NP	Appropriate management actions incorporated into site management plans
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Kurnell Dune Forest EEC***:Undertake targeted bush regeneration works where required.	Botany Bay NP, Towra Pt NR	Targetted Bush regeneration undertaken where required
Goal 1 Native veg, biodiversity, land	Threatened Species	Botany Bay	***Little Tern:*** Control feral & native predators (including rats, cats and foxes) as part of the intensive management of nesting, resting and fledgling feeding sites.	Towra Pt NR	Feral & native predators controled when needed

DRAFT

Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland North	***Acacia bynoeana (Ab), Cumberland Land Snail (CSL):*** Undertake targeted bush regeneration works, where required.	Wianamatta RP (Cranebrook - Ab), Castlereagh NR (Ab), Agnes Banks NR (Ab); CLS - all C Nth reserves except Pitt Town NR	Targetted Bush regeneration undertaken where required
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland North	***Agnes Banks Woodland (ABW), Castlereagh Swamp Woodland (CSW), Castlereagh Ironbark Forest (CIF), Cumberland Plain Woodland (CPW), Shale Gravel Transition Forest (SGTF), Shale Sandstone Transition Forest (SSTF) EEC:*** Manage, to best practice standards, areas of EECs which have conservation as a primary objective, or where conservation is compatible.	Agnes Banks NR (ABW, CIF, CSW, SGTF), Cattai NP (SSTF), Castlereagh NR (CSW, CIF, SGTF), Rouse Hill RP (CPW, SSTF), Scheyville NP (CPW, SGTF), Windsor Downs NR (CSW, CIF, CPW), Wianamatta RP (Cranebook - CIF, CPW, SGTF)(ADI - CIF, CPW, SGTF)	EECs manageed to best practise standards
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland North	***Brown Treecreeper (Bt) Black-chinned Honeyeater (BCHE), Speckled Warbler (SW), Grey-headed Flying fox (GHFF):*** Implement sympathetic habitat mangement in conservation reserves, council reserves and crown reserves where the species occurs.	Bt - Previously recorded from Scheyville NP (now extinct from Cumberland Plain); Agnes Banks (GHFF), Cattai NP (BHE, GHFF), Castlereagh NR (BHE, SW, GHFF), Scheyville NP (BHE, SW), Windsor Downs NR (BHE), Wianamatta RP (BHE, SW, GHFF)	Sympathetic habitat management incorpoarted into weed & fire management plans & implemented
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland North	***Tetratheca glandulosa:***Undertake identified prority threat management works including weed control, restrict access, stormwater management works and slashing under power lines.	Cattai NP	Priority threat management works implemented for the species

DRAFT

		Cumberland South	***Castlereagh Swamp Woodland Community (CSW), Castlereagh Ironbark Forest (CIF) Cumberland Plain Woodland (CPW), Moist Shale Woodland (MSW), Shale Gravel Transition Forest (SGTF), Shale/Sandstone Transition Forest (SSTF), Sydney Turpentine-Ironbark Forest (STIF) :*** Manage, to best practice standards, areas of EECs which have conservation as a primary objective, or where conservation is compatible.	Bents Basins SCA (SSTF), Gulguer NR (SSTF), Kemps Ck NR (CSW, CPW, SGTF), Leacock RP (CPW), Mulgoa NR (CPW, MSW, SSTF), Prospect NR (CPW); CIF - Not in Cumberland STh reserves, Newington NR (STIF)	EECs manageed to best practise standards
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland South	***Hooded Robin (HR), Black-chinned Honeyeater (BCHE); Brown Treecreeper (BTC) Cumberland Land Snail (CSL), Grey-headed Flying fox (GFF), Speckled Warbler (SW):*** Implement sympathetic habitat mangement in DECCW estate, conservation reserves, council reserves, and crown reserves where the species occurs.	Gulguer NR (HR, BCHE); BTC - Previously recorded from Guguer NR (now extinct from Cumberland Plain); CSL - All Cumb Sth Reserves (except Bents Basins SCA & William Howe RP); GHFF - All Cumb Sth reserves; Kemps Ck (SW)	Sympathetic habitat management incorporated into FMP, weed management plans & POM
Goal 1 Native veg, biodiversity, land	Threatened Species	Cumberland South	***Cumberland Land Snail:*** Implement weed control at sites where necessary.	All Cumb Sth Reserves (except Bents Basins SCA & William Howe RP)	Targetted Bush regeneration/ weed control undertaken where required

DRAFT

		Nattai	***Hooded Robin (HR), Black-chinned Honeyeater (BCHE), Speckled Warbler (SW); Diamond Firetail (DF):*** Implement sympathetic habitat mangement in DECCW estate, conservation reserves, council reserves, and crown reserves where the species occurs.	Nattai NP (HR, BCHE, SF, SW), Burragorang SCA (HR, BCHE, DF, SW) & Wollondilly River NR (HR, SW, DF)	Sympathetic habitat management incorporated into FMP, weed management plans & POM
Goal 1 Native veg, biodiversity, land	Threatened Species	Royal	***Kurnell Dune Forest EEC:*** Undertake targeted bush regeneration works where required.	Royal NP	Targetted Bush regeneration undertaken where required

DRAFT