The Vertebrate Fauna of the Nattai and Bargo Reserves

Project funded under the Central Directorate Parks and Wildlife Division
Biodiversity Survey Priorities Program

Conservation Programs and Planning
Branch, Metropolitan
Environmental Protection and Regulation Division
Department of Environment and Conservation (NSW)
August 2004

Department of
Environment and
Conservation (NSW)

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Conservation Assessment and Data Unit
Conservation Programs and Planning Branch, Metropolitan
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Cover Photos

Feature Photo (Daniel Connolly)
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Black Crevice-skink (David O'Connor)
Tall Moist Blue Gum Forest (Daniel Connolly)
Rainforest (Daniel Connolly)
Short-beaked Echidna (D. O'Connor)
Grey Gum (Daniel Connolly)
Red-crowned Toadlet (Dave Hunter)

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OVERVIEW

The Nattai and Bargo Reserves study area covers over 80000 hectares of a prominent sandstone tableland dissected by dramatic gorges and valleys. The study area includes Nattai National Park, Nattai State Conservation Area, Bargo State Conservation Area (and recent extensions) and the Bargo River crown lands. It encompasses a diverse array of vegetation communities and animal habitats. There have been 195 systematic fauna surveys completed within the study area sampling diurnal and nocturnal birds, reptiles, frogs, arboreal and ground mammals and bats. This has been supplemented by many hours searching and recording fauna during field traverses and targeted habitat searches. These surveys have established that Nattai National Park has the third highest number of vertebrate fauna species of all NPWS reserves in the greater Sydney region.

This report collates and summarises documented information known on the terrestrial vertebrate fauna of the area and presents the results of extensive surveys completed over the last few years. Most recently work completed under the Central Directorate Biodiversity Survey Priorities Program has ensured that the range of habitats present in the reserve have been sampled. These surveys augment a significant amount of fauna survey effort within the adjoining Warragamba and Metropolitan Special Areas. This work will map regional trends in fauna distribution across the southern Sydney region.

The Nattai and Bargo Reserves contain fauna species and assemblages that are typical of the sandstone plateaux of the Sydney region. There are subtle indications that the fauna found in the drier and cooler climates of the Nattai Tableland are more closely aligned to the Lower Blue Mountains than they are to the Woronora Plateau. However, the unique factor of the Nattai Reserves is the broad rainshadow valley adjoining the Wollondilly River that supports groups of species that are not found in sandstone habitats. The species of this valley are more typical of the fauna found on the NSW western slopes. The bird assemblages found are of particularly high conservation value, with eight threatened bird species recorded. These are the Regent and Black-chinned Honeyeaters, Diamond Firetail, Turquoise and Swift Parrots, Hooded Robin, Speckled Warbler and Brown Treecreeper.

In addition the surveys have:

- Identified a previously unknown population of Brush-tailed Rock-wallabies in the Bullio portion of Nattai NP.
- Located a previously unknown population of Koalas within and adjoining southern Nattai NP near High Range.
- Identified that a total of 286 species are known to occur within the study area, with 187 birds, 34 reptiles, fourteen frogs, seventeen bats, seven arboreal mammals and 27 ground mammals recorded.
- Documented that Nattai NP features at least 279 vertebrate fauna species and Bargo SCA 110.
- Noted the persistence of Dingo and Emu populations within the Burragorang Valley.
- Recorded two threatened frog species the Red-crowned Toadlet and Giant Burrowing Frog in the reserves for the first time.
- Observed good numbers of several threatened species including the Yellow-bellied Glider, Powerful Owl, Glossy Black-cockatoo, Sooty Owl, Eastern Bent-wing Bat and Large-eared Pied Bat. Other threatened species recorded include Masked Owl, Eastern Freetail Bat, Large-footed Myotis and Spotted-tailed Quoll.
- Concluded that a number of threatened species are highly likely to occur on the basis that records have been confirmed from adjoining areas and that suitable habitat is present in the reserves. These include the Broad-headed Snake, Rosenberg's Goanna, Barking Owl, Eastern Pygmy-possum, Squirrel Glider and Grey-headed Flying-fox.
- Recorded eleven species of introduced mammal with Rabbits, Pigs and Foxes the most regularly reported, and six species of introduced bird, with the Common Starling being the most prevalent.

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1 INTRODUCTION

1.1 PROJECT AIMS

The Central Directorate Parks and Wildlife Division (PWD) of the NSW Department of Environment and Conservation (DEC, formerly NSW National Parks and Wildlife Service (NPWS)) has for the first time established a biodiversity survey priorities program for all NPWS managed estate within the Directorate. This program recognises that the Nattai and Bargo Reserves are characterised by very low levels of information on both flora and fauna (NPWS 2003a). The decision to sample these areas first was enhanced by the opportunity of integrating new survey work into a broader study examining the biodiversity values of the Warragamba and Metropolitan Special Areas (DEC in prep.). This study will amongst other things generate habitat maps for all of the threatened fauna species known to occur in the region.

The fauna survey program seeks to address the shortfall in information on vertebrate fauna within and adjoining the Nattai and Bargo Reserves. Improved information will enable park managers to better integrate local information into planning decisions and to become more active in promoting the values of the reserve. It will provide the opportunity to develop more focused strategies on threatened species management, monitoring programs and community education. Importantly it will expand the ability of park managers to understand the role the reserves play in conserving fauna within the greater Sydney Region.

Specific objectives of this report are to:

1. Document, review and collate existing fauna data
2. Identify and profile threatened fauna species and other regionally significant fauna that are known or likely to occur
3. Identify broad-scale patterns in fauna occurrence and habitat use across the reserves and identify habitats of particular conservation significance
4. Highlight areas where further survey work should to be carried out.

1.2 BACKGROUND

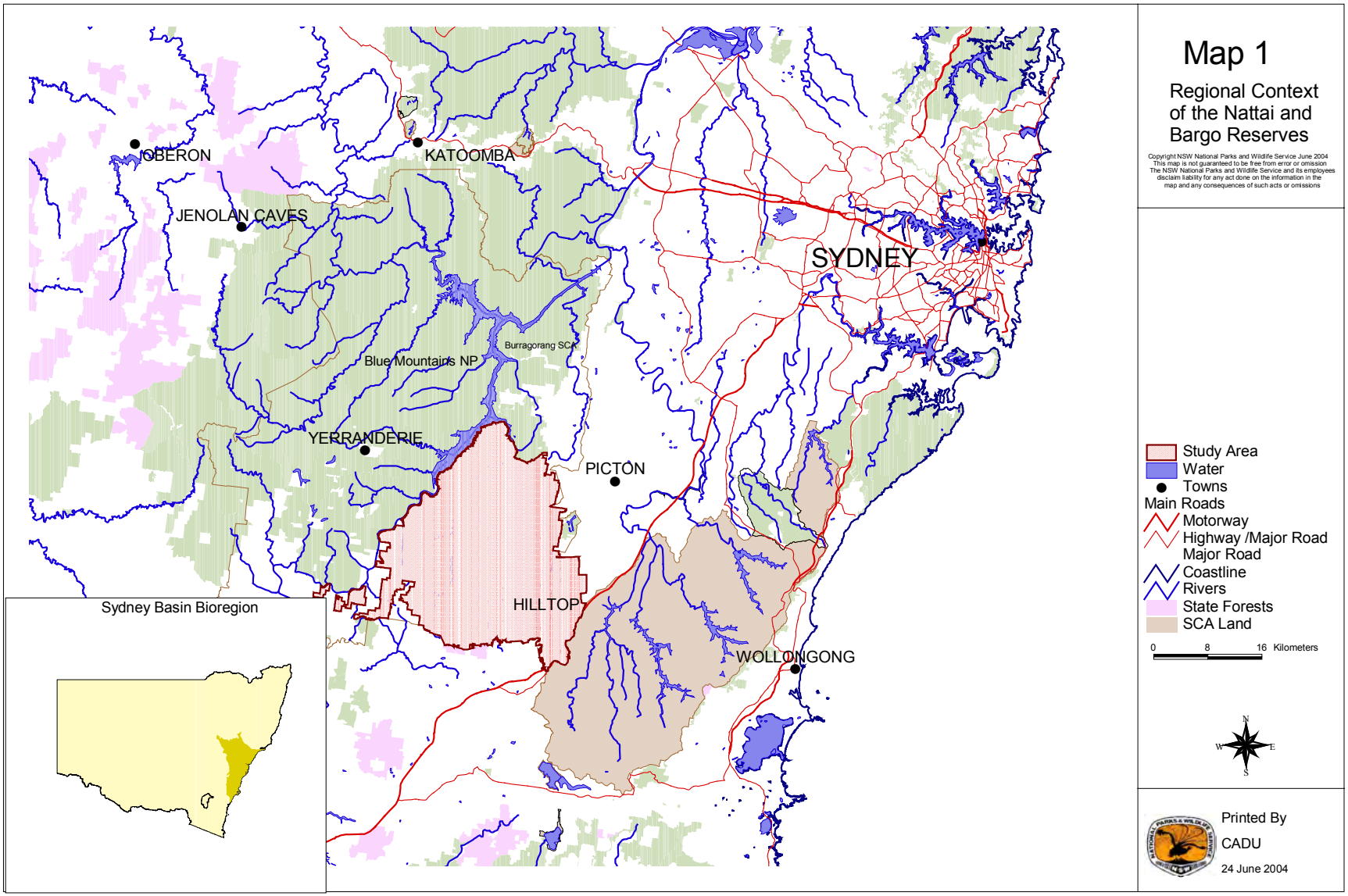
The Nattai Reserves lie between the south eastern rim of the Sydney metropolitan area and the northern arm of the Southern Highlands (Map 1). Located between Oakdale and Mittagong in the east and Bullio in the west these reserves cover an uninterrupted expanse of native vegetation.

The study area comprises three reserves and adjoining crown lands (Map 2). Nattai National Park (NP) (55000 hectares), Nattai State Conservation Area (SCA) (3383 hectares) and Bargo SCA (5660 hectares) were gazetted in 1991. There are currently 1900 hectares of crown land that have been proposed as extensions to Bargo SCA, while the remaining areas adjoining the Bargo River are crown lands or freehold tenures. The villages of Colo Vale, Hilltop, Buxton, Balmoral and Thirlmere form a ribbon of development along the eastern boundary of the Bargo SCA. Nattai National Park includes the gazetted Nattai Wilderness Area (under the NSW Wilderness Act, 1997) and forms part of the recently inscribed Blue Mountains World Heritage Area.

1.3 ENVIRONMENT

Biogeography

The Nattai and Bargo Reserves lie almost entirely within the Sydney Basin Bioregion. However, the western boundary of the Nattai National Park borders the South Eastern Highlands Bioregion. These Bioregions are two of 85 that have been delineated in the interim Biogeographic Regionalisation of Australia (IBRA) (Thackway and Cresswell 1995). The purpose of these regions is to establish a framework for conservation planning using broad landscape characteristics to highlight similar influences on landscapes and native biota. The interactions between climate, geology and broad vegetation are the primary attributes that have been used. One of the applications of the IBRA system


OBERON
KATOOMBA
JENOLAN CAVES
SYDNEY
Burragorang SCA
Blue Mountains NP
YERRANDERIE
PICTON
HILLTOP
WOLLONGONG
Sydney Basin Bioregion
Map 1
Regional Context of the Nattai and Bargo Reserves
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Study Area
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Motorway
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Major Road
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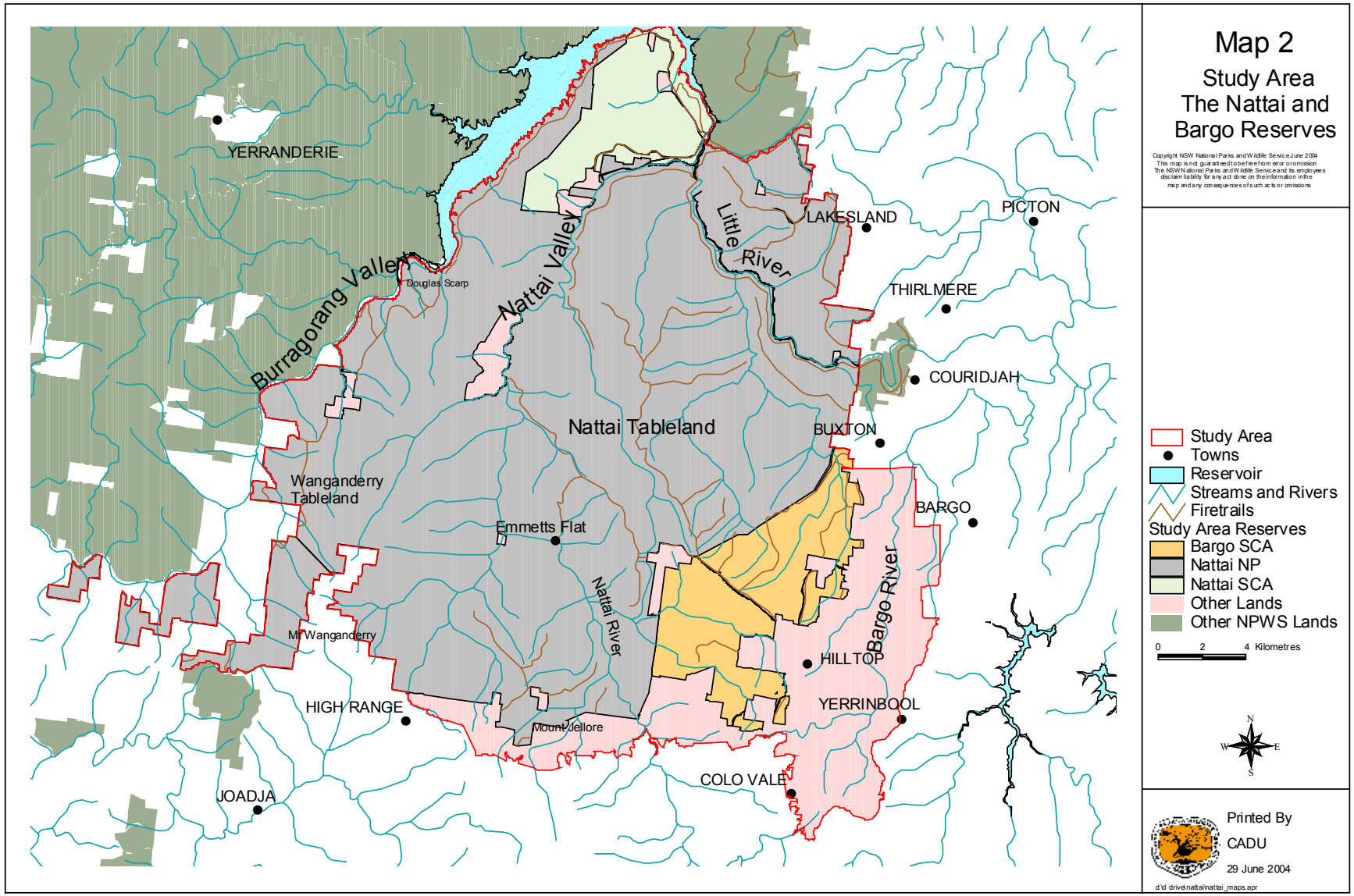
Map 2
Study Area
The Nattai and
Bargo Reserves
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BUXTON
Nattai Tableland
Wanganderry
Tableland
Emmetts Flat
Nattai River
BARGO
Bargo River
Mt Wanganderry
HILLTOP
YERRINBOOL
HIGH RANGE
Mount Jellore
COLO VALE
JOADJA
Study Area
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has been to review the reservation status of each Bioregion to assist with acquisition priorities for a representative national reserve system. While designed with a review of reservation adequacy in mind, they are a useful regionalisation that may be used to examine and compare species composition and distribution patterns. Map 1 also illustrates the location of the Sydney Basin Bioregion in NSW.

Geomorphology

Much of the Nattai and Bargo reserves are composed of rugged and inaccessible landscapes. The main geographic features of the reserves are the extensive sandstone tablelands and the rivers and the tributaries that dissect them. The tablelands are comprised of Hawkesbury Sandstone that is from the Triassic age. This includes the Nattai Tableland, the southern portion of the Burragorang Tableland, and the Wanganderry Tableland as well as the Wildgoat and Buxton Plateaux. The Nattai, Little and Wollondilly Rivers have cut through the Hawkesbury Sandstone and formed large river valleys. The many creeks and tributaries of these rivers have also incised the tablelands forming smaller valley features and canyon like environments. Small bands of Narrabeen Group Sandstone are often found underlying the Hawkesbury Sandstone. Both, however, generate coarse-grained sandy soils that are quite infertile and often shallow and rocky.

Impressive escarpments occur above the main river valleys, and pronounced clifflines indicate changes in geology. These valleys are predominantly comprised of Permian Sediments mostly from the Shoalhaven Group. These sediments have a depositional origin, which lead to sedimentary rocks of varying grain size, including sandstone, shale and siltstone. The sandstone produces an infertile sandy soil similar to those found on the overlying Hawkesbury Sandstone. The shale and siltstone material tends to occur in flatter locations such as footslopes or escarpment benches. A clay loam soil tends to develop in these areas, which is of slightly higher fertility and has better water holding capacity.

Higher fertility soils are found in a number of restricted locations in the study area and are mostly of volcanic origin. The Burragorang Valley east of the river as well as south west from Bonnum Pic is comprised of porphyritic material of Devonian age. A small amount of this material is found within Nattai NP, where it develops into a rocky clay soil of moderate depth and fertility. Even higher fertility soils are found in areas derived from shale, basalt and trachyte. Basalt outcrops are found at Mts. Wanganderry and Flora, although they are mostly outside Nattai NP. Shale soils are exposed in aureole like formations on caps where the basalt has been eroded. Wianamatta Shale soils are also found to the north east of the reserves in the Thirlmere area and these influence the Oakdale and Blue Gum Creek areas where transitional soils of a mixture of shale and sandstone develop. Mt. Jellore is an igneous intrusion of trachyte and this has produced a higher fertility soil where a rocky clay loam has developed.

Alluvial soils occupy the larger river flats along the Wollondilly, Nattai and Little Rivers. The material found in these locations is a mixture of siltstone, shale and sandstone. The soil is often found in deep sandy deposits although the soil richness varies according to the amount of siltstone and shale in the mixture. There are minor creeklines and tributaries on the sandstone tablelands where small amounts of sandy alluvium can be found. These are more evident on the undulating country, such as near the town of Hilltop. This soil is a coarser sandy alluvium with some forming a swamp like habitat where organic material is periodically inundated with water. A number of hanging swamps also occur.

Elevation

There is a moderate elevational range within the Nattai and Bargo reserves. The lowest areas occur around Lake Burragorang which, when completely full is at around 120 metres above sea level (ASL). Conversely the highest elevation is found on the peak of Mt. Jellore, which lies at just over 830 metres ASL. Much of the reserves are located on the sandstone tablelands that range between 500 and 700 metres ASL. There is decline in elevation towards the north east. Below the sandstone tablelands, the valley environment of the Nattai, Wollondilly and Little Rivers ranges between 200 and 400 metres, again with a decrease in elevation as the former river drains toward the Warragamba gorge.

Climate

Elevation and distance from coast influence the climate of the Nattai and Bargo reserves. Mean annual rainfall levels decrease from around 920 millimetres per annum near Hilltop to less than 700 millimetres in the rainshadow of the Burragorang Valley. Rainfall rises to around 950 millimetres on Mt. Wanganderry, just south of the reserve on the Wombeyan Caves Rd. Mean annual temperatures

more closely follow elevation trends with dry warm conditions prevalent in the deep gorges of the Nattai and Little Rivers and, most distinctively, the Burragorang Valley.

1.4 VEGETATION

The vegetation of the reserves has recently been comprehensively documented in DEC (2004b) and NPWS (2003b) and is summarised below. Older studies such as Fisher *et al.* (1995) also provide a regional overview of the vegetation present. The vegetation patterns in the study area are influenced by three distinctive landsystems: the sandstone tableland; the deeply incised valleys and flats; and the broad Burragorang Valley.

The sandstone plateau includes the Wildgoat, Nattai and Wanganderry Tablelands. These form a combination of broad ridges and numerous gullies, gorges and creeklines that form part of the Hawkesbury-Nepean Catchment. The broad ridges feature shallow to skeletal soils that support open woodlands and forests with a distinctively sclerophyllous shrub and heath layer (Plate 1). Common tree species include Red Bloodwood (*Corymbia gummifera*), Sydney Peppermint (*Eucalyptus piperita*), White Stringybark (*E. globoidea*) and Scribbly Gum (*E. sclerophylla*). The understorey is generally covered in low growing shrubs that includes Banksia spp. (*B. ericifolia* subsp. *ericifolia* and *B. serrata*), *Leptospermum trinervium* and Mountain Devil (*Lambertia formosa*). A variation of the sandstone ridgetop woodlands occurs on the rim of the eastern and southern limits of the reserves. Here the sandstones are underlain by Mittagong Formation Sandstones and Shale and are marginally more fertile than the soils derived from Hawkesbury Sandstone. The vegetation is noticeably taller and features higher abundance of Grey Gum (*Eucalyptus punctata*). In the south near High Range the community can include Smooth-barked Apple (*Angophora costata*).

Plate 1: Sandstone Woodland on Yabbies Road Fire Trail

Exposed rock is common on some of the narrow ridges and cliff edges. In these locations, the community grades into a more open heath with mallees (*Eucalyptus stricta, E. obstans* and *E. burgessiana*) sometimes present along with other stunted tree species that are common within the sandstone ridgetop communities.

Residual shale caps are present on a number of ridgelines and knobs in the north east and south of the reserve. These produce more fertile soils that have different levels of sandstone and shale influence. The forest is taller, generally includes a grassy understorey with rushes such as Spiny-headed Mat-rush (*Lomandra longifolia*) and an abundance of Sheoaks (*Allocasuarina* spp.). Easterly forms of the community also feature tall Grey Gums, Stringybarks and Mountain Blue Gums (*Eucalyptus deanei*) with a dense small tree layer of Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*).

Vegetation growing on sheltered slopes and gullies on the sandstone plateaux changes with the degree of shelter. The slopes feature a dry shrubby forest with plenty of rock outcropping and benches. The forest is primarily comprised of Sydney Peppermint and Blue-leaved Stringybark (*Eucalyptus agglomerata*) with Grey Gum less frequent. At the base of the gully a tall open forest develops above a fern covered floor (Plate 2). Trees most commonly recorded in this environment are River Peppermint (*Eucalyptus elata*), Sydney Peppermint, Blue-leaved Stringybark, Mountain Grey Gum (*E. cypellocarpa*) and, in the far south at higher elevations, Blue Mountains Ash (*E. oreades*). Mesic shrub species develop in this community including Blueberry Ash (*Elaeocarpus reticulatus*). In the most protected gorges a well-developed rainforest subcanopy can develop and can include Coachwood (*Ceratopetalum apetalum*) and Black Wattle (*Callicoma serratifolia*). Narrow ribbons of rainforest form a luxuriant strip along gorges and feature tall Coachwood, Sassafras (*Doryphora sassafras*) and Lilly Pilly (*Acmena smithii*).

The descent into the dramatic Nattai and Little River valleys exposes the underlying sandstones, shales and sediments that were laid down during the Permian period. The vegetation growing on these landforms responds to the different soils that erode from the different parent materials as well as degree of shelter from sun and wind. Exposed slopes are covered in an open woodland that is dominated by Red Ironbark (*Eucalyptus fibrosa*) and a sparse shrub layer. Sheltered aspects are commonly dominated by tall Grey Gum (Plate 3) with the most protected slopes underneath the dramatic Nattai Walls featuring tall Mountain Blue Gum. An unusual box species, *Eucalyptus hypostomatica*, grows in protected positions in a narrow band underneath the sandstone clifflines. As with all protected forests on the escarpment, the ground cover is generally grassy with multitudes of low growing herbaceous species. On the escarpment foothills an open forest of Forest Red Gum (*Eucalyptus tereticorn*is) and Grey Box (*E. moluccana*) is prominent.

Plate 2: Sheltered Forest west of Wattle Ridge.

Dry rainforest develops on the escarpments of the major valleys. Common in the gully lines and amongst rock outcrops and boulders on escarpment benches, Grey Myrtle (*Backhousia myrtifolia)* forms dense thickets. Less frequently sprawling Port Jackson Figs (*Ficus rubiginosa*) and Giant Stinging Trees (*Dendrocnide excelsa*) grow in deeper soils in very narrow niches.

The river flats associated with the Nattai and Little Rivers also support some distinctive vegetation communities. On the banks of the rivers, tall River Oaks (*Casuarina cunninghamiana* subsp. *cunninghamiana*) occupy the floodzones. On the first terraces Rough-barked Apple (*Angophora floribunda*) is common, sometimes with the rare Nepean River Gum (*Eucalyptus benthamii*) in the upper reaches of the Nattai Valley. Elsewhere, tall River Peppermint, Mountain Blue Gum, Forest Red Gum and Thin-leaved Stringybark (*Eucalyptus eugenioides*) feature. The alluvial flats are very grassy, due to high soil fertility.

Plate 3: Exposed Escarpment Forest near Middle Flat.

The Burragorang Valley represents the final land system of the reserves. Located in a distinct rainshadow, the valley is the driest area in the reserves. The geology is also different, with a granite-like rock, known as Porphyry, intruded into the bedrock during the Devonian period. This rock erodes to produce a fertile clay loam. The richer soils and the dry climate produce a vegetation community that is closely related to those found on the central western slopes of NSW. Tall grassy woodlands feature combinations of Forest Red Gum, Grey Box, Yellow Box (*Eucalyptus melliodora*), Narrow-leaved Ironbark (*E. crebra*) and White Box (*E. albens*). One of the more unusual communities also occurs in this area, an open dry woodland on a scarp above the Wollondilly River near Murphys Crossing. It includes Black Cypress Pine (*Callitris endlicheri*), Narrow-leaved Ironbark and the distinctive blue-leaved Coast Myall (*Acacia binervia*).

1.5 FIRE

Fire history prior to 1957 is not well documented (Wootten, 1965) although it is suggested that much of the area has been burnt on several occasions since the time of European settlement. In addition, the burning regime used by the indigenous occupants is not known.

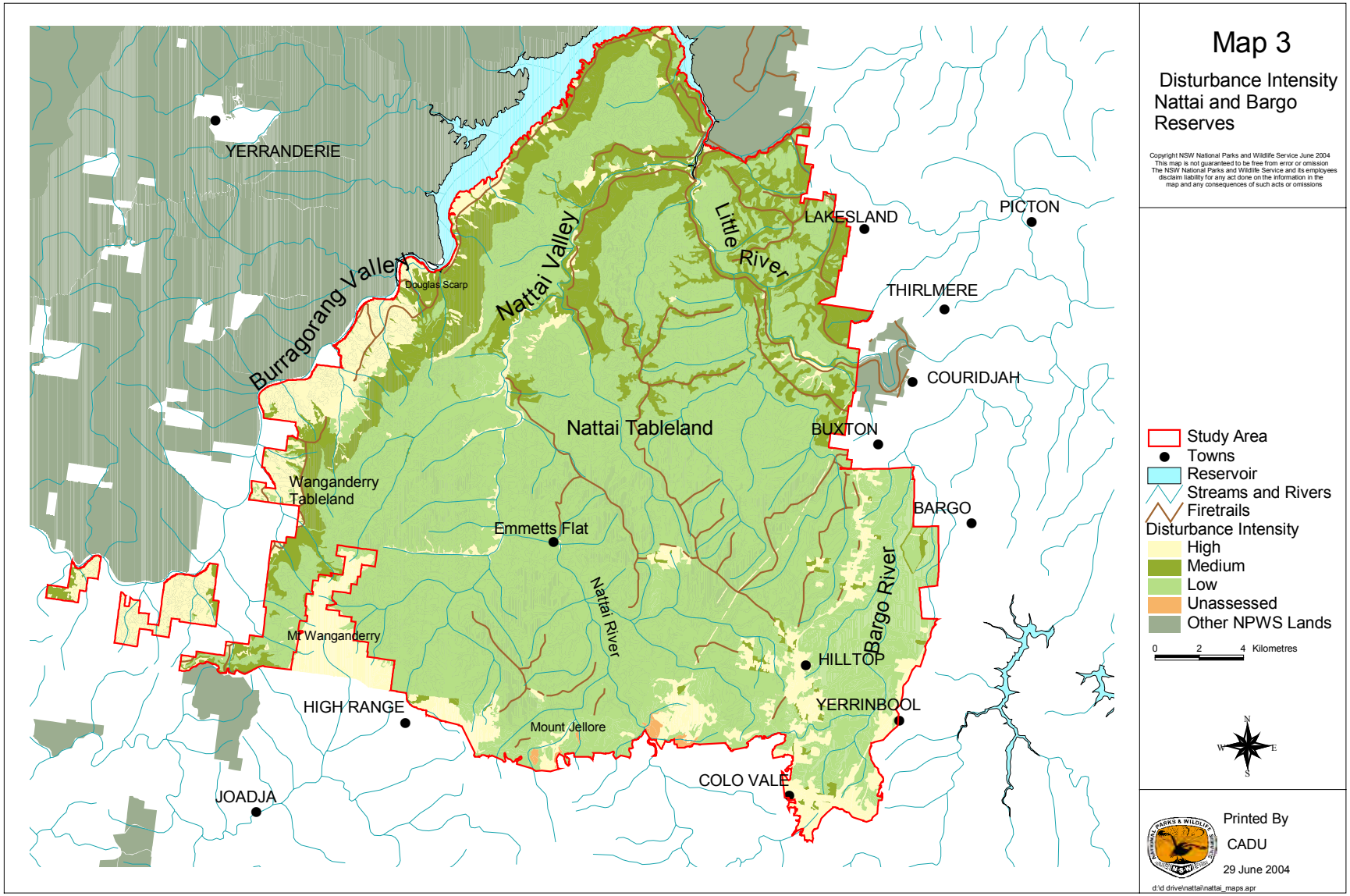
Fire history information for the area is of varying quality and usually only consists of the final extent of the fire; this has been recorded from 1975 to present (NPWS 2001a). Large fires in March 1965 burnt downstream of the junction of the Nattai and Wollondilly Rivers. This was followed by an extensive fire in November 1968, which burnt much of the reserves between Wanganderry Tableland and Lakesland (NPWS 2001a). A number of smaller fires have occurred since that time and within the last ten years there have been a further two large fires in the reserves. In 1997/98 a fire burnt the northern half of the Wanganderry Tableland and another large and intense fire burnt the majority of the reserves in the summer of 2001/02.

The majority of wildfires are started by lightning strikes (NPWS 2001a) although arson and the escape of small fires, including hazard reduction burns, are also common. Much of the fire activity, including hazard reduction burns, has been along the eastern edge of the reserves incorporating Little River and the southern Burragorang Tableland. The northern portion of the Wanganderry Tableland has also received more frequent fire events than other areas, which may indicate that it is more prone to lightning strikes than other areas, though its inaccessibility means that once fires start they are difficult to suppress.

1.6 DISTURBANCE

The impacts of human activities on the natural landscape of Nattai Reserves are concentrated on fertile soils on flat to undulating country. Most of the disturbance has been associated with grazing and pastoral pressures in the Burragorang Valley and the larger gorges associated with the Nattai and Little Rivers. A large powerline easement dissects the Bargo SCA. Map 3 illustrates the intensity of disturbance in the landscape. Clearing of the native vegetation has affected extensive areas of the Burragorang Valley. Natural regeneration has resulted in extensive areas of pioneering shrub growth that includes Drooping Sheoak (*Allocasuarina verticillata*), Native Blackthorn (*Bursaria spinosa*), Sticky Daisy Bush (*Olearia elliptica*) and Sticky Cassinia (*Cassinia uncata*).

Within the Nattai Valley a number of coal seams have been mined, and pit heads and tunnels mark some of the escarpment slopes. Disturbance of native vegetation is present around these sites. These mines are supported by some significant infrastructure such as roads, powerline easements, bridges and conveyors.


Map 3
Disturbance Intensity
Nattai and Bargo
Reserves
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PICTON
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COURIDJAH
BUXTON
Nattai Tableland
Wanganderry
Tableland
Emmetts Flat
BARGO
Nattai River
Bargo River
Mt Wanganderry
HILLTOP
YERRINBOOL
HIGH RANGE
Mount Jellore
COLO VALE
JOADJA
Study Area
Towns
Reservoir
Streams and Rivers
Firetrails
Disturbance Intensity
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2 METHODS

2.1 EXISTING FAUNA DATA

The Atlas of NSW Wildlife (DEC 2004a) was the primary resource used to acquire existing data on the fauna of the park. Systematic fauna survey effort has been limited within the Nattai and Bargo reserves. Mount King Ecological Surveys (1989, 1994) carried out some sampling around the shores of Lake Burragorang as part of the Warragamba Dam flood restoration works, though much of the data in these reports is difficult to incorporate into the Atlas. The majority of records within the Atlas prior to the summer of 2003-04 derive from DEC systematic surveys of the park, undertaken as part of the Comprehensive Regional Assessment fauna surveys (1997-99) and the Warragamba Special Area fauna surveys (2002-03), which are each described below. The former carried out sampling in the Burragorang and Nattai Valleys, and the sandstone plateau on Wattle Ridge Trail, while the latter surveyed the northern portions of Nattai National Park. Belik and Close (1997) summarised the available biodiversity data for the Bargo River area immediately adjoining Bargo SCA for the Nepean Catchment Committee and undertook limited survey in October 1996. The National Parks Association (NPA) completed a community biodiversity survey in the same area in June 1997 as part of a proposal for the establishment of a Bargo River National Park. The records from these surveys have been included within the report, but many of the survey techniques undertaken do not allow direct comparison with surveys undertaken by DEC.

The bulk of the remaining records derive from the licensed data sets of Birds Australia (Blakers *et al.* 1984 and Barrett *et al*. 2003) and the specimen register of the Australian Museum. Blakers *et al.* (1984) sightings involve a ten-minute spatial grid, based on easting and northing lines. All birds recorded from within this grid are then assigned to AMG coordinates at the centre of the grid, such that the data is not spatially accurate on a fine scale. This process was also used by some observers included in Barrett *et al.* (2003), although others provided information at a finer scale. The Australian Museum data derives from specimens submitted to the museum by members of the public, as well as from field trips undertaken by Museum staff specifically to collect fauna specimens. Early specimens in the register often have a low level of spatial and temporal reliability. For this reason, records from the Australian Museum prior to 1950 have been excluded from discussion in this report. Catchment rangers have collected opportunistic records of fauna for many years prior to the transfer of lands to the NPWS in 1991. Observations by landowners, bushwalkers and naturalists have also contributed to the Atlas of NSW Wildlife, although these records are sparse.

2.2 SURVEY STRATIFICATION AND SITE SELECTION

Vegetation mapping was used to identify the range of fauna habitats present in the study area. There are 37 different communities described and mapped (DEC 2004b) which have varying distributions ranging from highly restricted to extensive. Each specific vegetation community within the park was placed into a broader flora group; vegetation communities that shared significant similarities in floristic composition, structure, topographic position and substrata were grouped together. Fauna survey site stratification was based on these broad flora groups, while aiming to sample the full variation of vegetation communities within each group as much as possible.

The preferable sampling strategy would have aimed to sample the mapped vegetation communities proportionately according to the mapped area of each community within the reserve *and* have included enough repeat sampling within each vegetation community to provide reasonable reliability that potential variations within widespread stratum were captured. Such replication of sites serves to strengthen the reliability of patterns derived from collected data. The pre-trip site selection process aimed to fulfil this goal as much as possible. Survey work that was completed in 1997 and more recently in 2002 was overlaid on the vegetation mapping in order to examine sampling adequacy An analysis identified the previous systematic fauna survey effort undertaken within each vegetation community and broad flora group within the park. Vegetation communities that had not previously been sampled or had been under-sampled (where the amount of previous survey effort was less than that estimated by the proportional size of the community) were prioritised for sampling. Small and isolated communities were not targeted, while extensive communities have been afforded replicated sampling.

New sites were selected using ArcView, with information gained from topographic maps, vegetation maps, access trails, and location of previous survey effort. Sites were positioned primarily on or close to access trails to facilitate conduct of spotlighting and harp trapping surveys and to maximise the number of sites that could be accessed during the limited survey period. In the field, the proposed site locations were ground-truthed to ensure that they were representative of the mapped vegetation community, had not been significantly affected by recent burning or other habitat modification, and comprised a single vegetation community. If these criteria were not met, an alternative location was selected for the site. Systematic survey sites were 100 metres by 200 metres in area, and spaced a minimum of one kilometre from each other (two kilometres apart for nocturnal call playback surveys). Given the extent of the 2001-2002 wildfires sampling of some burnt vegetation was unavoidable.

Selection of survey sites was extremely limited, at both stages of the process, by the steep and dramatic terrain of the park, the location of access trails, and the large amount of travelling time between areas. Given the nature of the terrain, many sites involved extensive walking to access sheltered forest, gully forest and rainforest.

Table 1 presents the area of each broad flora group within the reserves and the corresponding survey effort for each fauna survey technique. Map 4 shows the location of fauna survey sites and the vegetation within the reserves. Appendix A provides the specific AMG, vegetation type and survey techniques of each survey site. The tables and figures include all systematic surveys undertaken within the reserves by DEC between 1997 and 2004.

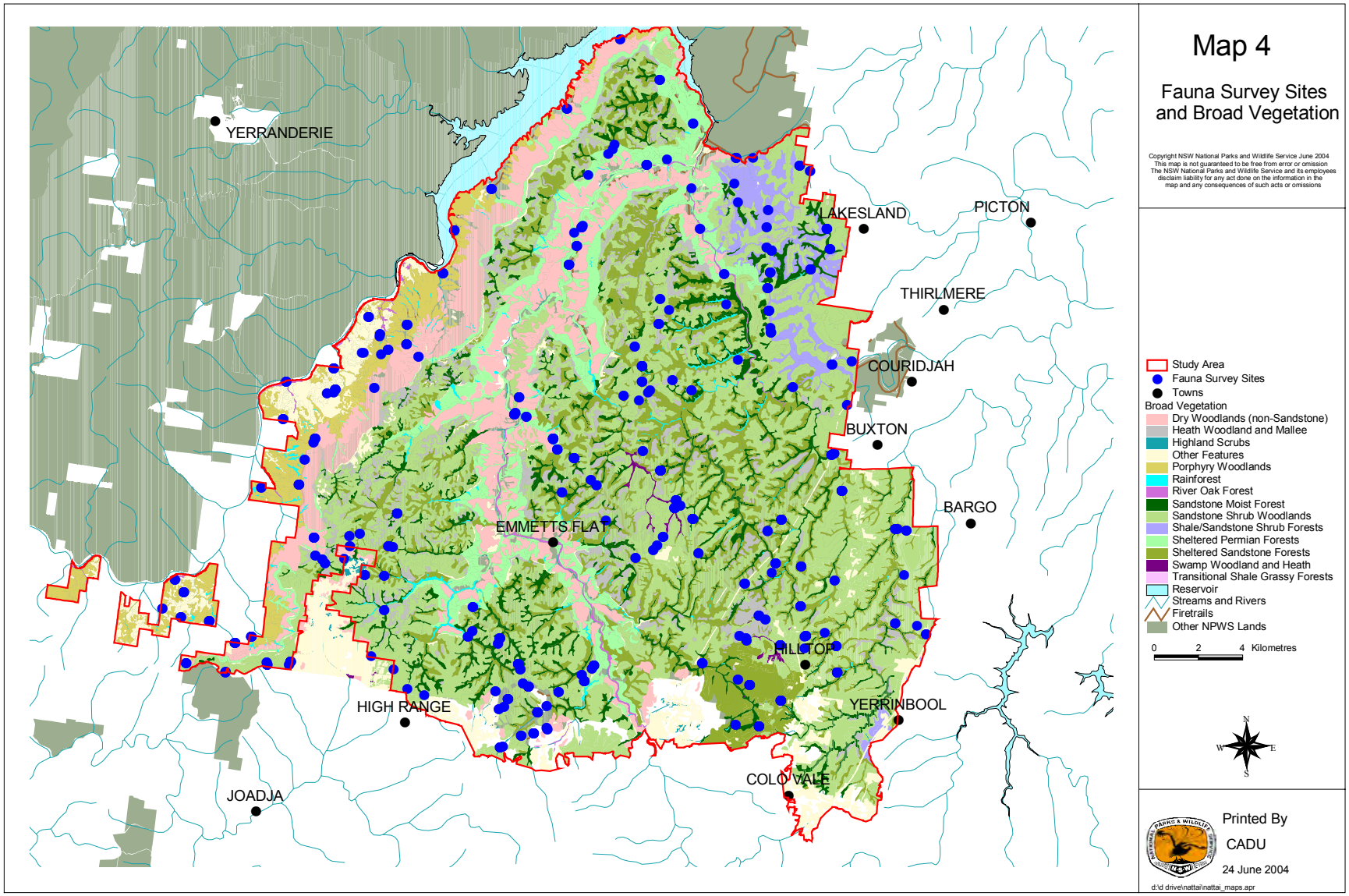
Table 1: Area of each broad flora group within the Nattai and Bargo Reserves and corresponding allocation of systematic survey methods (includes systematic survey sites from CRA, SCA and Biodiversity Survey Priorities projects).

Broad Vegetation	Mapped area of vegetation community Reserves (ha)	Relative mapped area of vegetation community (%)	No. of ultrasonic bat detector sites	No. of diurnal bird sites	No. of diurnal reptile sites	No. of Elliott trap sites	No. of hair tube Sites	No. of harp trapping bat sites	No. of nocturnal call playback sites	No. of nocturnal streamside search sites	No. of site spotlights for arboreal mammals	No. of spotlight transects for arboreal mammals
Rainforest	614	0.9	0	3	0	0	0	0	2	0	2	1
Tall Forest	12616	17.9	5	10	11	6	0	6	7	0	11	0
Woodland	30020	42.6	3	27	27	5	1	8	32	5	22	4
Open Forest	21875	31.0	2	23	18	7	0	13	20	4	24	1
Heaths and Swamps	1163	1.6	1	1	3	0	0	1	0	1	1	0
Other	4197	6.0	0	5	7	0	2	4	6	0	8	2
Total	**70485**	**100**	**11**	**69**	**66**	**18**	**3**	**32**	**67**	**10**	**68**	**8**

2.3 SURVEY METHODS

The systematic fauna survey methods used were based on those developed by the NPWS Biodiversity Survey Coordination Unit (NPWS 1997). The systematic techniques described below were used to sample the following vertebrate fauna groups: diurnal and nocturnal birds, reptiles, amphibians, bats, and arboreal and terrestrial mammals. Consistency in the use of these techniques allows comparison between fauna species detected across different vegetation types and environments within the park. Furthermore, it will allow future comparisons with consistent surveys of environments elsewhere.

Field survey teams were supplied with field proformas to facilitate comprehensive, consistent recording of field data and to increase accuracy and efficiency of data entry into the DEC Biodiversity Sub-system (BSS) of the Atlas of NSW Wildlife computer database. The names of observers and recorders were noted on every data sheet to aid data verification and entry.


YERRANDERIE
LAKESLAND
PICTON
THIRLMERE
COURIDJAH
BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Map 4
Fauna Survey Sites and Broad Vegetation
Copyright NSW National Parks and Wildlife Service June 2004
This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions
Study Area
Fauna Survey Sites
Towns
Broad Vegetation
Dry Woodlands (non-Sandstone)
Heath Woodland and Mallee
Highland Scrubs
Other Features
Porphyry Woodlands
Rainforest
River Oak Forest
Sandstone Moist Forest
Sandstone Shrub Woodlands
Shale/Sandstone Shrub Forests
Sheltered Permian Forests
Sheltered Sandstone Forests
Swamp Woodland and Heath
Transitional Shale Grassy Forests
Reservoir
Streams and Rivers
Firetrails
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Systematic site-based methods

Diurnal bird survey

Diurnal bird censuses comprised a twenty minute observation and listening search within a two hectare (50 by 200 metre) area, conducted by an experienced bird surveyor. Censuses were conducted only during periods of relatively high bird activity (in the early morning) and reasonable detectability (eg. low wind and cicada activity). All bird species and abundance of individuals seen or heard were recorded. Individuals were scored as on-site if they were detected within the two hectare plot. Individuals recorded outside the plot, in adjacent vegetation types or flying overhead were recorded as off-site.

Diurnal herpetofauna search

A standard half-hectare area subplot (50 by 100 metres) within a two hectare standard site was searched for one person-hour (standardised regardless of the number of persons searching). Censuses were restricted to the period between mid-morning to late afternoon, when temperature and insolation are sufficient to ensure maximum reptile activity. Surveying was not conducted on overcast or rainy days.

This census technique entailed active searching of potential reptile and frog microhabitats within the half-hectare area. Active or basking reptiles were identified by sight or captured and identified by the use of keys. Sheltering or cryptic species were detected by searching around, under and within fallen logs, litter, decorticating and fallen bark, rock outcrops and other likely shelter sites. Incidental observations of other fauna were also recorded.

Nocturnal site spotlighting survey

This census comprised searching for arboreal mammals along a 200 metre transect within a site for half a person hour. Fifty-watt spotlights were used to scan the vegetation for animals and enable detection of reflected eye shine. Surveyors also listen intently for fauna calls during the survey period. All fauna observed within the census period were recorded, noting whether they were on or off site.

Harp trapping

While ultrasonic recorders were used principally to detect high flying bat species, collapsible bat traps, known as harp traps (Tidemann and Woodside 1978), captured low flying species. Two nights of trapping were conducted at each bat trap site. Sites were selected for their perceived potential to interrupt bats along their flight paths, and were usually along tracks or in gaps between trees where adjacent vegetation might force bats to fly.

Traps were checked each morning. Captured bats were identified by external morphology, forearm measurement and body weight, and keyed out where necessary using Parnaby (1992a) and Churchill (1998). Animals were released on the following night at the point of capture.

Bat ultrasonic ('Anabat') call recording

Ultrasonic recorders (Corben 1989) are particularly useful for detection of high-flying species, which often comprise more than one third of an area's bat species (Parnaby 1992b), yet are under sampled by harp trapping (Richards 1992). The method requires the recording and identification of high frequency, echolocation "calls" made by bats, which, except for one or two species, are ultrasonic, that is, inaudible to humans.

<u>1997-2002 surveys</u>
The recording equipment for the surveys consisted of an Anabat II® detector and a tape recorder. Census duration was 30 minutes. Censuses began at or soon after dusk, and were conducted between then and up to two hours after dusk, a peak activity period for microchiropteran bats. A 40-kilohertz calibration tone was recorded for a few seconds at the start and end of each recording session and sometimes at intervals during the recording period.

<u>Current surveys</u>
The recording equipment for the surveys consisted of an Anabat II® detector and digital flash card recorder, housed within a tupperware box for weather protection. The box was set up in locations where bats were expected to fly, such as over water bodies, at cave entrances and along tracks. The Anabat was set to commence detection at dusk and turn off at dawn. During the night, a delay switch operated to turn on the recording device when bat activity was detected and then de-activate the device while no bat activity was occurring. The equipment was left in each location for one night only, then moved elsewhere.

Anabat recordings were transferred onto computer and analysed by Narawan Williams, a recognised expert in this field. Identification was designated as either definite, probable or possible, following the methodology of Parnaby (1992b). Calls that proved difficult to identify were also assessed by Michael Pennay (DEC Western Regional Assessments Unit) using the techniques described in Pennay *et al.* (2004).

Nocturnal streamside search

Streamside searches for frogs were undertaken for half a person hour in one of two ways: in stream or gully habitats a 200 metre stretch was searched; at standing water bodies a half-hectare (50 by 100 metre) area was surveyed. The searches were only conducted on warm, dark, humid and wet nights within two days of rain. All frogs, and other animals, identified visually or by call within the time period were recorded, together with the weather conditions at the time of the survey.

Nocturnal call playback

Nocturnal birds and mammals are often detected only when they vocalise for territory or social contact, behaviour which can be elicited by broadcasting specific calls. A standard survey census involved broadcasting the calls of each of the four large forest owls - Powerful (*Ninox strenua*), Masked (*Tyto novaehollandiae*), Sooty (*T. tenebricosa*) and Barking (*N. connivens*) - from the centre of a site. Prior to call broadcasts, on arrival at the site, the surrounding area was searched by spotlight for five minutes to detect any fauna in the immediate vicinity and then a ten-minute period of listening was undertaken.

A pre-recorded compact disc of each species' call series was played, amplified through a megaphone. Calls of each species were played for five minutes, followed by a five minute listening period. The surrounding area was again searched by spotlight after a final ten minute listening period. After the census, the response or presence of any fauna, date and time that response occurred, and weather details such as amount of cloud cover was recorded. Very windy and rainy periods were avoided where possible. Censuses conducted in poor weather were noted.

Elliott trapping

This technique involved setting Elliott B traps at twenty metre intervals along a 200 metre transect through a site. Traps were baited with a mixture of peanut butter, oats and honey. Traps were left in place for four nights, checked and emptied every morning soon after dawn. Any animals captured within the traps were identified, sexed if possible, and released.

Hair-sampling tubes

Ten nine centimetre diameter hair-sampling tubes (after Scotts and Craig 1988) were placed in transects at approximately twenty metre intervals along a 200 metre transect. Alternative tubes were baited with meat or a mixture of peanut butter, honey and rolled oats. Each tube was fitted with adhesive paper to collect hairs of small and medium sized mammals that were attracted to the bait. Tubes were left on site for ten nights. Hair samples were identified by specialists using the techniques described by Brunner and Coman (1974) by an expert in the field, Barbara Triggs. Identifications were classified into three levels of reliability: definite, probable and possible.

Transect-based methods

Transect spotlighting survey

The method employed varied on a site by site basis, and was only undertaken during the CRA surveys. A team of two surveyors walked or drove along a transect, varying between 300 metres and eight kilometres in length, searching for arboreal mammals with 50 watt spotlights. An AMG was calculated for each sighting along the transect and entered into the data sheet.

Opportunistic methods

Predator and herbivore scat collection

The large numbers of hairs, and occasionally skeletal remains, in predator scats and pellets results in a high level of confidence in identifications of prey species and is hence an efficient sampling technique for prey animals. In addition, the recording of predator or non-predator scats constitutes records for the species that deposits the scat, providing locality records for species such as the Spotted-tailed Quoll (*Dasyurus maculatus*), Fox (*Vulpes vulpes*), Dingo (*Canis lupus dingo*), Dog (*Canis lupus familiaris*) and Pig (*Sus scrofa*). Due to the unknown time delay between prey ingestion and defecation, the location in which the prey animals lived cannot be accurately known, so this

technique is useful only for detecting the species presence within a general area. However, Lunney *et al.* (2002) showed that on average Dogs and Foxes defecate within a two kilometre radius of the site of prey ingestion.

Predator scats were collected, placed in paper envelopes, labelled and sent to specialist Barbara Triggs for analysis, using the methods described previously for hair tube samples.

The location of herbivore scats was also noted on an opportunistic basis to indicate the presence of an animal. If there was any doubt in herbivore scat identification in the field, samples were brought back for identification by an expert.

Incidental records

Surveyors driving or walking through the park recorded the location of interesting fauna when it was seen or heard. Particular animals targeted by this technique were those undersampled by systematic surveys, including large ground mammals, non-vocalising birds, and secretive, shy and/or rare animals. The date, time, map grid location (usually obtained from a GPS) and microhabitat of the animal were recorded on a data sheet.

2.4 SURVEY TIMING

As indicated above, systematic field surveys have been undertaken within the study area over a number of years. Table 2 summarises the timing of these surveys and the techniques that were undertaken in each season.

Table 2: Timing of DEC systematic fauna surveys within the Nattai and Bargo Reserves.

Survey program	Timing	Techniques employed
Fauna Survey of the Lake Burragorang area (Mt King Ecological Surveys)	1989 – 1994	Elliott trapping, cage trapping, spotlight transects, opportunistic bird and reptile records
National Parks Association Community Survey Bargo River crown lands	October 1996 and July 1997	Bird census, spotlighting, Elliott trapping, reptile search
Comprehensive Regional Assessment (CRA)	April – May 1997	Bird census, reptile search, transect spotlighting, harp trapping, 30 minute bat call detection, streamside search, hair tubes, nocturnal call playback, opportunistic methods
	September 1998	Nocturnal call playback and site spotlight
Warragamba Special Area Surveys – Year 1	December 2002 – March 2003	Bird census, reptile search, site spotlighting, opportunistic methods
	April – June 2003	Nocturnal call playback and site spotlighting
Biodiversity Survey Priorities Surveys	December 2003 – January 2004	Bird census, reptile search, site spotlighting, harp trapping, overnight bat call detection, streamside search, Elliott trapping, opportunistic methods
	June 2004	Elliott trapping, nocturnal call playback and site spotlighting
Warragamba Special Area Surveys – Year 2	January-March 2004	Bird census, reptile search, site spotlighting, harp trapping, overnight bat call detection, streamside search, Elliott trapping, opportunistic methods

3 RESULTS AND DISCUSSION

3.1 OVERVIEW

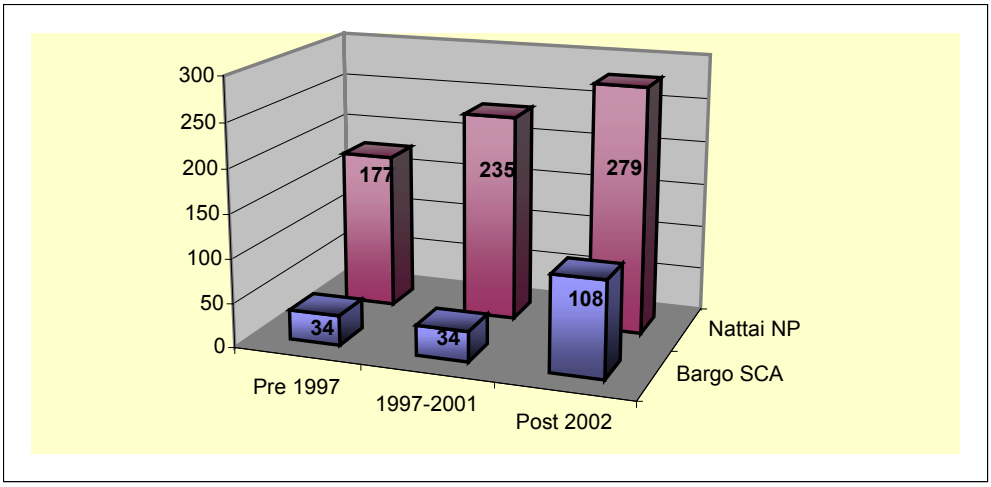
Over 195 systematic fauna survey sites have been completed within the Nattai and Bargo Reserves over several years since 1997. These surveys cover the range of habitats and landscapes present and have been completed during both summer and winter months. While a survey of a reserve system of this size is never comprehensive, it is the first serious attempt at completing a fauna inventory using stratified survey effort. A number of smaller scale surveys have been completed in the adjoining Bargo River crown lands and have contributed valuable records.

Over 280 terrestrial vertebrate fauna species are recorded from the Nattai and Bargo reserves. There are 279 vertebrate fauna species recorded from Nattai National Park elevating it to the to the third highest number of vertebrate fauna species found in any NPWS reserve of the Sydney Basin behind Royal National Park and Blue Mountains (Upper Mountains Area) National Park (NPWS 2003a). Of the 279 species, 22 are listed on the NSW Threatened Species Act, 1995 (NSW TSC Act). Bargo State Conservation Area is a considerably smaller reserve encompassing fewer habitats. A total of 108 species have been recorded with six of those included on the NSW TSC Act.

A complete list of fauna species found in the Nattai and Bargo reserves is provided in Appendix B. While many of the species are common across much of the coastal and hinterland sandstone plateaux, the Burragorang Valley supports a suite of animals that are uncommon to these environments. In addition, a large artificial water body, the expansive Lake Burragorang, attracts water birds that further supplement the range of species present.

The value of dedicated survey effort is apparent in the contribution it has made to building our knowledge of fauna species known to occur in the reserves. Figure 1 illustrates a steady increase in the number of species known to occur in the reserve following major survey effort. Since the implementation of formal surveys in 1997, the number of species known to occur in Nattai NP has increased by 56 percent, while in Bargo a more dramatic rise of 68 percent has resulted from recent survey effort.

Figure 1: Number of terrestrial vertebrate fauna species recorded in Nattai and Bargo Reserves following Systematic Survey



3.2 DIURNAL BIRDS

The relatively high numbers of diurnal bird species within the Nattai and Bargo reserves can be attributed to the variation in habitat types. The marked differences between the sandstone plateau and the grassy box woodlands of the rainshadow valleys have considerable impact on the composition of species that occupy these habitats. Bird diversity is also artificially enhanced by the inclusion of Lake Burragorang on the western boundary of the reserves.

There have been 146 species of bird recorded within Nattai and Bargo reserves. This includes nine species listed on the NSW TSC Act (1995) which are the Regent Honeyeater (*Xanthomyza phrygia*), Glossy Black-cockatoo (*Calyptorhynchus lathami*), Swift Parrot (*Lathamus discolor*), Turquoise Parrot (*Neophema pulchella*), Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), Speckled Warbler (*Pyrrholaemus sagittatus*), Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*), Hooded Robin (south eastern subspecies) (*Melanodryas cucullata cucullata*) and Diamond Firetail (*Stagonopleura guttata*) which are discussed individually in Section 5 of this report. The first of these species is listed as Endangered in NSW, while the remainder are listed as Vulnerable. All except the Glossy Black-cockatoo are united by a preference for the dry grassy woodlands that are found in the Burragorang Valley.

Reid (1999) reported on declining woodland birds within these types of habitats NSW Wheat-Sheep Belt. Many of the species highlighted in that report have been included in the Schedules of the NSW TSC Act and will be dealt with in Section 5. A number of other species included on this list have been widely recorded in the Nattai and Bargo reserves. These include Rufous Whistler (*Pachycephala rufiventris*), Eastern Yellow Robin (*Eopsaltria australis*), Eastern Shrike-tit (*Falcunculus frontatus*), Dusky Woodswallow (*Artamus cyanopterus*) and Varied Sittella (*Daphoenositta chrysoptera*). These species are amongst those listed that are the least restricted to woodland habitats (Pizzey and Knight 1997).

The recent publication of data collected by Birds Australia (Barrett *et al.* 2003) also lists a number of species that appear to have declined since the publication of the first bird atlas (Blakers *et al.* 1984). Species on this list that have been recorded within the reserves include Rockwarbler (*Origma solitaria*), Spotted Quail-thrush (*Cinclosoma punctatum*), Red-browed Treecreeper (*Climacteris erythrops*), White-winged Chough (*Corcorax melanorhamphos*) and Gang-gang Cockatoo (*Callocephalon fimbriatum*). Nattai NP and the Warragamba Special Area, together with the neighbouring Blue Mountains and Kanangra-Boyd NPs play an important role in the conservation of these species and their habitats.

Honeyeaters are indicative of the diversity of bird species found in the reserves. Twenty different honeyeater species have been recorded some showing clear habitat preferences as detailed in Table 3. A group of species, including Eastern Spinebill, New Holland Honeyeater and Little (*Anthochaera chrysoptera*) and Red (*A. carunculata*) Wattlebirds are most abundant on the sandstone tablelands in the east of the reserves. The first three are particularly linked to heathlands and woodlands with *Banksia* spp. in the understorey. Another group of species, including White-naped Honeyeater (*Melithreptus lunatus*), Bell Miner (*Manorina melanophrys*) and Lewin's Honeyeater (*Meliphaga lewinii*), are also restricted to the eastern areas, but are usually associated with more mesic habitats in gullies and moister slopes. The drier woodlands of the Burragorang Valley and, to a lesser extent, Nattai Valleys also has a third suite of species. These have been recorded in smaller numbers and include Fuscous (*Lichenostomus fuscus*), White-plumed (*L. penicillatus*), Regent and Black-chinned Honeyeaters, and the Noisy Miner (*Manorina melanocephala*), though this latter species has also been recorded in disturbed habitats in the east. The Yellow-tufted Honeyeater (*Lichenostomus melanops*) also tends to prefer these drier woodlands, but is also found in other areas, particularly where Grey Gum is present. A number of species appear not to favour any habitat, being found throughout the reserves. These species include Yellow-faced (*Lichenostomus chrysops*), White-eared (*L. leucotis*) and Brown-headed (*Melithreptus brevirostris*) Honeyeaters and the Noisy Friarbird (*Philemon corniculatus*).

There are a number of species found in the Nattai and Bargo reserves that are not considered as threatened species but are unusual in the greater Sydney region. The first of these is the Emu (*Dromaius novaehollandiae*). This species is found in the Burragorang and Nattai Valleys and represents the closest population in a native environment to Sydney. While there are suggestions of Emus being in the valley at the time of European settlement, current populations are most likely relocated animals that were imported by landowners at Yerranderie and Yanderra (D. Ashton pers. comm.). These animals have since maintained a strong presence in woodland habitats of the

Burragorang and Nattai Valleys. The closest naturally occurring populations are found near Mudgee in Munghorn Gap Nature Reserve and Goulburn River National Park.

Table 3: Honeyeaters of the Nattai and Bargo Reserves, including number of records and preferred habitats (see text for details).

Common Name	Records	Location
Eastern Spinebill	166	Sandstone plateaux
New Holland Honeyeater	107	Sandstone plateaux
Yellow-faced Honeyeater	106	Widespread
White-eared Honeyeater	79	Widespread
White-naped Honeyeater	61	Slopes and Gullies
Red Wattlebird	54	Sandstone plateaux
Noisy Friarbird	46	Widespread
Brown-headed Honeyeater	30	Widespread
Little Wattlebird	29	Sandstone plateaux
Yellow-tufted Honeyeater	26	Widespread
Bell Miner	25	Slopes and gullies
Lewin's Honeyeater	22	Gullies
Noisy Miner	21	Burragorang Woodlands and disturbed lands
Fuscous Honeyeater	7	Burragorang Woodlands
Regent Honeyeater	4	Burragorang Woodlands
White-plumed Honeyeater	3	Burragorang Woodlands
Black-chinned Honeyeater (eastern subsp.)	3	Burragorang Woodlands

Another interesting species is the Rockwarbler. It is a small ground feeding bird that has a distribution that is closely tied to the sandstone plateaux of the Sydney Basin Bioregion. Good numbers of this bird have been found in the rocky outcrops on slopes and gullies in the Nattai and Bargo reserves. Also Pilotbirds (*Pycnoptilus floccosus*) are near the northern limit of their distribution in the Sydney Basin Bioregion. The reserves include numerous records of this species (DEC 2004a).

Plate 4: Yellow-tailed Black-cockatoo
©Narawan Williams

Cockatoos (family Cacatuidae) and parrots (family Psittacidae) were two other groups also found to be diverse and abundant. Overall, there have been five species of cockatoo and six species of parrot recorded. Observed during the current surveys were Glossy and Yellow-tailed (*Calyptorhynchus funereus*) (Plate 4) Black-cockatoos and Sulphur-crested (*Cacatua galerita*) and Gang-gang Cockatoos, while the Galah (*Eolophus roseicapillus*) has been recorded by Birds Australia. The Australian King-parrot (*Alisterus scapularis*), Crimson (*Platycercus elegans*) and Eastern (*P. adscitus eximius*) Rosellas and Little Lorikeet (*Glossopsitta pusilla*) and the two threatened parrots listed previously listed have all been recorded within the reserves.

The number of species of birds of prey is also indicative of the habitat diversity. Wedge-tailed (*Aquila audax*) and Little (*Hieraaetus morphnoides*) Eagles are often seen soaring above the broad valleys while the White-bellied Sea-eagle (*Haliaeetus leucogaster*) is found cruising across Lake Burragorang or tracing some of the larger rivers such as the Wollondilly and the Nattai. Swamp Harriers (*Circus approximans*) have been seen near Blue Gum Creek in close proximity to Thirlmere Lakes, while Whistling Kites (*Haliastur sphenurus*) have been recorded near

Murphys Crossing. Smaller species such as Australian Hobby (*Falco longipennis*) and Nankeen Kestrel (*F. cenchroides*) are also infrequently encountered in the open valleys. Peregrine Falcons (*Falco peregrinus*) were also observed in flight, though were more commonly identified from their tell-tale whitewash marked roosts on escarpment edges and cliff tops.

Twenty-three species of birds are closely associated with the aquatic habitats provided by Lake Burragorang. These include Black Swan (*Cygnus atratus*), Australian Pelican (*Pelecanus conspicillatus*), White-faced Heron (*Egretta novaehollandiae*), Great Egret (*Ardea alba*), Pacific Black Duck (*Anas superciliosa*), Royal Spoonbill (*Platalea regia*), Great Crested Grebe (*Podiceps cristatus*) and Little Pied Cormorant (*Phalacrocorax melanoleucos*). Numbers of these species are all inflated by the presence of this permanent water body.

The sandstone plateaux provides an open sclerophyllous heath and shrub woodland that attracts birds such as Eastern Spinebill, White-throated Treecreeper (*Cormobates leucophaeus*), Grey Shrike-thrush (*Colluricincla harmonica*), Spotted Pardalote (*Pardalotus punctatus*), Yellow-faced Honeyeater, Brown Thornbill (*Acanthiza pusilla*), Grey Fantail (*Rhipidura albiscapa*) and Crimson Rosella. Off the ridges and exposed slopes sheltered forests develop and form habitat for some different species. These wetter influences provide habitat for the Eastern Whipbird (*Psophodes olivaceus*), Golden Whistler (*Pachycephala pectoralis*), Superb Lyrebird (*Menura novaehollandiae*) and White-browed Scrubwren (*Sericornis frontalis*). In the wettest gullies, species typical of coastal rainforest, such as Black-faced Monarch (*Monarcha melanopsis*), Brown Gerygone (*Gerygone mouki*), Bassian Thrush (*Zoothera lunulata*) and Yellow-throated Scrubwren (*Sericornis citreogularis*) are found. Many of these species reach the western limit of their distribution in the reserves.

In contrast, the Burragorang Valley is characterised by a fragmented cover of grassy box woodlands. It represents one of the more unique habitats for birds found within the reserve system of the Sydney Basin Bioregion. The conservation significance of these woodlands for bird species is underlined by the seven threatened species that are known to occur within them. However, there are a number of other species that are not included on the threatened species list but are primarily found in these habitats. These include Dusky Woodswallow, Restless Flycatcher (*Myiagra inquieta*), Weebill (*Smicrornis brevirostris*) and Jacky Winter (*Microeca fascinans*).

3.3 NOCTURNAL BIRDS

The Nattai and Bargo reserves feature all of the nocturnal bird species that are known to occur in the Sydney Basin Bioregion. These include the Masked, Powerful and Sooty Owls. All are listed as Vulnerable on the NSW TSC Act. The latter two species have been recorded in good numbers. An additional threatened owl species, the Barking Owl, has been recorded less than two kilometres from the reserve boundary, and given the similarity of habitat, would be expected to make use of the reserves. These species are discussed in more detail in Section 5.

Other nocturnal bird species are widespread and more commonly recorded. Southern Boobook (*Ninox boobook*) and Australian Owlet-nightjar (*Aegotheles cristatus*) are by far the most frequently heard night birds, followed by Tawny Frogmouth (*Podargus strigoides*) and White-throated Nightjar (*Eurostopodus mystacalis*). The Barn Owl (*Tyto alba*) is uncommon away from the open cleared habitats of the Burragorang Valley.

3.4 ARBOREAL MAMMALS

Eight species of arboreal mammal have been recorded: Common Brushtail Possum (*Trichosurus vulpecula*), Common Ringtail Possum (*Pseudocheirus peregrinus*), Sugar Glider (*Petaurus breviceps),* Greater Glider (*Petauroides volans*), Feathertail Glider (*Acrobates pygmaeus*), Eastern Pygmy-possum (*Cercartetus nanus*), Yellow-bellied Glider (*Petaurus australis*) and Koala (*Phascolarctos cinereus*). The latter three species are listed as vulnerable on the NSW TSC Act. Further descriptions of these species are provided in Section 5.

Greater Gliders (Plate 5) are common in the taller forests found in the gullies incising the sandstone plateaux. The abundance of the gliders varies from site to site depending on the prevalence of tree hollows. In the east and north of the reserves, tall Mountain Blue Gum characterises many of the gully lines and alluvial flats. In sites with an older age class of trees, Greater Glider abundance reached more than four individuals per 200 metres of spotlighting. Greater Glider densities fall in many of the more accessible gullies, as they have been logged and trees are mostly regrowth to mature age and have not yet developed hollows. Gullies in the south of the reserve are drier and cooler, and support

forests dominated by Grey Gum, Mountain Grey Gum and River Peppermint. While Greater Gliders are still common in these gullies, densities were not as high as at locations to the north east. The fur colour of this species varies with individuals being black, black and white, grey or pure white. All of these colour variations have been observed in the Nattai reserves.

Plate 5: Greater Glider ©Narawan Williams

The Common Brushtail Possum is a well-known animal on the fringe of urban areas. While it has successfully adapted to the urban environment, in the study area it has a distinct preference for the open grassy woodlands found in the Burragorang Valley. This means that the species is virtually absent from the gullies across the sandstone plateau.

Sugar Gliders appear to be more evenly distributed across the range of habitats present in the reserves. These gliders are most frequently detected by their distinctive 'yapping' call rather than by sight. The closely related Squirrel Glider (*Petaurus norfolkensis*), a species listed on the NSW TSC Act, has not been recorded within the reserves. However, there has been evidence of them found in bone fragments found within Powerful Owl pellets collected just north of the reserves near Nattai village (D. Ashton pers. comm). A number have also been observed to the west in Yerranderie SCA (DEC, in prep.) and also to the east on the Woronora Plateau (Phillips *et al.* 1996). This threatened species is likely to occur in the Nattai reserves at low abundance with greater survey effort required to confirm its presence.

The Common Ringtail Possum was most frequently observed in dry forests and woodlands with a dense shrub understorey. Such habitats are in abundance on the sandstone plateaux and dry escarpment slopes. It is often observed feeding in these forests in small shrubs of the genera *Banksia* and *Acacia.*

The smallest arboreal mammals found are the Feathertail Glider and Eastern Pygmy-possum. Both are not commonly recorded, as spotlighting is not an efficient method of detecting their presence. There have been three observations of the Feathertail Glider in the reserves with two in the Nattai River valley and one near Jooriland in the Burragorang Valley. There are anecdotal reports of these animals being encountered in forests and woodlands near the urban interface between Colo Vale and Picton. The Eastern Pygmy-possum has been recorded in the Bargo crown lands but not within the reserves although it would certainly be expected to occur. This species is discussed in more detail in Section 5.

3.5 BATS

There are two groups of bats in Australia: the Megachiroptera (fruit bats) and the Microchiroptera (insectivorous bats). The latter species are small insect and nectar feeding flying mammals. Some of these species are amongst the smallest mammals in the world, weighing less than four grams. Microchiropteran bats are nocturnal and largely dependent on echolocation to navigate and feed. Australia-wide, the autecology of this group of animals is not well known, with many species only recently described and many more under continuing taxonomic review.

In the Nattai and Bargo reserves, sixteen different microchiropteran bat species have been positively identified. Eleven of these have been captured in harp traps and five species have only been identified from calls recorded using Anabat. The species that have been trapped are the Eastern Horseshoe-bat (*Rhinolophus megaphyllus*), Gould's Long-eared Bat (*Nyctophilus gouldi*), Lesser Long-eared Bat (*N. geoffroyi*), Large-eared Pied Bat* (*Chalinolobus dwyeri*), Chocolate Wattled Bat (*C. morio*), Gould's Wattled Bat (*C. gouldii*), Large-footed Myotis* (*Myotis adversus*), Little Forest Bat (*Vespadelus vulturnus*), Southern Forest Bat (*V. regulus*), Large Forest Bat (*V. darlingtoni*) and Eastern Bent-wing Bat* (*Miniopterus schreibersii oceanensis*). The species only identified from call were an undescribed Freetail-bat (*Mormopterus* sp. 1), Eastern Freetail-bat* (*M. norfolkensis*), Greater Broad-nosed Bat* (*Scoteanax ruepelli)*, Eastern Broad-nosed Bat (*Scotorepens orion*) and White-striped Freetail-bat (*Nyctinomus australis*). A number of records of the latter species were made opportunistically during other night time surveys as this bat makes an echolocation signal that is audible to the human ear. The analysis of bat ultrasonic calls is not an exact science and so the

Plate 6: Eastern Horseshoe-bat ©David O'Connor

interpretation of calls is allocated a reliability or accuracy based on the closeness of match with reference calls. The Eastern False Pipistrelle* (*Falsistrellus tasmaniensis*), a vulnerable species under the NSW TSC Act, has been assigned a lower level of reliability and is thought to probably occur based on the interpretation of call signals. A number of the species listed above (those with an asterisk*) are listed on the NSW TSC Act and these will be dealt with further in Section 5.

The suite of bat species present within the Nattai and Bargo Reserves is typical of the eastern sandstone environments of the Sydney Basin Bioregion. Many of these species are likely to have large home ranges and it is not known whether each of these species roost in the Nattai and Bargo reserves. There were no clear partitions in habitat use between the species except the Large-footed Myotis, which is closely aligned to streams and river systems.

A number of these species (Eastern Horseshoe-bat (Plate 6), Large-eared Pied Bat, Eastern Bent-wing Bat and Large-footed Myotis) are cave roosting species (Churchill 1998). They are also known to inhabit disused mine shafts, some of which are still prominent in the Nattai Valley. It is these species that are likely to be disturbed by changes or modifications to mine entrances and tunnels. Other species are tree roosting species within hollows, spouts and under bark (Churchill 1998).

Of the fruit bat species, only the Grey-headed Flying-fox (*Pteropus poliocephalus*) is known to occur in the study area. However, there are no documented records of this species from within the reserves. This is unusual as this threatened species is commonly observed on the eastern fringes between Yerrinbool and Lakesland. Orchards are prevalent in the area and fruit crops are often targeted by the species. This species is listed on the NSW TSC Act and is addressed in Section 5.

3.6 Other Native Mammals

Ground mammals are difficult to sample adequately. This is because they either require a large, labour intensive trapping effort (for example for Dasyurid and *Rattus* species), are large bodied, wide-ranging habitat generalists (eg. Wombats (*Vombatus ursinus*), wallabies, kangaroos), or prefer habitats that are difficult to access (e.g. Brush-tailed Rock-wallabies (*Petrogale penicillata*)).

Plate 7: Eastern Grey Kangaroos in the Burragorang Valley ©DEC

Five species of Macropod have been observed within the Nattai and Bargo reserves during these surveys, mostly from opportunistic records and secondarily from spotlight and hairtube surveys. These were the Swamp Wallaby (*Wallabia bicolor*), Red-necked Wallaby (*Macropus rufogriseus),*

Common Wallaroo (*M. robustus),* Eastern Grey Kangaroo (*M. giganteus*) and Brush-tailed Rock-wallaby. The latter species is listed as Endangered on the NSW TSC Act and is discussed further in Section 5.

Eastern Grey Kangaroos are found in large mobs in open grasslands and woodlands of the Burragorang Valley. Some mobs easily exceed 200 individuals and are an impressive sight in the early and late parts of the day (Plate 7). Closer to the forests and woodlands of the escarpment footslopes and the Douglas Scarp, Wallaroos and Red-necked Wallabies are commonly seen in small groups or as individuals. Swamp Wallabies, however, are uncommon on the valley flats and open spaces, preferring the cover provided by the vegetation on the ridges and gullies associated with the sandstone plateaux.

No evidence was found during these surveys to confirm the presence of the Parma Wallaby (*Macropus parma*) or the Long-nosed Potoroo (*Potorous tridactylus*). Both of these species are particularly shy, and are difficult to sample even where the species is known to occur. There are historical and/or anecdotal records of these animals, and while the habitat appears unlikely to support them, more intensive trapping and searches of gullies are required to reach firmer conclusions. The potential for the persistence of these species should not be entirely discounted.

While the Spotted-tailed Quoll is the only threatened species amongst the ground mammals known to occur in the reserves (see Section 5), an interesting diversity of smaller species have been recorded. Brown Antechinus (*Antechinus stuartii*) has been recorded from both Elliott trapping and hair sampling methods. This small marsupial has been recorded from a wide variety of habitats ranging from tall Blue Gum Forests of the Nattai River to ridgetops on sandstone in the Bargo River crown land. Yellow-footed Antechinus (*Antechinus flavipes*) has not been recorded within the reserves but there is a record of this species nearby at Buxton. Other commonly recorded species include the Bush Rat (*Rattus fuscipes*) and, when near human development, the introduced Black (*R. rattus*) and Brown (*R. norvegicus*) Rats and House Mouse (*Mus musculus*).

The Common Dunnart (*Sminthopsis murina*) has been recorded in the open area around the Jooriland Homestead in the Burragorang Valley. Landowners near the fragmented portions of the Nattai Additions near Scabby Flat have also observed this species (Plate 8). Common Dunnarts have a patchy distribution across woodlands and open forests of eastern Australia. They are infrequently captured using Elliott traps as they are trap-shy and usually occur at low abundance.

Plate 8: Common Dunnart observed near Scabby Flat
©Boyd Clouston

Bandicoots are known to occur in the reserves however the species of bandicoot present has not been identified because only diggings have been observed. These diggings are easily identifiable as Bandicoot by the triangular or conical hole they leave. While it is most likely that they are the Long-nosed Bandicoot (*Perameles nasuta*), further cage trapping work may confirm the species present.

Water Rats (*Hydromys chrysogaster*) have been observed on the Wollondilly and Nattai Rivers at a number of different locations. This semi-aquatic rodent is likely to be found alongside the larger rivers and streams throughout the reserves.

Records indicate that Common Wombats are widely distributed and abundant throughout the reserves. They make use of most habitats and tend to exhibit a preference for gullies, alluvial flats and sites with deeper soils where burrows are more easily excavated.

Australia's two monotremes, the Platypus (*Ornithorhynchus anatinus*) and Short-beaked Echidna (*Tachyglossus aculeatus*), are both known to occur in the reserves. These egg-laying mammals occupy different habitats within the study area. Echidnas have been recorded infrequently from a number of different habitats, with observations of individuals being made in the Nattai Valley and Blue Gum Creek and evidence of diggings across many habitats on and below the sandstone plateaux. Platypus are occasionally recorded from larger rivers and streams throughout the region. While only one observation of the Platypus has been made at McArthurs Flat on the Nattai River, it is reasonable

to assume that they will make use of other rivers that dissect Nattai NP. There is anecdotal evidence of Platypus on the Bargo River (Belik and Close 1997) within the crown lands.

Dingoes (*Canis lupus dingo*) are regularly observed in the Nattai and Wollondilly Valleys and have been for many years. Evidence of continued breeding is apparent with four pups seen near Martins Creek (D. Connolly pers. obs.). Some of those encountered in the Burragorang Valley displayed a Wild Dog influence while those in the Nattai Valley were more representative of pure Dingo. Nevertheless it is not possible to ascertain the level of purity in the species on observation alone. A research project on Dingo across the Warragamba Special Area will commence shortly, which aims to distinguish the distribution of Dingo in comparison to Dog across the region (B. Purcell pers. comm.). As is typical for Dingoes our analyses of Dingo/Wild Dog scats confirmed that Swamp Wallabies make up a large proportion of their diet.

3.7 REPTILES

The reptile fauna of the study area is typical of that found across the sandstone hinterland of Sydney. The Broad-headed Snake (*Hoplocephalus bungaroides*) is the only reptile on the threatened species list known to occur in the Nattai area. While not found within the reserves, it has been found in the adjoining Bargo River crown lands. More detail on this species is provided in Section 5.

Skinks are the most diverse group of reptiles with a total of sixteen species identified. The most frequently encountered and abundant were the Copper-tailed Ctenotus (*Ctenotus taeniolatus*), Dark-flecked Garden Sunskink (*Lampropholis delicata*) and Eastern Water-skink (*Eulamprus quoyii*). These species are typical of the most common habitats within the reserves ie. the mosaic of sandstone forests and woodlands on the plateau. Rocky outcrops and cliff edges support White's Rock-skink (*Egernia whitii*), Copper-tailed Ctenotus and Red-throated Cool-skink (*Bassiana platynota*). Creeklines rarely support skinks other than the Eastern Water-skink. The Dark-flecked Garden Sunskink is a habitat generalist that is found in almost all habitats wherever there is a sufficient litter layer. The much larger Cunningham's Spiny-tailed Skink (*Egernia cunninghami*) has only been recorded in the open box woodlands found in the additions in the far west of Nattai NP.

Plate 9: Bell's Phase Lace Monitor
©Nick Corkish/DEC

Dragons are relatively common throughout the reserve. On larger creeks and streams the Eastern Water Dragon (*Physignathus lesueurii*) is frequently observed basking on rocks and boulders adjoining large pools of water. On exposed woodlands associated with dry slopes and ridgetops both the Mountain Heath Dragon (*Tympanocryptis diemensis*) and Jacky Lashtail (*Amphibolurus muricatus*) are often encountered. The latter exhibits a preference for the grassy woodlands of the Burragorang Valley, while the former is a feature of the sandstone plateaux. Both of these species are similar in appearance but can be distinguished by the number of spines and the colouration of the mouth.

Three species of Gecko have been recorded. The Broad-tailed Gecko (*Phyllurus platurus*) is most commonly found on sandstone clifflines and overhangs in sheltered forests. Lesueur's Velvet Gecko (*Oedura lesueurii*) is encountered amongst rock outcrops, boulders and pagodas associated with exposed sandstone ridgetops where it is usually found during the day sheltering underneath exfoliating rock. This species is prey for the endangered Broad-headed Snake. The attractive Thick-tailed Gecko (*Underwoodisaurus milii*) has also been recorded in the reserves, although its distribution appears heavily weighted toward the footslopes of the west Nattai Walls on the Permian sediments of the Burragorang Valley.

Lace Monitors (*Varanus varius*) have commonly been observed in the dry open woodlands of the Burragorang and Nattai River Valley. Some of the individuals seen in the Burragorang Valley were of

the Bell's Phase that displays a distinctive thick black and yellow band colouration (Plate 9). This form is more typically found further west in dry parts of NSW and Queensland (Wilson and Swan 2003). The observations in the reserves highlight the dry westerly ecosystems that are located in the Burragorang Valley.

Single individuals of several snake species have been found. Most of these species are from the Elapid family, including the Yellow-faced Whipsnake (*Demansia psammophis*), Mainland Tiger Snake (*Notechis scutatus*), Red-bellied Black Snake (*Pseudechis porphyriacus*), Eastern Small-eyed Snake (*Rhinoplocephalus nigrescens*) and Eastern Brown Snake (*Pseudonaja textilis*). Two other species from this family, Mustard-bellied Snake (*Drysdalia rhodogaster*) and White-lipped Snake (*D. coronoides*) are museum specimens that have been collected from in or adjoining the reserves. The Blackish Blind Snake (*Ramphotyphlops nigrescens*) is a small worm-like snake most often found underneath sandstone rocks, logs and boulders. They are occasionally encountered on the Nattai Tableland. Diamond Pythons (*Morelia spilota spilota*) have been recorded from several locations in sheltered forests.

The Eastern Snake-necked Turtle (*Chelodina longicollis*) has been recorded near the Nattai River and Blue Gum Creek. This species is also occasionally observed crossing roads in the area, moving between farm dams, soaks and small streams.

3.8 FROGS

The success of frog surveys is largely dependent on the availability of suitable habitat, recent climatic conditions, season and immediate weather conditions. Unfortunately, in the lead up to and during Spring-Summer 2003/4, survey conditions were extremely dry and warm, providing very poor conditions for conducting frog surveys. Despite this, twelve frog species have been recorded from the reserves. The most significant species recorded in the Nattai and Bargo reserves are the Red-crowned Toadlet (*Pseudophryne australis*) and the Giant Burrowing Frog (*Heleioporus australis*). Both of these species are listed as Vulnerable in the NSW TSC Act and are discussed in more detail in Section 5. Tadpoles of the latter species were found in the Little River in Bargo SCA (Plate 10).

Plate 10: Tadpoles of Giant Burrowing Frog were found in this stream in Bargo SCA. ©DEC

Six species from the genus *Litoria,* commonly called tree frogs, have been recorded in the reserves. The Green Stream (*L. phyllochroa),* Lesueur's (*L. lesueurii*) and Blue Mountains Tree (*L. citropa*) Frog prefer habitats with running water. The other species in this genus are adapted to a wider variety of habitats and are Keferstein's Tree (*L. dentata*), Verreaux's Tree (*L. verreauxii*) and Peron's Tree (*L. peronii*) Frogs.

The Common Eastern Froglet (*Crinia signifera*) is the most frequently encountered frog and is found in virtually all damp and wet habitats across the reserves. The Striped Marsh Frog (*Limnodynastes peronii*), Spotted Marsh Frog (*L. tasmaniensis),* Bullfrog (*L. dumerilii)* and Bibron's Toadlet *(Pseudophryne bibronii*) have also been recorded at sites that are characterised by damp bogs, soaks and dams. The latter two species are also often heard calling from ponds and soaks in dry creeks. The other two species recorded are Haswell's Froglet (*Paracrinia haswelli*) and Smooth Toadlet (*Uperoleia laevigata*), which are small cryptic species. The former nears the southern limit of its distribution in the reserves.

3.9 INTRODUCED SPECIES

Introduced mammal species are found in a number of different habitats in the Nattai Reserves. Foxes, Pigs, Wild Dogs, Feral Cats (*Felis catus*), Goats (*Capra hircus*), Cattle (*Bos taurus*), Rabbits (*Oryctolagus cuniculus*), House Mice and Black and Brown Rats have all been recorded in or adjoining the reserve. The presence of these species is not surprising as the reserves adjoin urban fringes in

the east and former grazing country in the Burragorang and Nattai valleys. Map 5 shows the location of records of these species.

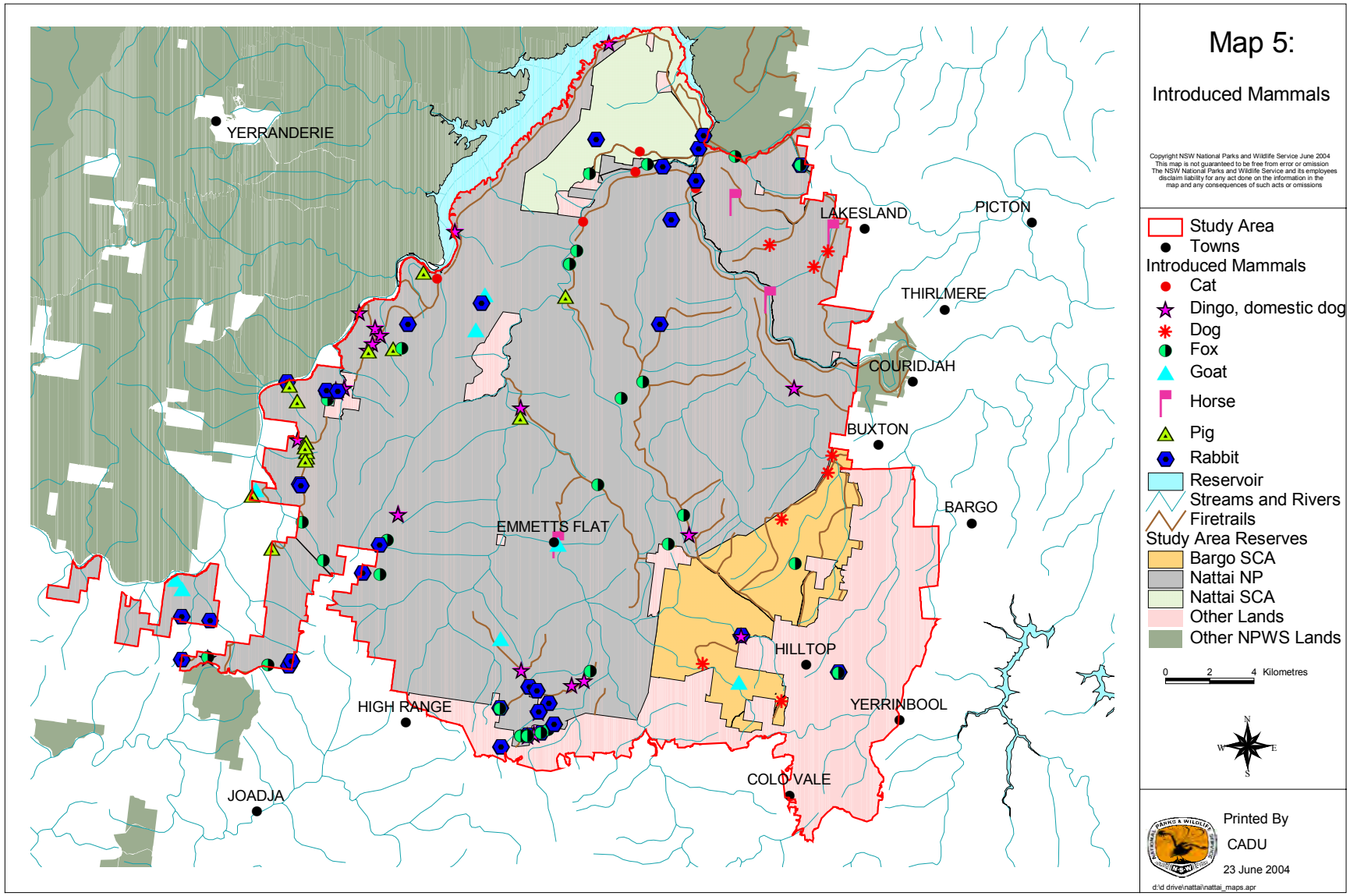
Pigs have most commonly been recorded in the Burragorang and Nattai Valleys foraging in the open country and wallowing in the soaks and easily dug soils of the deep alluviums of stream banks and terraces. They were not recorded on the sandstone plateau during these fauna surveys.

Foxes and wild Dogs appear to utilise a far greater number of habitats in the reserves and roam between the valleys and the plateaus along fire trails. In the eastern portions of Nattai NP and Bargo SCA, the proximity of urban development means that domestic dogs are occasionally observed roaming along fire trails. Foxes are more commonly observed in open and fragmented country in the valleys or near grazing lands on the perimeters of the reserves. However they are not restricted to these areas and fox scats have been collected from numerous locations along fire trails of the Nattai Tableland (Map 5).

These introduced species are likely to be having a significant negative impact on the native terrestrial flora and fauna of the park. Five of the species are listed, or are pending finalisation, as a Key Threatening Process on the TSC Act and the Commonwealth EPBC Act, as they are known to adversely affect threatened species and have the potential to cause other species to become threatened. The threats posed to native fauna by each animal are summarised as follows:

- Feral Rabbits impact negatively on indigenous species via competition for resources, alteration of the structure and composition of vegetation, and land degradation. Predation by the Fox is a major threat to the survival of native Australian fauna, with non-flying mammals weighing between 35 and 5500 grams and ground-nesting birds at greatest risk. Fox predation has been implicated in limiting habitat choice and population size of a number of medium-sized marsupials (NSW Scientific Committee 1998a). The fact that Foxes prey upon native animals within the park is evident from scat analysis, as summarised in Section 3.10 below.
- Feral Pigs compete for food resources with native fauna, actively predate upon native birds, reptiles, bird and reptile eggs, and frogs, and are capable of significant habitat degradation as a result of their behaviour and feeding habits (NSW Scientific Committee 2004a).
- Feral Goats were given a preliminary determination as a Key Threatening Process in June 2004. They cause habitat degradation and have the ability to significantly alter the habitat of native fauna. Goats may compete with native fauna for food, water and shelter (NSW Scientific Committee 2004b).
- Feral Cats threatens native fauna by direct predation. Cats are carnivorous and capable of killing vertebrates up to three kilograms. Preference is shown for mammals weighing less that 220 grams and birds less than 200 grams, but reptiles, and amphibians are also eaten (NSW Scientific Committee 2000).

Six introduced bird species have been recorded within the study area all in small numbers. This may result from not targeting the most disturbed habitats when undertaking systematic bird surveys. The number of records, and possibly species, would be increased by work in the cleared and urban areas in the east of the study area. Of the species that have been recorded, the Common Starling (*Sturnus vulgaris*) has been observed most frequently, with sightings at Yerrinbool, the cleared land around Mt. Wanganderry and in the Burragorang Valley. The Common Myna (*Acridotheres tristis*) has also been observed at the former two locations, as have the House Sparrow (*Passer domesticus*), European Goldfinch (*Carduelis carduelis*) and Eurasian Skylark (*Alauda arvensis*). The Eurasian Blackbird (*Turdus merula*) was recorded by Birds Australia near the disturbed habitats at “Wattle Ridge” and is also likely to be recorded around homesteads outside the reserve system. The Rock Dove (*Columba livia*) has only been recorded during the first Birds Australia Atlas Surveys so precise details of its location are not known, though it is highly likely to occur around the urban areas in the eastern parts of study area.


YERRANDERIE
LAKESLAND
PICTON
THIRLMERE
COURIDJAH
BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Map 5:
Introduced Mammals
Copyright NSW National Parks and Wildlife Service June 2004
This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees
disclaim liability for any act done on the information in the
map and any consequences of such acts or omissions
Study Area
Towns
Introduced Mammals
Cat
Dingo, domestic dog
Dog
Fox
Goat
Horse
Pig
Rabbit
Reservoir
Streams and Rivers
Firetrails
Study Area Reserves
Bargo SCA
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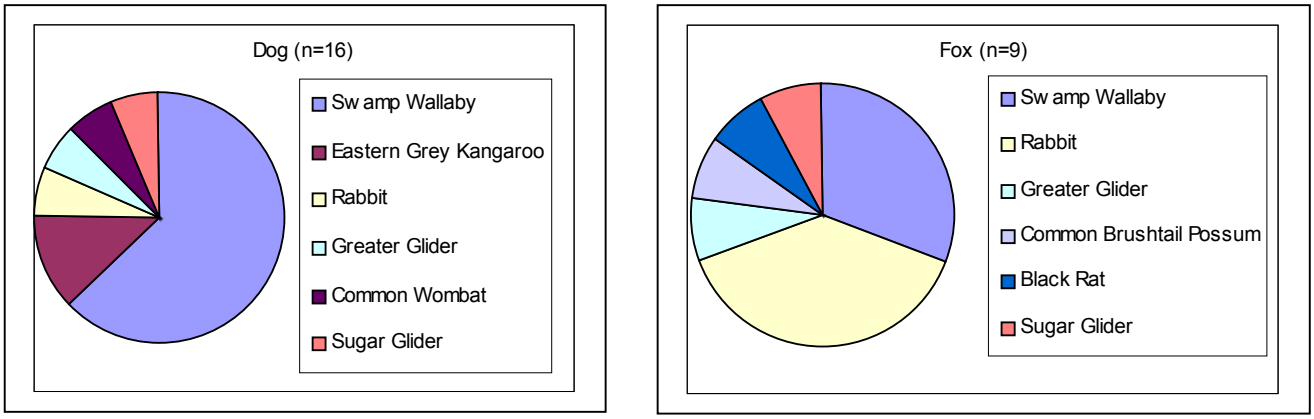
3.10 Feral Predator Scat Analysis

The diet of feral predators can be garnered from an analysis of scat composition. This is an effective technique for analysing the prey composition of foxes and wild dogs/dingoes. While no accurate locations can be assigned to where the prey was captured, there are trends apparent in the type of species that are favoured by these introduced predators. Some existing research (Lunney *et al.* 2002) suggests that the consumption of prey occurs within a two kilometre radius of the location of the scat.

Figure 2 illustrates the vertebrate prey composition for Foxes and wild Dogs collected during these surveys. The results suggest that dogs have a preference for larger prey with almost three-quarters of scats analysed containing Swamp Wallaby and Eastern Grey Kangaroo. In contrast, the results of the fox scat analyses highlight a greater prevalence of smaller prey items such as Rabbits, Black Rat, possums and gliders. Similar trends were found in Kanangra Boyd NP (DEC, 2004d). Only limited conclusions can be drawn from these analyses due to the relatively low number of scats analysed and the bias in the location of the scat locations. An analysis of predator scats across the region is being undertaken as part of the SCA fauna survey program, with the aim of yielding more comprehensive information about prey composition (DEC in prep.).

Figure 2: Vertebrate prey items (hair and skeletal remains) identified from Fox and Dingo/Dog scats.



3.11 Landscape Patterns in Fauna Distribution

There are two distinctive land systems in the study area that appears to exert the strongest influence on the fauna characteristics: the Sandstone Plateau and the broad Burragorang Valley.

The Sandstone Plateau

Primarily, Nattai NP and Bargo SCA are thought of as sandstone reserves. Around two thirds of the area is characterised by dramatic sandstone cliffs, escarpments, gullies and plateaux. The assemblage of fauna that occupies these environments is typical of other sandstone environments of the coast and hinterland of the Sydney Basin such as the lower Blue Mountains and the Woronora Plateau. The climate is mild and the area receives relatively good rainfall.

Sandstone ridgeline habitats support trees that tend to be low and often widely spaced with a dense shrub and heath layer comprised of sclerophyllous species that produce abundant flowering episodes. These attract nectivorous bird and mammal species. The bird assemblages in particular are very diverse for groups of birds such as the Honeyeaters. Over ten Honeyeater species have been recorded in these environments. Other birds include the Grey Fantail, White-throated Treecreeper and Brown Thornbill. Common reptiles in the leaf litter include Dark-flecked Sunskink and amongst rock outcropping, the Copper-tailed Skink and Mountain Heath Dragon. Arboreal mammals are uncommon with a low density of the Common Ringtail Possum recorded.

By way of contrast, sandstone gullies feature taller forests with a greater number of hollow bearing trees that grow above soft ferns, mesic shrubs and in very sheltered locations, rainforest trees. Arboreal mammals, the Greater and Sugar Glider are common with Yellow-bellied Glider present in taller forests where Grey Gum occurs. Characteristic bird species of these gully habitats include the Eastern Yellow Robin, Golden Whistler and Spotted Pardalote, with species such as Black-faced Monarch most common in the wettest environments. Reptile diversity is low given the limited sunlight

that penetrates the canopy. The Eastern Water-skink is frequently observed on small streams and Broad-tailed Geckoes are present in crevices of rock overhangs.

The Burragorang Valley

The Burragorang Valley is a distinctively different habitat from those found on the sandstone tablelands. The rainshadow produces a dry climate of less than 750 millimetres per year, and in combination with the richer igneous derived soils, produces a tall open grassy woodland that includes Forest Red Gum and Grey, Yellow and White Box. This habitat is more closely aligned to the habitats of the central west slopes of NSW, where similar climatic regimes, elevations and soils are more prevalent. There is limited overlap of plant species between the Burragorang Valley and the sandstone tablelands, with the distinctive transition to Black Cypress Pine along the Douglas Scarp near Murphys Crossing a dramatic example of these differences. Fauna respond to these changes and as a consequence the Burragorang Valley stands out as supporting combinations of species not found elsewhere in the reserves.

The grassy woodlands of the valley are home to a suite of birds listed under the Threatened Species Act, 1995. Often named under the banner “declining woodland birds” (Reid 1999), the group includes Brown Treecreeper, Diamond Firetail, Hooded Robin, Black-chinned Honeyeater and Speckled Warbler. Within Nattai NP, these species are unique to the Burragorang Valley. Other species such as the Regent Honeyeater, one of the rarest birds in Australia, also make use of the woodlands in the Burragorang Valley. The woodlands include one of the few winter flowering eucalypt species (White Box) found in the reserve and the Bioregion. Other trends in fauna are also apparent amongst some of the more common species. The Common Brushtail Possum is the most frequently recorded arboreal mammal in these woodlands reflecting the original habitat preferences for this species prior to European occupation. The distinctive Bell’s form of the Lace Monitor, more common in western NSW has never been recorded on the sandstone plateau in Nattai or adjoining sandstone environments in the study area yet is present in the Burragorang Valley.

There are few examples of these grassy woodlands remaining in the Sydney Basin Bioregion. Fewer still are protected within formal reserves. This makes the Burragorang Valley highly significant area for the combination of fauna species that are found, and the high numbers of threatened species that occur within it. It signifies that much of the habitat for these species has been flooded in the once extensive valley. The major fauna corridor to the grassy woodlands of the Cumberland Plain now no longer exists.

4 FUTURE WORK

Every effort was made during the recent systematic fauna surveys to sample the full variety of habitat types and fauna groups within the Nattai and Bargo reserve, and hence obtain a comprehensive picture of terrestrial vertebrate fauna within the park. The surveys were, however, subject to a number of constraints, leading to limitations and a recommendation that further work by undertaken within the area in coming years. Most of the vegetation communities described and mapped in DEC (2004b) have been sampled for fauna. The steep, inaccessible escarpments underneath the East and West Nattai Walls and Buxton Plateau have been sampled the least. These comprise a mix of exposed open ironbark woodlands and sheltered Grey Gum gullies. Extensive sampling has occurred within the same communities on the Scotts Main Range. Similarly, a review of sampling of the communities of the Burragorang Valley floor indicates lower levels of effort than is desirable. However, again these communities have been sampled a number of times in the adjoining Yerranderie SCA. Some large spatial gaps remain evident on the inaccessible Wanganderry Tableland. The rocky heath complex that comprises pagoda like rock outcrops is certainly worthy of future investigation, particularly for threatened reptiles such as the Broad-headed Snake.

Areas of endeavour that should be targeted in the future include:

- Maintain a monitoring program for the Brush-tailed Rock-wallabies at Bullio in accordance with the Recovery Plan for the species. Consultation with the Recovery Team should be maintained particularly in relations to the management of feral predators.
- Undertake further surveys to estimate the abundance of the Koala population at High Range. Further research should examine the interconnectedness with other populations in the Wollondilly Catchment.
- Address the undersampling of frogs due to the prolonged and intense drought. Further work that assists in developing an understanding of the distribution and abundance of the Red-crowned Toadlet and the Giant Burrowing Frog would be a valuable contribution to the conservation management of the species across the region. Further frog sampling may also clarify the presence of Littlejohns Tree Frog (*Litoria littlejohni*).
- Further targeted survey effort in the Bargo SCA additions may confirm anecdotal evidence of Brush-tailed Rock-wallabies and Koalas.
- Even though all habitats had at least some survey effort, some areas would benefit from additional survey. The rocky habitats of the Wanganderry Tableland and the steep slopes of the Nattai Valley are two areas that are under-surveyed within the reserves, mainly due to difficulties of access. Further survey of these habitats may reveal additional records of such species as Broad-headed Snakes and Koalas within the reserves.
- Any systematic work undertaken in the future should be undertaken utilising the methods described in Section 2.3 and in NPWS (1997). Data entry into the BSS is the responsibility of the survey coordinator and time and resources for data entry should be included within the original survey proposal. This will ensure that the data is available to all staff and clients of DEC with accurate details and also the data to be included in any analysis of systematic data undertaken.

5 THREATENED SPECIES PROFILES

This section provides a profile of each of the threatened fauna species that are known or highly likely to occur within the Nattai and Bargo reserves. The aim of each of these profiles is to provide the following: a background on the species biology; a summary of threats to the species; an assessment of how well the species is protected in the region; a map of known records of the species in the study area; and an appraisal of the distribution and status of the species in the Nattai and Bargo reserves.

The list of threatened species contains records of various levels of reliability. For this reason, a species profile has not been generated for all of the threatened species listed on the Atlas of NSW Wildlife as occurring within the reserves. Only those species that have been directly or reliably observed or have habitat that can strongly be tied to the reserves have been included in the list of profiles. Table 4 provides the list of threatened species recorded within the Atlas of NSW Wildlife for the area, together with annotation for each species regarding the latest record, reliability of identification and a rationale for the generation of a species profile.

Table 4: Threatened fauna species recorded within the Nattai and Bargo reserves.

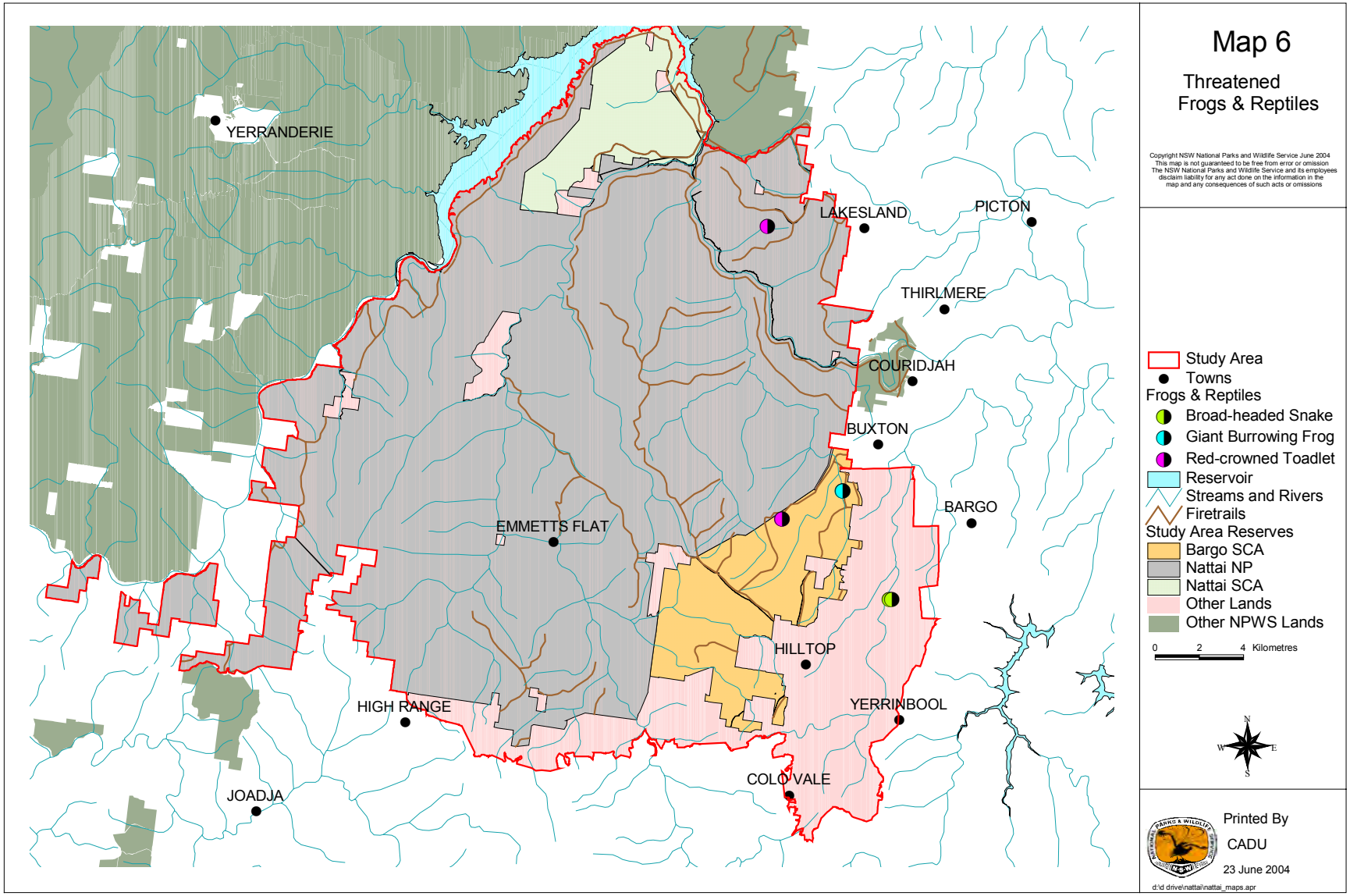
Scientific name	Common name	Status in NSW (TSC Act)	Status in Australia (EPBC Act)	No. of locations within study area[1]		Notes on reliability and date of last record	Species profile generated?
				DEC[2]	Other[3]		
Heleioporus australiacus	Giant Burrowing Frog	V	V	3	0	First record for the study area during this survey in the north east of Bargo SCA.	Y
Pseudophryne australis	Red-crowned Toadlet	V	-	3	0	First record for the study area during this survey in east in Nattai NP and Bargo SCA.	Y
Varanus rosenbergi	Rosenberg's Goanna	V	-	0	0	Not known from the study area, but records from Special Areas on either side, and potential habitat present.	Y
Hoplocephalus bungaroides	Broad-headed Snake	E	V	0	2	Known only from the Bargo River crown lands, though potential habitat throughout the reserves.	Y
Burhinus grallarius	Bush Stone-curlew	E	-	0	3	Only Australian Museum specimens from "Colo Vale" with most recent record 1906.	N
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	40	6	Regularly recorded within study area.	Y
Neophema pulchella	Turquoise Parrot	V	-	3	3	Most records in the Burragorang Valley, with the most recent 2002.	Y
Lathamus discolor	Swift Parrot	E	E	1	1	Records possibly refer to the same sighting during surveys in 1997. More recent records on western side of Wollondilly River.	Y
Ninox connivens	Barking Owl	V	-	0	0	Not recorded within study area, but records from surveys in 1997 in western Burragorang Valley. Heard calling in the Bullio area by local landholders.	Y
Ninox strenua	Powerful Owl	V	-	22	2	Regularly recorded within study area.	Y
Tyto novaehollandiae	Masked Owl	V	-	5	1	Scattered records from throughout the study area.	Y
Tyto tenebricosa	Sooty Owl	V	-	14	1	Most records from the north of the study area.	Y
Climacteris picumnus victoriae	Brown Treecreeper (eastern subsp.)	V	-	30	7	Most records from the Burragorang Valley.	Y
Pyrrholaemus sagittatus	Speckled Warbler	V	-	13	0	Records restricted to the Burragorang Valley.	Y
Xanthomyza phrygia	Regent Honeyeater	E	E	0	4	Scattered records in the west. Also reported on the western side of the Wollondilly River.	Y
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.)	V	-	2	1	Only recorded in the Burragorang Valley.	Y
Melanodryas cucullata cucullata	Hooded Robin (south eastern subsp.)	V	-	13	1	Only recorded in the Burragorang Valley.	Y
Stagonopleura guttata	Diamond Firetail	V	-	11	2	Most records from the Burragorang Valley.	Y
Dasyurus maculatus	Spotted-tailed Quoll	V	E	0	1	Anecdotal records from various locations in the reserves (not yet in the Atlas of NSW Wildlife).	Y
Dasyurus viverrinus	Eastern Quoll	E	-	0	6	Presumed extinct on the Australian mainland. All Museum specimens from prior to 1900 at "Colo Vale."	N
Phascolarctos cinereus	Koala	V	-	15	8	Most records in the south, with scattered individuals elsewhere.	Y
Cercartetus nanus	Eastern Pygmy-possum	V	-	0	0	Recorded in the Bargo Crown Lands, though record not in Atlas of NSW Wildlife.	Y

Scientific name	Common name	Status in NSW (TSC Act)	Status in Australia (EPBC Act)	No. of locations within study area[1]		Notes on reliability and date of last record	Species profile generated?
				DEC[2]	Other[3]		
Petaurus australis	Yellow-bellied Glider	V	-	83	4	Regularly recorded within study area.	Y
Petaurus norfolcensis	Squirrel Glider	V	-	0	0	Not recorded from study area, though known to the west and north.	Y
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	3	9	Population discovered during current survey in south western section of Nattai NP.	Y
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	0	0	No records within the Atlas of NSW Wildlife, but known to occur at orchards in private land within the study area.	Y
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	4	0	Recorded using Anabat in the western and southern sections during this survey.	Y
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	14	0	Widespread in the western half of Nattai NP.	Y
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	2	0	Only identified by Anabat (identification probable) to the south west of Nattai NP.	Y
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	35	0	Regularly recorded within study area.	Y
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	2	0	First recorded in the study area during the current survey, in the Burragorang Valley	Y

[1] Numbers indicate the number of records for the species, rather than the number of individuals. Only includes records on the Atlas of NSW Wildlife.

[2] Includes all records collected during CRA, SCA and Biodiversity Survey Priorities fauna surveys.

[3] Includes records on the Atlas of NSW Wildlife obtained from sources other than DEC systematic survey.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YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Map 6
Threatened
Frogs & Reptiles
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map and any consequences of such acts or omissions
Study Area
Towns
Frogs & Reptiles
Broad-headed Snake
Giant Burrowing Frog
Red-crowned Toadlet
Reservoir
Streams and Rivers
Firetrails
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GIANT BURROWING FROG

Species Profile

The Giant Burrowing Frog (*Heleioporus australiacus*) is a rotund ground-dwelling frog. It can attain a maximum length of over ten centimetres. Its powerful limbs are used to excavate burrows where they can aestivate for long periods of time during unfavourable conditions. This species has a large black tadpole with a purple ventral surface that takes up to eleven months to metamorphose (Anstis 2002). The species has two disjunct populations, with one restricted to sandstone geology of the Sydney Basin as far south as Jervis Bay, and the other to the south between Narooma and eastern Victoria (NPWS 2001b).

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Threats

The primary threat to the Giant Burrowing Frog is development of the sandy ridgetops that are its preferred habitat (NPWS 2001b). Other threats to this species are not well known. Some threats that might be relevant within the reserves include fire, road mortality, feral predators, and alterations to the drainage patterns of the plateau.

Local and Regional Conservation Status

The Giant Burrowing Frog is listed as a Vulnerable species on the NSW TSC Act (1995) and Vulnerable under the Commonwealth EPBC Act (1999). The Sydney Basin population is thought to have declined considerably, with tadpoles being encountered far less frequently than in the past (Anstis 2002). There is suitable habitat for the species across a large number of Sydney Sandstone reserves including Royal, Ku-ring-gai Chase and Brisbane Waters National Parks with fewer records obtained in Blue Mountains and Wollemi National Parks. They have also been recorded in the Woronora and Cataract Catchments on the Woronora Plateau (DEC 2004a). However, despite extensive areas of habitat and sustained survey effort over the last few years in the Sydney Basin, the species is rarely recorded.

Both tadpoles and adult frogs were observed during the current surveys in Bargo State Conservation Area at a track crossing Moore Creek upstream from Little River (Map 6). Individuals were detected by their distinctive owl-like hooting and were heard calling from under a rock ledge. Tadpoles were also seen nearby in the same stream.

These locations adjoin major roads and tracks through Bargo SCA. The river crossings within Bargo State Conservation Area remain heavily used by four-wheel drives. These records are significant, because even though this species has been recorded at a number of locations on the Woronora Plateau, it is the first time it has been recorded west of the Sydney to Canberra Freeway. Consideration should be given to ensuring that the species continues to persist by conducted monitoring surveys during the appropriate season and weather conditions.

RED-CROWNED TOADLET

Species Profile

The Red-crowned Toadlet (*Pseudophryne australis*) is a small (20 to 25 millimetres), strikingly coloured litter-dwelling frog. It is fairly restricted in its distribution, only occurring on the sandstone geologies of the Sydney Basin and within this range some morphological and genetic variation exists. The Red-crowned Toadlet lays its eggs in moist leaf litter, relying on rain to wash the eggs into a temporal pond where they can complete their development (NPWS 2001c).

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Threats

Development of ridgetop land is the primary threat to the Red-crowned Toadlet. Other threats may include habitat alteration due to fire, bush rock removal, water pollution and Chytrid fungus (NPWS 2001c). Due to their size and morphology, this species has only a limited ability to disperse. This probably makes them vulnerable to local extinction.

Local and Regional Conservation Status

The Red-crowned Toadlet is listed as Vulnerable on the NSW TSC Act (1995). Suitable habitat for this species is widespread across the sandstone plateaux of the Sydney Basin Bioregion, with the major populations occurring in the upper Blue Mountains, around the mouth of the Hawkesbury River and the Woronora Plateau extending to Royal National Park. Throughout its range it has been recorded in numerous National Parks, including a number within the Sydney urban area (DEC 2004a, 2004c). DEC surveys in the Sydney Basin Bioregion during the last five years have revealed that the species is perhaps more common in the region than previously thought (DEC, in prep.).

There are no documented historical records of this species on the Nattai Tableland. The recent surveys have confirmed for the first time that the species occurs within both Nattai National Park and Bargo State Conservation Area (Map 6). One location was discovered in each of the reserves, with one in a small moist gully off the Western Break Fire Trail in Bargo State Conservation Area and the other in deep sandy alluvium off Hoddles Track. Further records for the species could be anticipated because the prevailing drought of the last few years has restricted surveyor's ability to confirm the presence of the species in otherwise suitable habitats. Such habitats including gully heads and sandy depressions on ridgelines are widespread in the Nattai and Bargo reserves. Future surveys should be conducted during appropriate weather conditions.

ROSENBERG'S GOANNA

Species Profile

Rosenberg's Goanna (*Varanus rosenbergi*) (also known as Heath Monitor) is a large, powerful lizard with an unusual distribution. It is superficially similar to the commonly encountered Lace Monitor (*V. varius*) though morphologically and taxonomically it is closer to the Sand Monitor (*V. gouldii*). It can be distinguished from the Lace Monitor by the fine barring on its lips and tail and the spots on its legs. Within NSW it occurs in the Greater Sydney Basin and in the Southern Highlands, but then occurs discontiguously through Victoria, South Australia and south western Western Australia. The population on the Sydney Sandstone may or may not be genetically distinct. The lizard is well known to associate with sandstone environments, and is usually found in heath and woodlands where it shelters in burrows, hollow logs and rock crevices (Cogger 1996).

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Threats

Rosenberg's Goanna is particularly threatened in urban fringes, where the species is subject to pressure from development of the flat sandstone ridgetops that are its preferred habitat. Road mortality is also of concern (NPWS 2002a). Goannas have been identified as taking baits placed for Foxes (*Vulpes vulpes*) (Thomson and Kok 2002) and this species may consume baits placed during Fox and Dog (*Canis lupus*) eradication programs.

Local and Regional Conservation Status

Rosenberg's Goanna is listed as Vulnerable on the NSW TSC Act (1995). It is a poorly understood species and researchers are still learning about its distribution. Recent DEC survey work has found the species to be more widespread through the greater Sydney Basin than previously thought, particularly in heaths and woodlands at lower elevations (DEC 2004a, DEC in prep.). However, populations are sparse compared to the larger and more common Lace Monitor. Confirmed localities in the Sydney Basin include the Woronora Plateau, upper Blue Mountains and Wollemi National Parks and the Hornsby Plateau near Ku-ring-gai Chase National Park (DEC 2004a).

There are no confirmed records of Rosenberg's Goanna in the Nattai and Bargo reserves. However, there are records of this species to both the east (Metropolitan Catchments) and west (Blue Mountains National Park). Based on these records and the presence of suitable habitat on the sandstone plateaux of the study area, it is likely that this species does occur. Survey of suitable habitat in remote areas such as the Wanganderry Tableland may confirm the species presence.

BROAD-HEADED SNAKE

Species Profile

The Broad-headed Snake (*Hoplocephalus bungaroides*) is a semi-arboreal species that spends a portion of the year under sandstone exfoliations, and a part of the year in tree hollows. It averages about 60 centimetres in length and is recognisable by its black and yellow patterning. It is restricted to the sandstone environments of the Sydney Basin between Wollemi National Park and the Clyde River catchment, south west of Nowra. Within this range it has disappeared from such areas as Port Jackson and Middle Harbour, and on the western edge of its distribution around Bathurst. It is primarily a nocturnal ambush predator (NPWS 1999a) and is known to prey on Lesueur's Velvet Gecko (*Oedura lesueurii*).

©Alex Dudley

Threats

The key threat to the Broad-headed Snake is likely to be the collection of bush rock for landscaping (Shine and Fitzgerald 1989). This activity, although now either prohibited or requiring permits in most local government areas, is still widely practiced illegally. Removal of rock not only threatens this species directly, but removes habitat for its main prey species, Lesueur's Velvet Gecko. In addition, the Broad-headed Snake is colourful, rare and venomous, making it prized by snake-collectors. Collection of specimens from the wild is also likely to be a threat to this species (NPWS 1999a), particularly on the peripheries of urban areas, such as Picton and Mittagong. Within the Nattai Reserves there are many areas that exhibit signs of disturbance by collectors on many of the large rock plates and outcrops. Other potential threats include urbanisation of sandstone ridgetops, impacts of feral animals, through both predation and disturbance, and altered fire regimes that may effect the snake when it is utilising tree hollows (NPWS 1999).

Local and Regional Conservation Status

The Broad-headed Snake is listed as Endangered on the NSW TSC Act (1995) and Vulnerable on the Commonwealth EPBC Act (1999). It is restricted to the Sydney Basin and has disappeared from many locations where they have been previously well known to occur. Its remaining strongholds appear to be the upper Blue Mountains and Wollemi National Parks, Royal National Park extending on to the Woronora Plateau, and eastern Morton National Park west of Nowra. Its rarity is exemplified by the fact that three years of intensive systematic survey in suitable habitat on the Woronora Plateau has only recorded this species at one location (DEC in prep.).

Historical records of this species in Nattai National Park do not occur in the Atlas of NSW Wildlife, although there is a confirmed record of the species in the area in the 1960's (R. Wells pers. comm.). Despite the extensive search effort for this species, no individuals have been recorded during any of the DEC led surveys in the Nattai and Bargo reserves over the last seven years. This is disappointing given the extensive areas of suitable habitat and the density of Lesueur's Velvet Gecko, a preferred prey species found in the same habitat. An NPA led survey in the Bargo crown lands found an individual on a west facing rock outcrop overlooking the Bargo River Gorge (Map 6).

GLOSSY BLACK-COCKATOO

Species Profile

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is a medium-sized black cockatoo, which has a diagnostic black-brown head, with yellow patches in the female, and red tail panels. It is usually seen in pairs or trios (with dependant young) in eucalypt woodland or forest, where it nests in hollows. This species feeds almost exclusively on Sheoaks (*Allocasuarina* species including *A. verticillata, A. torulosa* and *A. littoralis*) (Higgins 1999). Two subspecies are restricted to eastern Australia between Queensland (Eungella) and eastern Victoria, with the nominate *lathami* found in NSW, and a third, isolated, endangered subspecies on Kangaroo Island (South Australia) (Higgins 1999).

©Peter Ekert

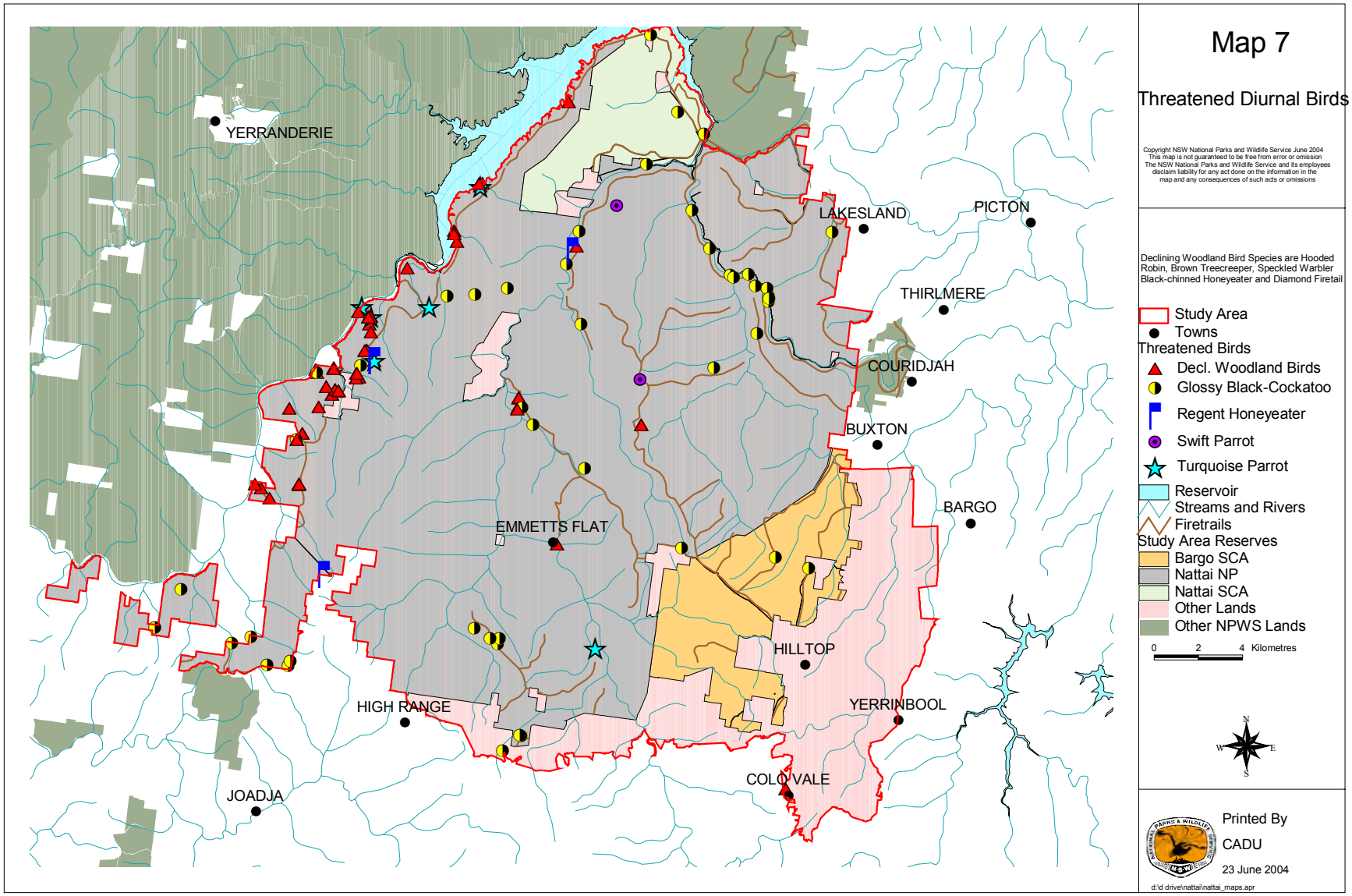
Threats

Habitat destruction for agriculture or residential development appears to be one of the main threats, due to both removal of nesting and feeding sites, and also from competition from more open habitat species such as Galahs (*Eolophus roseicapillus*). Because many *Allocasuarina* species are fire sensitive, inappropriate burning regimes may effect food supplies. Illegal trapping for aviculture may be a localised, minor threat (Garnett and Crowley 2000).

Local and Regional Conservation Status

The Glossy Black-cockatoo is listed as Vulnerable on the NSW TSC Act (1995). Relatively large areas of the Sydney Basin provide suitable habitat for Glossy Black-cockatoos and there are a large number of records for this species throughout the Bioregion (DEC 2004a). The habitat is well protected, occurring in numerous NPWS reserves, including Morton, Blue Mountains, Ku-ring-gai Chase and Wollemi National Parks.

The Nattai Reserves provide outstanding high quality habitat for Glossy Black-cockatoos, with three main areas supporting high numbers of the species. Locations of records are shown on Map 7. Sheltered escarpment slopes that plunge down from the sandstone tableland support an abundance of Forest Oak (*Allocasuarina torulosa*). Chewed *Allocasuarina* cones from feeding Glossy-black Cockatoos are regularly observed on the forest floor in these environments. Some of the more sheltered sandstone gullies in the eastern band of Nattai National Park also feature this tree, although evidence of Black cockatoo feeding is not as prevalent. The dry rainshadow valley of the Wollondilly River supports the large-fruited Drooping She-oak (*A. verticillata*) in the understorey across much of the Box-Red Gum woodlands found on the richer porphyry soils. Dense regenerating thickets of this species are often found near former grazing country and supply an abundant food resource for the cockatoos. In the south of Nattai National Park on the sandstone tableland near High Range and Mt. Wanganderry, Black She-oak (*A. littoralis*) is prominent as a small tree amongst open woodlands and forests. Again, individuals have been regularly observed and evidence of feeding is widespread. This pattern is somewhat unusual in that Black She-oak is common in many other areas in the Nattai and Bargo reserves but lacks the obvious signs of heavy feeding that are found in the southern area of the Nattai National Park. The presence of these three feed tree species over such a large area makes these reserves important for the Glossy Black-cockatoo as it allows individuals to move between different areas if feed resources are altered by such events as wildfires. It also reinforces the contribution the reserves make to the protection of suitable habitat for the species in the Bioregion.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BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Map 7
Threatened Diurnal Birds
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map and any consequences of such acts or omissions
Declining Woodland Bird Species are Hooded
Robin, Brown Treecreeper, Speckled Warbler
Black-chinned Honeyeater and Diamond Firetail
Study Area
Towns
Threatened Birds
Decl. Woodland Birds
Glossy Black-Cockatoo
Regent Honeyeater
Swift Parrot
Turquoise Parrot
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TURQUOISE PARROT

Species Profile

The Turquoise Parrot (*Neophema pulchella*) is a small, brightly coloured parrot, distinguished by its bright green upper parts, yellow under parts and blue face and shoulder patch. The male is considerably brighter than the female, and also has a red shoulder band. Usually occurs in pairs or small family parties in eucalypt woodlands and open forests that have a ground cover of grasses. It nests in tree hollows, and has a usual clutch size of two to five eggs (Higgins 1999). It is restricted to eastern Australia, where its range has contracted by over 50 percent since the 1890s (Garnett and Crowley 2000).

©DEC

Threats

Garnett and Crowley (2000) summarise the main threats as: past clearing for agriculture, which has greatly reduced the overall distribution; predation by cats and foxes; loss of hollows that are used for nesting in managed forests; and inappropriate burning regimes that may favour a shrubby rather than a grassy understorey.

Local and Regional Conservation Status

The Turquoise Parrot is listed as Vulnerable on Schedule 2 of the NSW TSC Act (1995). In the Sydney Basin Bioregion, the species is most commonly found within dry grassy woodland environments that are prominent in the Hunter and Capertee Valleys and to a lesser extent the Cumberland Plain. They are also frequently recorded in dry sclerophyllous shrub woodlands of Wollemi and Goulburn River National Parks and Munghorn Gap Nature Reserve (DEC 2004a). Individuals do turn up in areas of less typical habitat such as the Woronora Plateau (NPWS 2002a).

The Burragorang Valley, of which Nattai National Park forms part, is an area in which the species has been frequently observed (Map 7). The dry grassy box woodlands that are found on the valley floor and adjoining hills support a number of recent observations, with records on both sides of the Wollondilly River. The only other record in the study area is a single bird seen west of Hilltop in 1984, indicating that this species may occasionally be seen away from the Burragorang Valley.

SWIFT PARROT

Species Profile

The Swift Parrot (*Lathamus discolor*) is a medium-sized, green parrot with distinctive red and blue head markings. It favours open eucalypt forest and woodland where it feeds on nectar and lerp. It breeds only in Tasmania, and migrates to the mainland as far north as southern Queensland during autumn and winter. During the non-breeding season it is nomadic, with small to large flocks congregating at suitable food sources. Favoured food trees in NSW include Swamp Mahogany (*Eucalyptus robusta*), Mugga Ironbark (*E. sideroxylon*), White Box (*E. albens*) and Spotted Gum (*Corymbia maculata*) (Higgins 1999).

©DEC

Threats

The Swift Parrot has a small population of approximately 2000 individuals (Tzaros 2002) which may still be declining (Garnett and Crowley 2000). Outside the breeding area the main threat is from habitat destruction (Garnett and Crowley 2000). Due to the variable nature of the flowering of its favoured feeding trees during the non-breeding season it is nomadic and is sensitive to clearance of areas that it may rely on once every few years. Due to its rapid flight, the species often is killed in collisions with windows, vehicles and fences, though this occurs more regularly in Tasmania (Garnett and Crowley 2000).

Local and Regional Conservation Status

The Swift Parrot is listed as Endangered on the NSW TSC Act (1995) and as Endangered on the Commonwealth EPBC Act (1999). Most of the records of Swift Parrots in the Sydney Basin Bioregion are in coastal habitats, particularly the Central Coast, but they have also been regularly recorded in drier areas of the Hunter and Capertee Valleys and the Cumberland Plain. Within these areas it has been recorded in small numbers in a number of reserves, including Botany Bay and Wyrrabalong National Parks, and Castlereagh Nature Reserve (DEC 2004a). Intensive surveys in recent years have greatly increased understanding of habitat usage by Swift Parrots in their wintering grounds in NSW (D. Saunders pers. comm.).

Swift Parrots have been recorded in the Burragorang Valley since 1941 (Chafer *et al.* 1999) and most recently near the Jooriland Homestead as recently as 2002, feeding on lerps in the Red Gum-Box Woodlands. A flock of seven was also observed flying over the Wild Goat Plateau in May 1997. These records are shown on Map 7. The Box Woodlands in the Burragorang Valley, however provide the highest quality habitat in the reserves for this species with the presence of winter flowering eucalypts (White Box) providing a prominent, though irregular, food resource during winter migration.

BARKING OWL

Species Profile

The Barking Owl (*Ninox connivens*) is an owl of intermediate size between the larger Powerful Owl (*N. strenua*) and the Southern Boobook (*N. boobook*). It has dark brown upper-parts and a white underbody with coarse brown streaking (Higgins 1999). It is often identified by its call, which is a distinctive, dog-like barking that can be confused with Fox (*Vulpes vulpes*) or Dog (*Canis lupus*) barks. It usually inhabits dry open eucalypt forests and woodlands, where it is associated with hydrological features such as rivers and swamps (Taylor *et al.* 2002a). It nests in hollows, usually of large eucalypts, where it lays one to three eggs. It is an opportunistic feeder, eating more insects than other large forest owls, but consumes small terrestrial and arboreal mammals and birds during the breeding season. The race *connivens* occurs east of a line connecting Cooktown (Queensland) and the Flinders Ranges (South Australia) with an isolated population in the south west of Western Australia. Other races occur across northern Australia, in New Guinea and the Moluccas (Indonesia) (Higgins 1999).

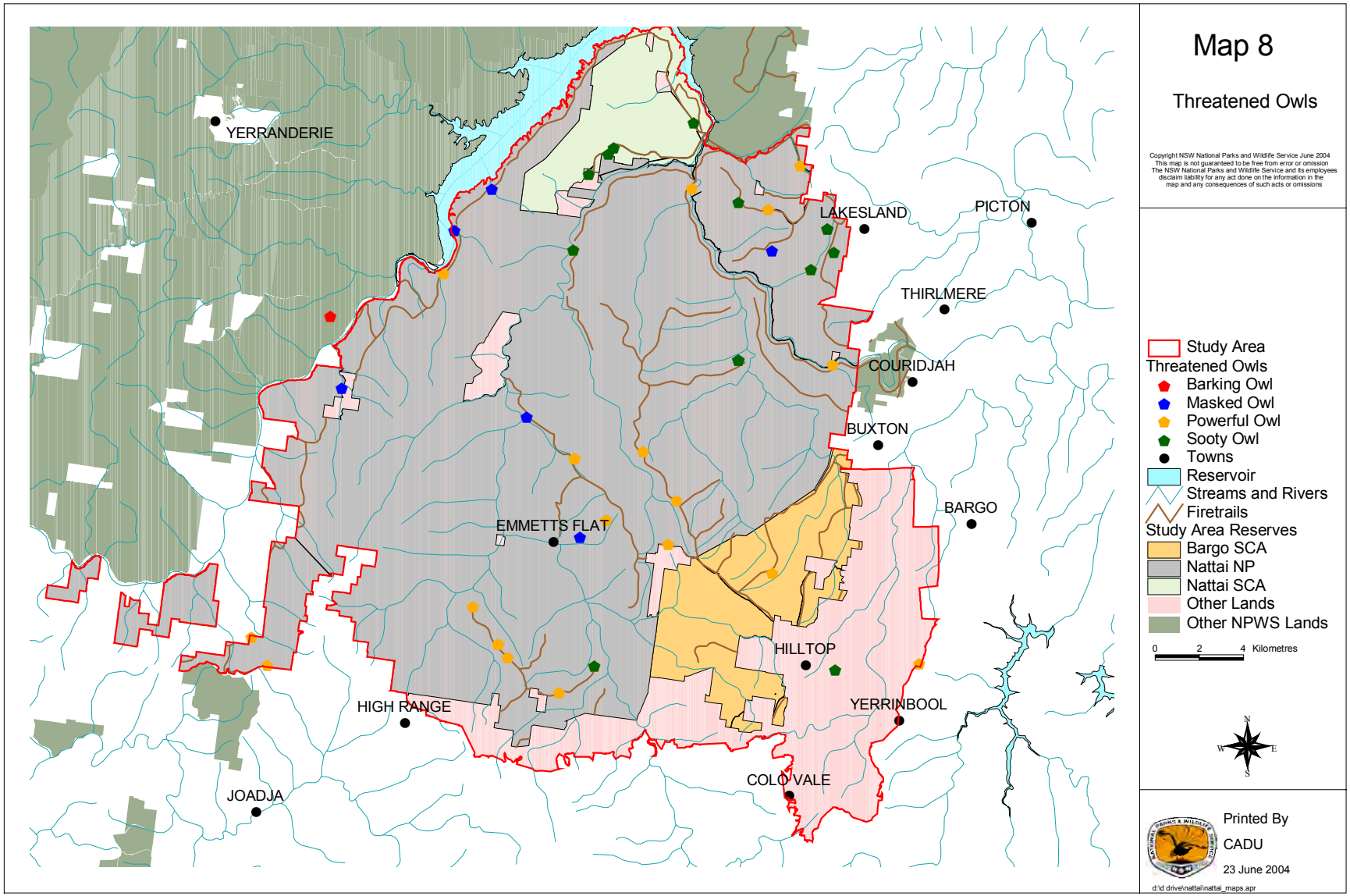
Threats

The main identified threat to the species is habitat destruction, particularly the removal of woodlands and forests from more low-lying fertile areas for agriculture (Taylor *et al.* 2002b). Remaining habitat is also subject to further degradation through forestry and collection of firewood, which often involves the removal of large hollows. The owl is often located, however, at the edge of forest blocks adjacent to cleared land, possibly due to increased prey availability at such locations (Taylor *et al* 2002b). The owl may also suffer some competition from feral honeybees (*Apis mellifora*) (Garnett and Crowley 2000). The long generation time (ten years) means that the species may take a long time to recover after suffering a decline (NSW Scientific Committee 1998b).

Local and Regional Conservation Status

The Barking Owl is listed as Vulnerable on the NSW TSC Act (1995). It is the rarest owl species known to occur in the Sydney Basin Bioregion, with most records associated with drier woodlands. Recent work by DEC across the southern Blue Mountains and Woronora Plateau have confirmed how rare this bird is. Only four individuals were recorded in over 300 systematic owl playback sites. This compares to a 30-40% positive response rate for other large forest owls. It has been identified in Yengo and Wollemi National Parks, amongst others, although there appear to be more records outside the reserve system in the dry grassy woodlands of the Capertee and Hunter Valleys, and the north-western suburbs of Sydney. Much the vegetation of these environments has been cleared for agriculture or urbanisation.

An individual has been recorded in 1997 just outside Nattai National Park on the western side of the Wollondilly River in lightly timbered country (Map 8). The grassy woodlands here are typical habitat for this species. The species almost certainly would make use of similar habitat found on the eastern side of the river. Another more recent observation has been made by a landholder in the Bullio area.


YERRANDERIE
LAKESLAND
PICTON
THIRLMERE
COURIDJAH
BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Map 8
Threatened Owls
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Study Area
Threatened Owls
Barking Owl
Masked Owl
Powerful Owl
Sooty Owl
Towns
Reservoir
Streams and Rivers
Firetrails
Study Area Reserves
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POWERFUL OWL

Species Profile

The Powerful Owl (*Ninox strenua*) is the largest owl in Australia and is distinguished by its relatively small, round head and long tail. It is dark brown above with prominent off-white barring, and paler underneath with diagnostic dark chevrons. It inhabits various forest habitats, though it usually breeds and roosts in closed forest, including rainforest and wet sclerophyll forest. It hunts in more open forests, where it feeds mainly on arboreal mammals, particularly Common Ringtail Possums (*Pseudocheirus peregrinus*) and Greater Gliders (*Petauroides volans*). This species usually nests in a hollow in a eucalypt within or below the canopy, and normally lays two eggs. They usually maintain a territory of between 300 and 1500 hectares, with size dependent on habitat quality and prey density. It is endemic to eastern Australia, being recorded between Eungella (Queensland) to near the South Australia-Victoria border (Higgins 1999).

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Threats

Past land clearance for agriculture has reduced the area of habitat available for the Powerful Owl (Garnett and Crowley 2000), particularly the availability of roost sites. It can, however, manage to survive in areas with some levels of disturbance, such as in selectively logged forests (Kavanagh 1997) and it is also still recorded in suburban areas of Brisbane, Sydney and Melbourne (Garnett and Crowley 2000, DEC 2004c). Two of the determining factors for the species persistence in disturbed areas is the presence and suitable abundance of prey species (Chafer 1992) and nesting/roosting sites (Debus and Chafer 1994).

Local and Regional Conservation Status

The Powerful Owl is listed as Vulnerable on the NSW TSC Act (1995). It occurs throughout the Sydney Basin Region across extensive areas from the rural-urban fringes of Sydney Metropolitan area to west of the Dividing Range into the Central Tablelands. Most reserves within the region support known territories of this species. Recent DEC surveys within the Warragamba Special Area, and the neighbouring Blue Mountains and Kanangra-Boyd National Parks have found Powerful Owls to be relatively abundant and widespread in the region (DEC in prep.).

The Nattai and Bargo reserves support many territories, with a large number of records found across the sandstone plateau as well as the deeply incised valleys of the Nattai and Little River valleys (Map 8). Surveys revealed a tendency for the species to respond to owl-call playback in taller forests associated with the sandstone gullies or with the taller open forests that are found on the shale enriched forests on ridges and plains in the east and south of the reserves. The species is clearly a habitat generalist, roaming over a variety of habitats. Both preferred prey species, the Common Ringtail Possum and the Greater Glider are common in the reserves. The number of Powerful Owl found during this survey supports growing evidence (DEC, in prep.) that the species is more common than once thought across the sandstone environments of the Sydney Basin.

MASKED OWL

Species Profile

The Masked Owl (*Tyto novaehollandiae*) is a large 'barn' owl, which has three colour morphs (with intermediates), but is distinguished from the similar Barn Owl (*T. alba*) by its larger size, more thickset and hunchbacked appearance, fully feathered legs and larger feet (Higgins 1999). It inhabits a wide range of woodland habitats with large hollows for roosting and open areas for hunting. It feeds mostly on ground-dwelling mammals, such as rats (*Rattus*) and Antechinus (*Antechinus*), and occasionally on diurnal birds, Sugar Gliders (*Petaurus breviceps*) and insects. The owl has a home range of 800 to 1200 hectares (Kavanagh 2002). It nests in hollow trees, usually eucalypts, where two to three eggs are the normal clutch. The nominate subspecies *novaehollandiae* was formerly found around the southern coast of Australia between Fraser Island (Queensland) and Carnarvon (Western Australia), though its range has contracted, particularly in Western Australia (Garnett and Crowley 2000). Other subspecies occur in Tasmania, northern Australia and in New Guinea and adjoining islands, some of which are sometimes considered separate species (Higgins 1999).

Threats

Clearance of native forest for agriculture and urban development, and the resulting fragmentation of habitat, has negatively affected the abundance of Masked Owls (Kavanagh 2002, Garnett and Crowley 2000). The species does not persist within fragments of forest less than 200 hectares (Kavanagh 2002). The species may be affected by logging, through removal of hollows or reduction in foraging habitat due to vigorous regrowth (Garnett and Crowley 2000), though it has been suggested that modern mosaic logging operations do not cause major changes to the abundance of the species (Kavanagh 2002).

Local and Regional Conservation Status

The Masked Owl is listed as Vulnerable on the NSW TSC Act (1995). It is not frequently recorded in the sandstone environments of the Sydney Basin Bioregion. By contrast the open woodlands of the coastal plains between Wyong and Port Stephens are known to support high numbers of the species and represent the best habitat in the region. Most of the records in this area are outside NPWS estate, but scattered locations are known from Yengo, Blue Mountains and Murramarang National Parks, and Berowra Valley Regional Park (DEC 2004a).

The Masked Owl is known to occur in the Nattai and Bargo Reserves (Map 8), and along with the Barking Owl (*Ninox connivens*) was far less frequently recorded than either the Sooty (*Tyto tenebricosa*) or Powerful (*N. strenua*) Owls. There are only five records of the species in the reserves, with most associated with the drier escarpment woodlands of the Nattai and Wollondilly Valleys. One unusual, though confirmed response, was elicited from a Masked Owl in a sandstone gully in the Couridjah area, indicating that the species habitat preference may be more varied than is sometimes suggested. The low response rate to playback techniques for the Masked Owl are consistent with that achieved elsewhere in the southern sandstone plateaux (DEC, in prep.), confirming that the species genuinely occurs at very low abundance in this region.

SOOTY OWL

Species Profile

The Sooty Owl (*Tyto tenebricosa*) is a medium to large 'barn' owl, with sooty grey plumage that is finely spotted and flecked with white. It is found in tall wet forests, including wet sclerophyll and rainforest, where it is often first detected by its distinctive 'falling bomb' call. It roosts and breeds in hollows, often located in emergent trees, which may be greater than 100 years of age. Pairs probably maintain permanent territories that are between 200 and 800 hectares in area (Higgins 1999). It feeds on a wide range of arboreal and terrestrial mammals (Kavanagh 2002). In Australia the subspecies *tenebricosa* is distributed along the east coast between the Conondale Ranges (Queensland) to north east of Melbourne (Victoria). A smaller subspecies (*arfaki*) occurs in New Guinea (Higgins 1999).

Threats

Garnett & Crowley (2000) list the main threat as habitat clearance for agriculture, with additional fragmentation or degradation caused by logging, burning, dieback and urbanisation. The effects of logging have been particularly well studied, though the overall effect is not entirely clear (Higgins 1999). Due to its nocturnal habits, the Sooty Owl is not often recorded using established bird detection methods. Recent improvements in survey technique have greatly improved the detectability of this and other owl species (Kavanagh 1997).

Local and Regional Conservation Status

The Sooty Owl is listed as Vulnerable on the NSW TSC Act (1995). The distribution of this species in the Sydney Basin Bioregion is strongly tied to the presence of wet sclerophyll forests and rainforests. Habitats of this type are most extensive in areas of high rainfall and richer soil. The Illawarra escarpment behind Wollongong and the Watagan Ranges between the Central Coast and Newcastle support the largest areas of high quality habitat (NPWS 2002a). In these areas it has been recorded in Illawarra Escarpment and Jilliby State Conservation Areas, with other records in Royal, Blue Mountains and Bouddi National Parks. Habitat becomes increasingly restricted to protected slopes and gullies as distance from the coast increases until near the western arm of the Dividing Range the environment is too dry to support this species.

The distribution of suitable habitat is patchy across the Nattai and Bargo reserves and is restricted to deep, protected sandstone gullies and south facing escarpment slopes (Map 8). In these locations a mosaic of narrow rainforest gullies and tall Eucalypts occur, forming ideal habitat for the Sooty Owl. Playbacks in or near these locations frequently returned positive responses for the species. There are now over twelve confirmed locations within the reserves. Like the Powerful Owl (*Ninox strenua*), these surveys are revealing that the species is perhaps more common in sandstone environments than once thought (DEC, in prep.). However, unlike the Powerful Owl, the Sooty Owl is a habitat specialist, and suitable habitat is confined to small areas in the reserves.

BROWN TREECREEPER

Species Profile

The Brown Treecreeper (*Climacteris picumnus*) is a medium-sized brown bird that is superficially similar in appearance to the Red-browed (*C. erythrops*) and White-throated (*Cormobates leucophaeus*) Treecreepers. It is distinguished from both by its slightly larger size, distinctive pale supercilium (eyebrow stripe) and by call. Typically a bird of eucalypt woodlands with a grassy or open shrub understorey, and abundant fallen timber and/or dead trees. Unlike most treecreepers, they spend approximately half of the time on the ground where they feed on insects, particularly ants and beetles, taken from live and dead trees, fallen branches and off the ground. It occurs in pairs or small groups in permanent territories where tree hollows are utilised for breeding (Higgins *et al.* 2001). The eastern subspecies (*victoriae*) occurs along the coast and ranges in Victoria, New South Wales and south-east Queensland, with the other two subspecies occurring either west (*picumnus*) or north (*melanotus*) (Schodde and Mason 1999).

Threats

The eastern subspecies of the Brown Treecreeper is one of a suite of woodland birds that have declined throughout their range due to habitat clearance (Reid 1999). Traill and Duncan (2000) stated that the population was estimated to have declined by at least twenty percent in the last fifteen years. Studies have shown that populations can not persist in habitat fragments smaller than 300 hectares, mostly because females either disperse or suffer from preferential mortality. As with most treecreepers, once extinction occurs in a remnant, natural recolonisation is unlikely (Garnett and Crowley 2000). The lack of hollows may also be the limiting factor as known to compete with introduced species like the Common Starling (*Sturnus vulgaris*) (Higgins *et al.* 2001) and European Honeybees (*Apis mellifora*) (NSW Scientific Committee 2001a). Grazing also has impacts by decreasing the diversity of ground-dwelling invertebrates which reduces the levels of food availability (NSW Scientific Committee 2001a).

Local and Regional Conservation Status

The eastern subspecies of the Brown Treecreeper is listed as Vulnerable on the NSW TSC Act (1995). Though it is found through all the eastern Bioregions in New South Wales, it is least common in the South East Coast and Australian Alps, and has declined significantly within the Sydney Basin and NSW North Coast. Within the Sydney Basin Bioregion, the species is restricted to open woodlands of the central tablelands and open coastal plains and valleys such as the Cumberland Plain and Hunter Valley (DEC 2004a). The species has virtually disappeared from the Cumberland Plain in the last 30 years (NSW Scientific Committee 2001a, DEC 2004a). These environments are all characterised by agricultural and urban clearing with small isolated fragments of native vegetation common.

Brown Treecreepers are regularly observed in Nattai National Park in the Burragorang and Nattai Valleys where there are extensive areas of grassy box woodlands present. The records of this species have been combined with the other declining woodland bird species in Map 7. This habitat is certainly some of the most contiguous and protected habitat for the species in the Bioregion. Historically, it may have once occurred in the eastern parts of the study area, but this population appears to be extinct.

SPECKLED WARBLER

Species Profile

The Speckled Warbler (*Pyrrholaemus sagittata*) is a small, ground-dwelling scrubwren-like bird. It is similar in size and shape to the Buff-rumped Thornbill (*Acanthiza reguloides*) but can be identified by its boldly streaked underbody, distinctive facial pattern and noticeably longer tail. The female differs from the male by having a chestnut, rather than black, streak in the eyebrow. It usually occurs in the grassy understorey of dry sclerophyll forests and woodlands dominated by eucalypts, often with scattered shrubs. They feed on insects and seeds with most foraging occurring on the ground. Pairs, and occasionally trios, live permanently in large (up to twelve hectares) territories where a well concealed domed nest is built on the ground in grass tussocks. Two to four (usually three) eggs are laid though breeding success can be low. The Speckled Warbler is endemic to south eastern Australia, being found between Maryborough (Queensland) and the Grampians (Victoria) (Higgins and Peter 2002).

Threats

The Speckled Warbler is one of a number of woodland birds that has declined in density throughout its range due mainly to agricultural land clearing (Reid 1999). Speckled Warbler populations are estimated to have declined by at least twenty percent in the last fifteen years (Traill and Duncan 2000). Small isolated patches may result in local extinction due to natural fluctuations (Garnett and Crowley 2000) with extinction occurring in areas with no patches over 100 hectares (NSW Scientific Committee 2001b). Weed invasion, nest predation by exotic mammalian predators and a loss of ground cover by grazing by stock, kangaroos and rabbits are other notable threats (NSW Scientific Committee 2001b, Garnett and Crowley 2000).

Local and Regional Conservation Status

The Speckled Warbler is listed as Vulnerable on the NSW TSC Act (1995). It is widespread in the eastern Bioregions of the state, extending as far west as the Cobar Peneplain, but is scarce or absent from the South East Coast and Australian Alps. Within the Sydney Basin Bioregion the species is closely tied to the Hunter and Capertee Valleys, Burragorang and Wollondilly Valleys and the north western Cumberland Plain. This latter location is one of the areas that is known to have a declining population (NSW Scientific Committee 2001b). Within these areas, most records in NPWS reserves are restricted to the north, with Goulburn River National Park and Munghorn Gap Nature Reserve being particularly important.

The Nattai National Park is one of the few reserves in the region that supports both good numbers of the species and extensive areas of habitat. This species has been combined with the other declining woodland birds in Map 7, but all the records are restricted to the Burragorang Valley. Here, it has been observed sheltering amongst Native Blackthorn (*Bursaria spinosa*) and nests have also been located.

REGENT HONEYEATER

Species Profile

The Regent Honeyeater (*Xanthomyza phrygia*) is a medium-sized honeyeater with a striking black and yellow plumage. It typically favours box-ironbark woodland, though it also utilises River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) Forests and coastal habitats such as Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*). The population seems to undertake complex movements, generally dependent on where flowering food trees are available. It feeds mainly on nectar, and nests in the crowns or eucalypts where usually lays two or three eggs. It is endemic to south-eastern Australia, formerly between Rockhampton (Queensland) and Adelaide, though it is now rare in Queensland and probably extinct in South Australia, with a general contraction of range in the other two states (Higgins *et al.* 2001).

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Threats

Land clearance for agriculture has removed about three-quarters of the suitable habitat of the Regent Honeyeater. The remaining vegetation is fragmented, and is still being affected by the removal of larger trees. Habitat alteration may also advantage more aggressive honeyeaters, such as miners (*Manorina* spp.) and friarbirds (*Philemon* spp.) with resulting competition. The population is estimated to be no more than 1500 individuals (Garnett and Crowley 2000; Higgins *et al.* 2001).

Local and Regional Conservation Status

The Regent Honeyeater is listed as Endangered on the NSW TSC Act (1995) and as Endangered on the Commonwealth EPBC Act (1999). Compiling records was one of the priorities of the Draft Regent Honeyeater Recovery Plan (Menkhorst *et al*. 1999) and so a number of records are included in the Atlas of NSW Wildlife. Many of these are within the Sydney Basin Bioregion with important areas appearing to be the Capertee and lower Hunter Valleys, the northern Cumberland Plain and the Central Coast. Most of these records are outside formal reserves, but there are occasional observations made in Goulburn River National Park and Munghorn Gap and Cockle Bay Nature Reserves.

The species is an occasional visitor to Nattai National Park with several individuals recorded in or adjoining the reserve over the last seven years (Map 7). All are associated with the drier grassy woodlands in the Burragorang Valley, with White Box (*Eucalyptus albens*) providing an important flowering resource for the migrating species during the winter months. The habitat present in the Burragorang Valley ranks alongside a small number of areas considered vital for the ongoing persistence of the species in the region.

BLACK-CHINNED HONEYEATER

Species Profile

The Black-chinned Honeyeater (*Melithreptus gularis*) is a medium-sized, rather stocky and short-tailed honeyeater. It is distinguished from other *Melithreptus* honeyeaters by its relatively larger size, bright blue or jade green eye-wattle and distinctive call. They occupy the dry eucalypt woodlands that feature ironbark and/or box species with low to moderate rainfall levels, where they are usually found in pairs or small groups of up to twelve. They feed on insects, nectar and lerp usually in the upper canopy and outermost flowers and leaves. There are two subspecies which have in the past been named as two separate species; the eastern, nominate subspecies (*gularis*) is found between south east Queensland and Victoria, while the 'Golden-backed Honeyeater' (*laetior*) is widespread across northern Australia (Higgins *et al.* 2001).

Threats

The eastern subspecies of the Black-chinned Honeyeater is one of a suite of woodland birds that have declined throughout their range due to habitat clearance (Reid 1999). They are threatened by clearance and the fragmentation of woodland habitat and don't appear to survive in remnants less than 200 hectares (NSW Scientific Committee 2001e). The species appears to occur naturally at low densities (NSW Scientific Committee 2001e) and is relatively mobile, so the reason for this absence in small fragments is unknown (Garnett and Crowley 2000). They are also likely to experience high levels of competition from aggressive honeyeater species associated with smaller fragments and may suffer increased nest predation from such species as Pied Currawongs (*Strepera graculina*) (NSW Scientific Committee 2001e).

Local and Regional Conservation Status

The Black-chinned Honeyeater is listed as Vulnerable on the NSW TSC Act (1995). Scattered records for this species occur in the eastern half of the state, though with the highest number of records in the Nandewar, Sydney Basin and NSW South West Slopes Bioregions and a complete absence from the South East Corner and Australian Alps. In the Sydney Basin region most records come from drier areas such as western Sydney, the Capertee and Hunter Valleys. All of these areas have been heavily cleared in the past and remain subject to ongoing threatening processes. Most of the records are also outside DEC reserves, though it has been recorded in a number, notably Goulburn River and Werakata National Parks and Munghorn Gap Nature Reserve (DEC 2004a).

In Nattai National Park, the Burragorang Valley supports extensive areas of good quality habitat for the species, where it is closely associated with the Red Gum-Box Woodlands on Devonian soils. This species has been mapped with the other declining woodland bird species in Map 7. There have been a number of records of the species in the Jooriland area and in the Nattai Valley. The species is rarely recorded further east with other observations made on the shale country near Bargo and Wilton. Flowering events of feed trees, particularly White Box (*Eucalyptus albens*) and Mugga Ironbark (*E. sideroxylon*) would be particularly important for this highly nomadic species.

HOODED ROBIN

Species Profile

The Hooded Robin (*Melanodryas cucullata*) is a medium-sized bird that usually occurs in eucalypt woodland or *Acacia* shrubland. The adult male is distinctive and has a black hood and upper body with a white stripe on the shoulder. The adult female is mostly grey with a dark-brown wing. Both sexes have a white wing stripe and underparts and a prominent white side-panel on the tail, which along with their larger size, distinguish this species from the Jacky Winter (*Microeca fascinans*) and female *Petroica* Robins. They utilise dead or fallen timber as perches when foraging where it feeds mainly on insects. Usually occurs as pairs, though cooperative breeding is also common, with normally two or three eggs laid in a cup-shaped nest placed in a horizontal fork (Higgins and Peter 2002). There are four subspecies covering most of Australia, with the two subspecies in New South Wales being *picata,* which extends from north western NSW through to the Kimberleys in Western Australia, and the nominate (*cucullata*) which is south and east of this subspecies (between Queensland and South Australia) (Schodde and Mason 1999).

Threats

The south eastern subspecies of the Hooded Robin has been identified as one of a number of birds that have declined significantly in range and population in the sheep-wheat belt of central west NSW due to the degradation and fragmentation of woodland habitats. (Reid 1999). Populations do not appear to persist even in large fragments of remaining habitat although the precise reason for this is as yet unknown (Garnett and Crowley 2000). Habitat modification and reduction of food availability through grazing by stock and weed invasion may also be a threat (NSW Scientific Committee 2001c). Eggs and young have been known to be predated by native avian predators and possibly by Foxes (*Vulpes vulpes*) (Higgins and Peter 2002).

Local and Regional Conservation Status

The south eastern subspecies of the Hooded Robin is listed as Vulnerable on the NSW TSC Act (1995). It has been recorded in most subcoastal areas of New South Wales, though is rare in the Australian Alps Bioregion. Within the Sydney Basin Bioregion it is virtually restricted to the Hunter, Capertee and Burragorang Valleys, though it formerly occurred on the Cumberland Plain (DEC 2004a, Keast 1995). In these it is closely tied to the drier woodlands, which are generally poorly reserved, with the only reserves with more than one record being Munghorn Gap Nature Reserve, Nattai National Park and Yerranderie State Conservation Area (DEC 2004a).

Good numbers of this species have been recorded in the Burragorang and Wollondilly Valleys. Extensive areas of grassy box woodlands are present in a mosaic of open and timbered country. Nattai National Park protects large areas of this habitat on the eastern arm of the Wollondilly River, which makes it one of the most important areas for this species in the Bioregion.

DIAMOND FIRETAIL

Species Profile

The Diamond Firetail (*Stagonopleura guttata*) is an attractive finch, which is distinguished by its bold black breast band and white-spotted black flanks. The eye, beak and rump are red, with the latter contrasting strongly with the black tail in flight (Pizzey and Knight 1997). It is most frequently encountered in Eucalypt dominated communities that have a grassy understorey, where it feeds mainly on grass seeds (Garnett and Crowley 2000). Usually encountered as pairs, though sometimes forms small flocks in autumn and winter. They nest in trees or sometimes mistletoe, building bottle-shaped nests and usually produce four to six eggs (Pizzey and Knight 1997). It is endemic to south-eastern Australia, with records extending from Rockhampton (Queensland) to the Eyre Peninsula and Kangaroo Island (South Australia) (Pizzey and Knight 1997).

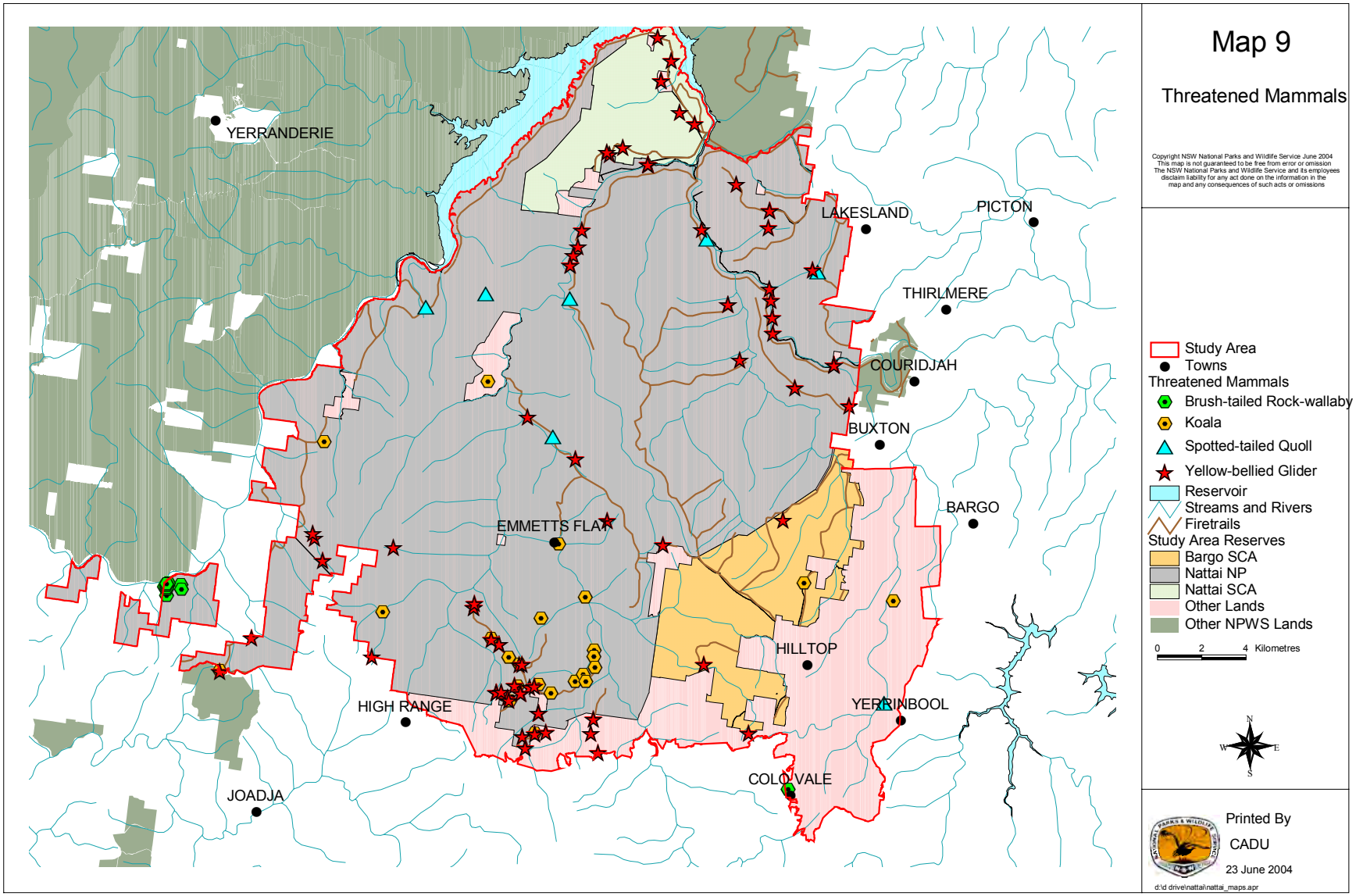
Threats

The Diamond Firetail has been historically recorded in all types of timbered country (Smith *et al*. 1995) but much of its habitat has been cleared and it is therefore included in the suite of woodland birds that have declined in south-eastern Australia (Reid 1999). They appear to be unable to survive in areas with no remnants larger than 200 hectares (NSW Scientific Committee 2001d). Clearing and habitat degradation by over-grazing and the spread of exotic grasses may also result in the loss of key food plants and possibly competition from flock-foraging Red-browed Finches (*Neochmia temporalis*) (Garnett and Crowley 2000). Predation by foxes and cats may be another threat (Smith *et al.* 1995).

Local and Regional Conservation Status

The Diamond Firetail is listed as Vulnerable on the NSW TSC Act (1995). It is widely recorded in the eastern two thirds of the state, with scattered records in the far west, although it is less widely recorded in the three coastal Bioregions and in the high country of the Australian Alps. Within the Sydney Basin Bioregion the species is closely associated with grassy box woodlands found on the more fertile soils on the inland valleys, including the Capertee, upper Hunter and Burragorang, and occasionally on the Cumberland Plain. These environments are generally poorly conserved throughout the region, though records are known from Goulburn River and Wollemi National Parks and Munghorn Gap Nature Reserve (DEC 2004a).

This species has been recorded quite widely in and around the Burragorang Valley and is mapped with the other declining woodland species in Map 7. The valley supports extensive areas of grassy box woodlands and as a result provides some of the best available habitat within the Bioregion. Immature Diamond Firetails have also been observed, indicating that breeding populations occur in the valley.


Map 9
Threatened Mammals
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YERRANDERIE
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PICTON
THIRLMERE
COURIDJAH
BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Study Area
Towns
Threatened Mammals
Brush-tailed Rock-wallaby
Koala
Spotted-tailed Quoll
Yellow-bellied Glider
Reservoir
Streams and Rivers
Firetrails
Study Area Reserves
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SPOTTED-TAILED QUOLL

Species Profile

The Spotted-tailed or Tiger Quoll (*Dasyurus maculatus*) is a medium-sized marsupial carnivore that is identified by its rufous to dark brown fur and white spots which are present on the body and tail. It is essentially terrestrial, but is also an agile climber. It feeds on a wide variety of birds, reptiles, mammals and invertebrates and it uses several 'latrines' within its territory for defecation (NPWS 1999b). There are three populations of this species. The first is in far north Queensland, the second extends from Southern Queensland to Victoria, and a final genetically distinct population occurs in Tasmania (Firestone *et al.* 1999).

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Threats

The main problems confronting the Spotted-tailed Quoll are believed to be habitat loss, habitat degradation, predation and competition by introduced cats (*Felis catus*) and foxes (*Vulpes vulpes*), and direct mortality at the hands of humans (Mansergh 1984). Quolls were heavily persecuted as killers of domestic fowl, and have been hunted and trapped to extinction in many parts of the country. In more recent years, baiting for foxes, dogs and dingoes may have taken a toll on this species (D. Andrew pers. comm.).

Local and Regional Conservation Status

The Spotted-tailed Quoll is listed as Vulnerable on the NSW TSC Act (1995) and as Endangered on the Commonwealth EPBC Act (1999). The southern populations are believed to have declined in range by up to fifty percent (Maxwell *et al.* 1996). The distribution of potential habitat within the Sydney Basin Bioregion is extensive although the occupancy rate of this habitat is likely to be very low. Regional habitat models suggest there are a number of core areas for Spotted-tailed Quolls including the area around the Hawkesbury River mouth, north through the Watagan Ranges, the area to the south of Port Stephens, the central Blue Mountains Region and the Budderoo Plateau (NPWS 2000). A reasonable percentage of this land is protected in reserves, though most of the recent records have only been from Blue Mountains and Brisbane Waters National Parks, and Barren Grounds Nature Reserve (DEC 2004a).

The Spotted-tailed Quoll is amongst one of the most cryptic ground mammals, as densities are generally very low and individuals are likely to roam over very large areas. A relocated individual has been known to travel over ten kilometres to return to its site of capture at Lakesland (D. Ashton pers. comm.). There have been chance observations of this species in or near the Nattai reserves at Sheeys Creek Road, Nattai River near Martins Flat, Lakesland (D. Ashton pers. comm.) and records from campers at the top of Beloon Pass (Map 9). There are additional records held by DEC staff of occurrences on the Nattai Road near the escarpment edge and the species is infrequently observed harassing chicken coops on the bush interface between Colo Vale and Picton. This species has not been observed during recent surveys, although it is notorious for being difficult to trap and requiring immense effort to detect in the wild using standard survey techniques (Lunney and Matthews 2001). Nevertheless, the fact that no individuals were observed opportunistically despite the large amount of time in the field suggests that the species occurs at very low abundance. It is likely to be using a wide variety of habitats within the reserves. Intensive cage trapping effort would be required to obtain a more accurate picture of species abundance and habitat use throughout the reserves.

KOALA

Species Profile

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The Koala (*Phascolarctos cinereus*) is a distinctive, iconic arboreal mammal of eucalypt forest and woodland. It feeds on a wide range of eucalypt and other tree species, though in a local area a few species will be preferred almost exclusively. Individuals spend most of the day resting in the forks of trees, and are most active following sunset (NPWS 1999c). They generally move about a home range, the size of which varies on the density of food trees and population size, though individuals, particularly dispersing juveniles, are known to travel up to 50 kilometres (Martin and Handasyde 1995; NPWS 1999c). Three subspecies occur between north Queensland and the Eyre Peninsula in South Australia. However, the distribution is now fragmented and introductions, such as to Phillip Island, have possibly altered the genetic diversity of many of the populations (Martin and Handasyde 1995).

Threats

NPWS (1999c) summarises the threats to the Koala as follows: destruction of habitat by clearing for urban development, agriculture and mining; degradation of habitat through fragmentation and disturbance such as fire or weed invasion; direct mortality from dogs and motor vehicles; and infection by *Chlamydia* which causes keratoconjunctivitis (an infection of the eyes) and infertility. The latter appears to occur naturally in Koalas in NSW, and symptoms are displayed when animals are stressed (NPWS 2003c). In Victoria, populations that have been transferred from Phillip Island appear to have lost their immunity and rates can be high, but it does not appear to be a major threat (Menkhorst 1995a). Throughout its entire range, loss, fragmentation and degradation of habitat is its greatest threat (NPWS 2003c). Reed *et al*. (1990) reported on a survey in 1986-87 that found that the Koala had disappeared from 50 to 75 percent of its known range in NSW and populations had been lost from many localities, particularly on the southern and western edges of their distribution.

Local and Regional Conservation Status

The Koala is listed as Vulnerable on the NSW TSC Act (1995). As an easily recognisable species, there are a number of records throughout the Sydney Basin Bioregion. Concentrations appear to be located around the Central Coast, Blue Mountains and the fringes of the Cumberland Plain including within the Metropolitan Catchment. Records from reserves within this distribution are less common, though sightings have been made in Dharug, Wollemi and Morton National Parks. A local population of Koalas was discovered near High Range at the south end of Nattai National Park during DEC surveys in November 2003. Three individuals were observed at different locations during spotlight transects and male Koalas were heard bellowing at a number of others (Map 9). Koala scats were also positively identified under a number of Grey Gums (*Eucalyptus punctata*). These results strengthen the validity of some incidental observations made by casual observers in the Russells Needle area and between this location and Emmetts Flat where a dead individual was recently found. Other isolated observations have been made near the Wollondilly Lookout near the border of Joadja Nature Reserve, on the escarpment footslopes beneath Bonnum Pic and on west road fire trail in Bargo State Conservation Area. These observations indicate that Koalas make widespread use of Nattai National Park. Areas of high densities are united by their proximity to enriched soils that are associated with shale cappings, igneous intrusions and alluviums on valley flats. Most sites are associated with the prevalence of Grey Gum or Forest Red Gum (*Eucalyptus tereticornis*). A broader review of the regional distribution highlights that Koalas have been observed in the upper Nattai Valley behind Mittagong and around the villages of Hilltop and Balmoral (DEC,2004a). These Southern Highland records are isolated by the Sydney to Canberra Freeway from other Koala populations known in the Nepean and Avon Catchments and further north at Wedderburn (DEC 2004a, DEC in prep.). Intermixing between populations is likely to be prevented by the barrier urban areas place on dispersal.

EASTERN PYGMY-POSSUM

Species Profile

The Eastern Pygmy-possum (*Cercartetus nanus*) is a small (between 14 and 21 centimetre) possum that is found in a wide variety of habitats, including rainforest, sclerophyll forest and heaths. It is generally nocturnal, and is an opportunistic omnivore, including nectar, pollen, insects, seeds and fruit in its diet. Each individual has a number of nests, which are usually constructed in tree hollows, throughout their territory, and will move up to 125 metres, through tree, shrub and ground layers (Turner and Ward 1995). It is distributed between extreme south east Queensland and South Australia, and Tasmania, though it is only found at higher at higher altitudes in northern New South Wales and is generally commoner in southern latitudes (Bowen and Goldingay 2000, Menkhorst 1995b).

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Threats

The NSW Scientific Committee (2001f) listed the potential threats to the Eastern Pygmy-possum. They include isolated sub-populations with little dispersal potential which increase the risk of local extinction, habitat loss and fragmentation by clearing, inappropriate fire regimes that may effect understorey plants, the loss of nest sites through intensive forestry and firewood collection, and predation by foxes and cats.

Local and Regional Conservation Status

The Eastern Pygmy-possum is listed as Vulnerable on the NSW TSC Act (1995). This listing appears to be chiefly based on Bowen and Goldingay (2000), which showed that despite intensive survey effort throughout the known distribution, relatively few individuals have been detected. The survey techniques used in many of these surveys, however, may have underestimated the abundance of this species. Over a two week period in early 2000, 22 individuals were removed from a ten kilometre stretch of trench dug as part of a natural gas pipe laying procedure between Cataract and Cordeaux dams (NPWS 2002a). Broadscale regional habitat mapping for this species (NPWS 2000) indicate that most of the suitable habitat occurs in the sandstone areas surrounding the Sydney metropolitan area. Recent records of this species have been located in Royal, Ku-ring-gai Chase and Morton National Parks.

This species has not been recorded in the Nattai and Bargo reserves, probably because intensive trap effort has not been employed. Belik and Close (1997) captured an individual using pit traps in the Bargo River crown lands, though this record is not in the Atlas of NSW Wildlife as the exact details of the site are unknown. However, the habitat was described as “Drier open woodland” and on the basis of similar habitat being present in the reserves, the species is likely to be captured using the appropriate survey method.

YELLOW-BELLIED GLIDER

Species Profile

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The Yellow-bellied Glider (*Petaurus australis*) is a nocturnal mammal found in tall open sclerophyll forests of eastern Australia. As an arboreal species, it requires mature hollow bearing trees within which to den during the day, and at night from which to leap and glide using a membrane that extends from the wrists to the ankles (NPWS 1999d). It is characterised by grey fur above and a whitish to orange fur underneath with large bare ears. The species is more often heard than seen, as it frequently emits a distinctive throaty shriek, which can be heard from some distance. It feeds on eucalypt nectar, sap, manna and invertebrates found under shedding bark. Its feeding habits to extract sap can leave deep V-notched incisions in the bark of eucalypts, with individuals and families demonstrating preference for repeated use of individual trees for many seasons (Mackowski 1988). Yellow-bellied Gliders are known to utilise a home range of between 30 and 65 hectares (Goldingay and Kavanagh 1991). The southern, nominate subspecies ranges between Portland (Victoria) and central coastal Queensland with a separate subspecies isolated in north Queensland in the vicinity of the Herbert River (Russell 1995).

Threats

Yellow bellied Gliders are known to be greatly affected by the reduction of nesting resources when the availability of hollow bearing trees are lost through clearing, fragmentation or timber extraction (NPWS 1999d). Predation by cats and foxes are also thought to contribute to the species vulnerability. Impacts of fire regimes are poorly understood, although some suggest that availability of food is reduced after fire (NPWS 1999d).

Local and Regional Conservation Status

The Yellow-bellied Glider is listed as a vulnerable species on the NSW TSC Act (1995). The species appears to have a patchy distribution within the Sydney Basin Bioregion (DEC 2004a) with most localities restricted to taller moist forests associated with incised sandstone gullies. The locations of populations of this species suggest a coastal preference with elevated, cold environments exhibiting a total absence of records in the region. Typical examples of population strongholds include the tall moist forests of the Central Coast and Watagan Ranges, Blue Mountains Escarpments and gullies (DEC in prep.). Numerous records are known from reserves including Morton, Wollemi, Blue Mountains and Jervis Bay National Parks (DEC 2004a).

Within the Nattai and Bargo reserves Yellow-bellied Gliders are commonly heard in the tall moist forests that feature in the sandstone gullies and on the sheltered escarpment slopes. Throughout Nattai National Park the most aggressively targeted feed tree species appear to be Grey Gum (*Eucalyptus punctata*) and Mountain Blue Gum (*E.deanii*) and Mountain Grey Gum (*E. cypellocarpa*). Forests on ridges that support residual shale soils also support very high numbers of these gliders. Grey Gum is often profuse in these environments, with taller forests on the ridges of Hoddles Track in the north and those near High Range in the south being typical examples. All locations within the study area are shown on Map 9. Yellow-bellied Gliders appear to be more common than previously thought with the species regularly recorded in gullies and taller forests right across the sandstone plateaux of the Blue Mountains (DEC 2004a).

SQUIRREL GLIDER

Species Profile

©DEC

The Squirrel Glider (*Petaurus norfolcensis*) is a nocturnal mammal that inhabits dry sclerophyll forests and woodlands and builds leaf-lined nests in tree hollows. It is similar in appearance to the smaller and more common Sugar Glider (*Petaurus breviceps*). However, the Squirrel Glider has a longer more pointed face, longer and narrower ears and a bushier tail and also lacks the persistent yapping call of the smaller species. It has a varied diet, including insects, nectar, pollen, seeds, *Acacia* gum and sap from Eucalypts (Suckling 1995). It usually occurs in family groups of up to ten, consisting of one male, one or more females and their dependant young. Home ranges are thought to vary between 0.65 and 8.55 hectares, depending on habitat quality, and individuals have been known to move up to 500 metres in one night. It is sparsely distributed along the east coast and inland slopes of between north Queensland and Victoria (NPWS 1999e) in habitats that comprise sufficient numbers of hollow-bearing trees for shelter and winter flowering plant species for food (Quinn 1995).

Threats

NPWS (1999e) lists the following threats to the Squirrel Glider. They are known to be greatly affected by the loss of nesting resources when the availability of hollow bearing trees are lost through clearing, fragmentation or timber extraction. Predation by cats and foxes are also thought to contribute to the species vulnerability and individuals have been rescued by the Wildlife Information and Rescue Emergency Service (WIRES) after getting caught on barbed-wire fences. Impacts of fire regimes are poorly understood although the availability of food resources may be reduced or lost after fire.

Local and Regional Conservation Status

The Squirrel Glider is listed as a Vulnerable species on the NSW TSC Act (1995). Within the Sydney Basin Bioregion the dry woodlands of the Central Coast provide very high quality habitat for the species. This area has been well documented as a stronghold for the species (Smith and Murray 2002). Elsewhere the species has only been recorded at very low densities, including within Wollemi and Blue Mountains National Parks (DEC 2004a).

The species has never been observed in the Nattai and Bargo reserves. However, hair and bone fragments have been identified from Powerful Owl pellets in the south of Burragorang State Conservation Area to the north of the study area (D. Ashton pers. comm.). Individuals have also been seen west of the Wollondilly River (DEC in prep.). Given that similar open woodland habitats occur within the study area it is probable that the Squirrel Glider exists at very low densities.

BRUSH-TAILED ROCK-WALLABY

Species Profile

The Brush-tailed Rock-wallaby (*Petrogale penicillata*) is a medium sized macropod, characterised by its distinctive facial markings, black paws and high levels of agility (NSW Scientific Committee 2003). The tail is often used to aid identification, being long and thickly furred with a distinctive brush-like appearance near its tip (NPWS 2002b). Habitats occupied by this species tend to take one of three forms: loose piles of large boulders containing a maze of subterranean holes and passageways; cliffs (usually over fifteen metres high with many mid level ledges covered by overhangs; or isolated rock stacks, usually sheer sided and often girdled with fallen boulders (NPWS 2002b). Vegetation forms a vital component of the habitat, especially as refugia near major rock outcrops. The species typically exhibits low migration rates between colonies, impeding persistence and recovery of populations affected by threatening processes. Its range formerly extended between south east Queensland to the Victoria, but is was thought to be extinct in the latter state until small populations were rediscovered in the Grampians and near the Snowy River (Eldridge and Close 1995).

©E. Holland/DEC

Threats

Historical decline of the Brush-tailed Rock-wallaby is attributed to three factors: hunting for bounty and fur; predation by introduced predators; and competition with introduced herbivores (feral Goat (*Capra hircus*), Rabbit (*Oryctolagus cuniculus*) and stock) (NSW Scientific Committee 2003). The major threats continuing to impact on the species include ongoing predation and competition with feral species such as Fox (*Vulpes vulpes*) and wild Dogs (*Canis lupus familiaris*), habitat modification by fire, vegetation clearing, disease transmission (toxoplasmosis and hydatosis) by feral carnivores (NSW Scientific Committee 2003) and inbreeding (Environment ACT 1999).

Local and Regional Conservation Status

Brush-tailed Rock-wallabies are listed as Endangered on the NSW TSC Act (1995) and as Vulnerable on the Commonwealth EPBC Act (1999). In the Sydney Basin Bioregion they form part of one of the three Evolutionary Significant Units (ESU) that summarise genetically distinctive metapopulations within their distribution. These cover the sites at Kangaroo Valley, Jenolan Caves and Broke in the Hunter Valley. This central ESU is one of the most fragile in NSW and all sites are of very high conservation significance (NSW Scientific Committee, 2003). Other than Nattai, recent records from reserves are mostly within Yengo, Wollemi and Morton NP's.

This survey revealed that a population of the Brush-tailed Rock-wallaby persists on the Bullio portions of the Nattai National Park (Map 9). It is estimated that up to twenty individuals (C. Rummery pers. comm.) occupy a major rock outcrop on a site that adjoins private property. These sightings confirm recent scat evidence that has been collected in the last few years by DEC survey teams at nearby sites in the Wollondilly Valley. The exciting find points to the Wollondilly Valley as perhaps once providing extensive habitat across its steep precipitous valleys and scree slopes that mark the area between Wombeyan Caves and Jooriland. There is further historical evidence of the species occurring at cliffs above Sheeys Creek (Hoddles Head) although animals have not been seen in this area for many years. There are also additional records further north at the Warragamaba Dam wall. Surveys of this habitat during this project and by SCA staff (D. Ashton pers. comm.) failed to find evidence at these sites. There is an abundance of steep rocky cliffs across the study area that might have once provided suitable habitat for the species. Map 9 also shows an old Australian Museum specimen from "Colo Vale" but populations that existed in the Nepean and Bargo catchments are probably extinct (DEC in prep.).

Given the conservation significance of the Brush-tailed Wallaby site management and monitoring should be undertaken in close consultation with the Statewide recovery plan for the species.

GREY-HEADED FLYING-FOX

Species Profile

©Linda Broome/DEC

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is a large fruit bat that has dark grey body fur, a slightly paler grey head and a russet collar. It is the largest bat in the study area, with a wingspan of up to one metre. It is a highly mobile species and numbers roosting at specific camps may vary depending on season and food availability. They feed on nectar and pollen of various trees including *Eucalyptus, Melaleuca* and *Banksia* as well as fruits, originally of rainforest species, but now including commercial and garden crops. They can travel up to twenty kilometres to a food source, and are an important pollinator and disperser of native plants. It is endemic to the east of Australia between Melbourne, Victoria and Bundaberg in Queensland, though it formerly ranged as far north as Rockhampton (NPWS 2001d).

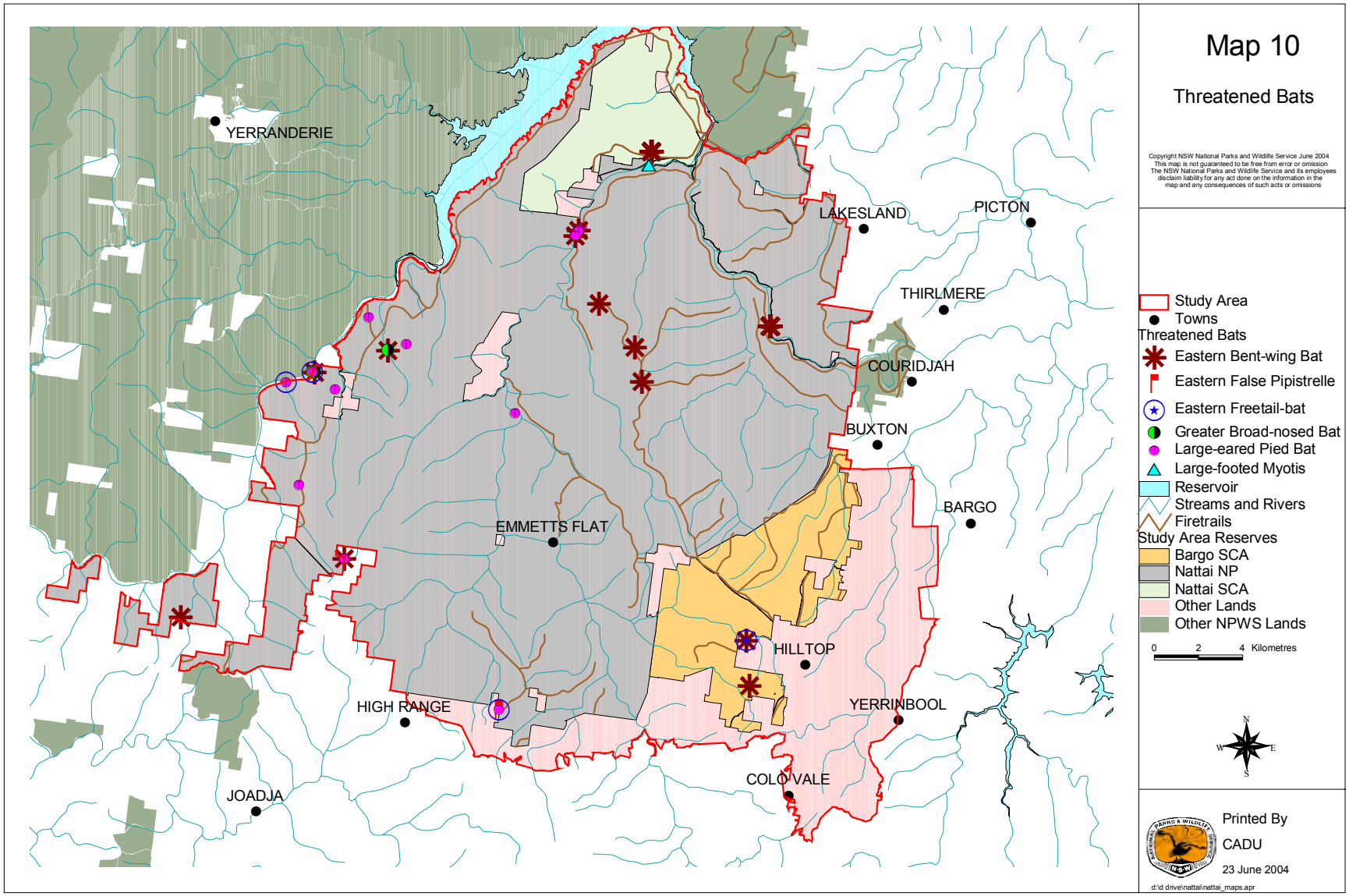
Threats

The main threats to the Grey-headed Flying-fox are destruction of habitat, particularly of foraging habitat, by clearing for urban development and agriculture, disturbance at roosting sites, particularly of pregnant females, unregulated shooting, particularly when feeding on commercial crops and electrocution on power lines, particularly in urban areas (NPWS 2001d).

Local and Regional Conservation Status

The Grey-headed Flying-fox is listed as Vulnerable on the NSW TSC Act (1995) and is also listed as Vulnerable on the Commonwealth EPBC Act (1999). Eby *et al.* (1999) estimated that there are approximately sixteen camps within the Sydney Basin Bioregion, three of which were occupied in July 1998. Current locality data suggests that the species is primarily distributed across the coastal and hinterland environments although this may likely to reflect reporting bias in the data. This includes records from Royal, Wyrrabalong and Seven Mile Beach National Parks (DEC 2004a)

At present there are no records of the Grey-headed Flying-fox from the Nattai and Bargo reserves on the Atlas of NSW Wildlife. This is surprising as the species is commonly perceived as a threat to orchard crops between Mittagong and Warragamba, and licences are issued by DEC each year to allow culling. Monitoring of the properties that have been issued licences may indicate whether the species does occur in large numbers, and if not then the issue of these permits may need to be reconsidered. The species is likely to make use of the Nattai and Bargo reserves on occasion, most probably during major Eucalypt flowering events.


Map 10
Threatened Bats
Copyright NSW National Parks and Wildlife Service June 2004
This map is not guaranteed to be free from error or omission
The NSW National Parks and Wildlife Service and its employees
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map and any consequences of such acts or omissions
YERRANDERIE
LAKESLAND
PICTON
THIRLMERE
COURIDJAH
BUXTON
BARGO
EMMETTS FLAT
HILLTOP
YERRINBOOL
HIGH RANGE
COLO VALE
JOADJA
Study Area
Towns
Threatened Bats
Eastern Bent-wing Bat
Eastern False Pipistrelle
Eastern Freetail-bat
Greater Broad-nosed Bat
Large-eared Pied Bat
Large-footed Myotis
Reservoir
Streams and Rivers
Firetrails
Study Area Reserves
Bargo SCA
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EASTERN FREETAIL-BAT

Species Profile

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The Eastern Freetail-bat (*Mormopterus norfolkensis*) is a member of a complex group of bats that retain considerable taxonomic uncertainty. Within this group the species is readily distinguished by its long forearm, upright ears and robust build (Allison and Hoye 1995, Parnaby 1992a). Reinhold *et al.* (2001) describes the ultrasonic call as "a pattern of alternating pulses", making it unique among *Mormopterus*, though it can also call without this pattern. There are very few specimens of this species on record, but it seems to be restricted to east of the Great Dividing Range between approximately Brisbane (Queensland) and Picton (New South Wales) (Duncan *et al.* 1999; Parnaby 1992a). It appears to favour dry eucalypt forest and woodland, though it has also been captured in rainforest (Churchill 1998). It usually roosts in tree hollows (Gilmore and Parnaby 1994), though it has been recorded in the roof of a hut and under the metal caps of telegraph poles (Churchill 1998).

Threats

The threats to this species are poorly known, though it is suspected that clearing for agriculture, development and logging, may pose serious threats. Threats may be heightened because the species' entire known distribution lies within an area of concentrated population density. More research in such areas as taxonomy, field identification and habitat requirements would allow better understanding of the species' conservation status (Duncan *et al.* 1999).

Local and Regional Conservation Status

The Eastern Freetail-bat is listed as Vulnerable on the NSW TSC Act (1995). Most records for the species in NSW are contained within the NSW North Coast, South East Corner and Sydney Basin Bioregions (DEC 2004a). Broad-scale habitat models predicted dry inland valleys and hinterlands to be the highest quality habitat for the species, such as occur within Goulburn River, Wollemi and Yengo NPs (NPWS 2000). These models were based on very limited information about the species, however, and most records for the species come from the Cumberland Plain and Central Coast areas, with scattered records (usually from call analysis) from reserves like Blue Mountains National and Western Sydney Regional Park. This disparity probably reflects the low levels of knowledge about this species. Recent DEC surveys across the Warragamba Special Area have collected vital information on the distribution and habitat of the Eastern Freetail-bat, which will be modelled and the results presented in the final report for the project (DEC in prep.).

There are five records of this species in or adjoining the Nattai and Bargo reserves (Map 10). The highest number of records exists in the Burragorang Valley, although, as mentioned previously, its habitat requirements are poorly known. Continued survey and modelling of little-known species such as this is crucial to the conservation management of threatened bat species.

LARGE-EARED PIED BAT

Species Profile

©Narawan Williams

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is readily recognisable from other members of its genus by the combination of large ears and overall black colour, with bands of white fur along the sides of the body, that join to form a V-shape (Parnaby 1992a; Churchill 1998). The call (undetectable by the human ear) is an alternate pattern made at a low frequency, which is readily distinguishable from all other species (Reinhold *et al.* 2001). Originally described from Copeton in 1966, it has been recorded from a number of scattered locations on either side of the Great Dividing Range between Rockhampton (Queensland) and Bungonia (New South Wales) (Hoye and Dwyer 1995). It has been found in a wide range of habitats, including wet and dry eucalypt forest, Cypress (*Callitris*) forest and sub-alpine woodland (Duncan *et al.* 1999). It is a cave-roosting species, though it has also been detected roosting in disused mine shafts, overhangs and once in an abandoned Fairy Martin (*Petrochelidon ariel*) nest (Churchill 1998). It seems to prefer the 'twilight' areas of caves, and may be dependent on sandstone outcrops (Duncan *et al.* 1999, Hoye and Dwyer 1995).

Threats

The only confirmed threat to this species is the destruction or interference of roost sites. Other potential threats include mining induced subsidence (particularly coal-mining in sandstone areas) which may destroy roost sites, habitat destruction for agriculture and urban development, and predation by feral animals (Duncan *et al.* 1999).

Local and Regional Conservation Status

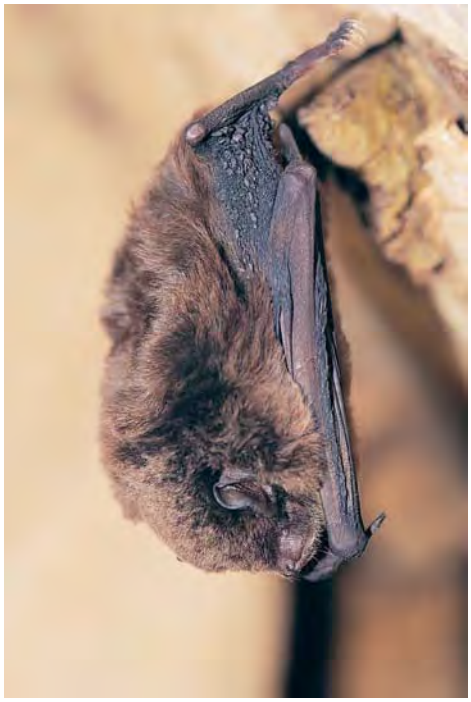
The Large-eared Pied Bat is listed as Vulnerable on the NSW TSC Act (1995) and also as Vulnerable on the Commonwealth EPBC Act (1999). It appears that the Sydney Basin Bioregion may support a significant proportion of the distribution of this species, though records are known to the north and west (DEC 2004a). Though there is a concentration of records across the Blue Mountains plateaux, particularly within Blue Mountains and Wollemi National Parks, there are records scattered through the Bioregion, including Kanangra-Boyd, Royal and Morton National Parks. Despite this wide distribution, they are infrequently captured, suggesting that they occur in low abundance.

This species has been captured at a number of locations near both the Burragorang Valley and in the Nattai River Valley. Other locations include the Mt. Wanganderry area and Nattai Tableland (Map 10). The presence of numerous sandstone overhangs, particularly within Nattai NP, suggests that this area would be used for roosting as well as feeding.

EASTERN BENT-WING BAT

Species Profile

The Common Bent-wing Bat (*Miniopterus schreibersii*) is the most widely distributed bat in the world, occurring through Europe, Africa and Australasia (Churchill 1998), though recent research suggests that there may be three taxa in Australia (Duncan *et al.* 1999). The subspecies *oceanensis* (often referred to as the Eastern Bent-wing Bat) is the relevant taxa for New South Wales and extends at least between central Victoria and Cape York Peninsula, Queensland (Duncan *et al.* 1999). This species is distinguished from most others by the long last bone in the third wing digit and from the Little Bent-wing Bat (*M. australis*) by the longer forearm (greater than 44 millimetres) (Parnaby 1992a). The call can be distinctive, however it is often inseparable from *Vespadelus darlingtoni* and *V. regulus* (Reinhold *et al.* 2001). It utilises a wide variety of habitats where it usually roosts in caves, though it has been known to use mines and road culverts (Churchill 1998). It is a fast flying species that usually feeds above the canopy (Churchill 1998) and has been known to travel up to 65 kilometres in a night (Dwyer 1966 in Ayers *et al.* 1996). Though individuals often use numerous roosts, they congregate en masse at a small number of caves to breed and hibernate (Churchill 1998).



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Threats

Damage and disturbance to roosting sites are the greatest threats to this species. Because only relatively few nursery caves are used, significant population changes can occur if these sites are damaged (Dwyer 1995). Disturbance of hibernating colonies can lead to starvation due to loss of energy reserves (Gilmore and Parnaby 1994). Disturbance of smaller roosts by recreational caving and tourism may also be significant, as may modification to feeding habitat by agriculture and urban development (Gilmore and Parnaby 1994). Some individuals are preyed upon by feral Cats (*Felis catus*) and, less often, foxes (*Vulpes vulpes*) (Dwyer 1995).

Local and Regional Conservation Status

The Eastern Bent-wing Bat is listed as Vulnerable on the NSW TSC Act (1995). Records are widespread within the Sydney Basin Bioregion and appear to be commonly encountered wherever ultrasound bat surveys are undertaken. Strong clusters of records are present in the Lower Hunter and Central Coast, Cumberland Plain, Woronora Plateau and across the southern Blue Mountains. Many of these records are on reserves including Royal, Blue Mountains and Wollemi National Parks.

This species was captured at several locations along Nattai River and Blue Gum Creek during surveys in 1997. A number of individuals were caught near the No.3 Colliery near a disused mine entrance. Adjoining mine entrances were examined for roosting activity though none were found. Other locations of the species include the Bargo SCA, Burragorang Valley and Wild Goat Plateau (Map 10). Roosting is known to occur in Colong Caves to the west (DEC 2004d), though the closest maternity cave is probably more distant.

LARGE-FOOTED MYOTIS

Species Profile

©Ray Williams

The Large-footed Myotis (*Myotis adversus*) is another bat species for which the taxonomy is currently undergoing review. The Australian specimens are now considered to consist of two or three species. The southern species (*M. macropus*) is recorded coastally and along the Murray River from south eastern South Australia to south east Queensland. However, the northern limit of this species and the area of overlap with *M. moluccarum* are poorly known (Duncan *et al.* 1999, Churchill 1998). Even though it can be recorded from up to 20 metres using Anabat, it can be difficult to identify from *Nyctophilus* species (Reinhold *et al.* 2001). It is easily distinguished from other species by its disproportionately large feet, which it uses to rake its prey of insects and small fish from the surface of water (Churchill 1998). It occurs in a wide variety of habitats as long as water is nearby. It normally roosts in caves, though will also use tree hollows, vegetation, and man-made structures, such as bridges and mines (Churchill 1998).

Threats

The threats to this species are poorly known, but it is probably most sensitive to changes in water quality. These may be sedimentation (from vegetation clearing and logging), eutrophication (sewage and fertiliser run-off), pollution and altered flow regimes (Duncan *et al.* 1999). Roosting sites may be susceptible to disturbance by such activities as recreational caving or roadworks (Duncan *et al.* 1999, Gilmore and Parnaby 1994).

Local and Regional Conservation Status

The Large-footed Myotis is listed as Vulnerable on the NSW TSC Act (1995). In the Sydney Basin region known locations are strongly tied to the coastal and hinterland environments of the Central Coast, Cumberland Plain and the Southern Highlands. The representation in NPWS reserves is relatively poor, with most of the captures on park occurring in Nattai, Royal and Popran National Parks (DEC 2004a).

Both the Wollondilly and Nattai Rivers are known to support good numbers of this species with ten individuals caught on the Wollondilly and nine on the Nattai River in 1997. There are other records of this species adjoining the reserves, with one individual recorded within the Bargo area (Belik and Close 1997) and another in the Burragorang State Conservation Area. Because it is usually only trapped directly over water (N. Williams pers. comm.), it may be more widespread than current records suggest. Roosting locations have not been detected in the reserves, though it is highly likely that they do occur.

GREATER BROAD-NOSED BAT

Species Profile

©Michael Murphy

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is a large microchiropteran bat that can only be confused with the Eastern False Pipistrelle but can be separated by having only one pair of upper incisors and smaller ears (Parnaby 1992a). Its ultrasonic calls can also be confused with this species, and with species of the genus *Scotorepens* (Reinhold *et al*. 2001). It is usually found in gullies draining east from the Great Dividing Range between south east New South Wales and north Queensland (Atherton Tablelands), where it utilises creeks and clearings for hunting (Churchill 1998; Hoye and Richards 1995). It is often said to be a lowland species, though Ayers *et al.* (1996) mention several examples of this species being recorded at higher altitudes and it has recently been caught up to 1250 metres in Kanangra-Boyd National Park (DEC 2004d). It usually roosts in tree hollows, though it may also utilise old buildings (Churchill 1998).

Threats

The threats to this species are poorly known, though they probably include habitat clearance for agriculture and urban development, and logging, which may removal suitable hollows (Duncan *et al.* 1999).

Local and Regional Conservation Status

The Greater Broad-nosed Bat is listed as Vulnerable on the NSW TSC Act (1995). The majority of records for the species in NSW occur in the NSW North Coast, South East Corner and Sydney Basin, with some records in the New England Tableland Bioregion and South-eastern Highlands Bioregion. Within the Sydney Basin the species is mainly restricted to the eastern half of the Bioregion, with the greatest density of records on the Central Coast and the Cumberland Plain. The species is reasonably well reported from DEC reserves, including Blue Mountains, Wollemi, Wyrrabalong National Parks (DEC 2004a). Recent DEC surveys have found this species to be widespread across the southern Blue Mountains. Species-habitat analyses planned for this region may elucidate a clearer picture of habitat preference (DEC in prep.).

There are four confirmed localities in or adjoining the Nattai and Bargo reserves (Map 10). These occupy vastly different environments from the Burragorang Valley to the Thirlmere Lakes area. Continued survey of poorly known species such as these is crucial to their conservation management (DEC in prep.).

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APPENDIX A

Systematic Site Details Nattai and Bargo Reserves

Site Number, Description, AMGs for each site within the Nattai and Bargo reports used in this report. The Vegetation Community is from NPWS (2003c). The final columns indicate the number of census of each technique that were undertaken at the site.

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
BARGO1-Bird Survey (site 1)	Parallel to Fire Trail No P2 approx 60m to it's west	56	274100	6202300	Outside	Woodland	Nepean Enriched Sandstone Woodland		1								
BARGO1-Bird Survey (site 2)	Between two western flowing gullies	56	273700	6202400	Outside	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1								
BARGO1-Bird Survey (site 3)	Eastern side of Bargo River on Valley Floor between two gullies.	56	273600	6202400	Outside	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1								
BARGO1-Bird Survey (site 4)	Along Fire Trail P2B	56	273600	6198100	Outside	Woodland	Nepean Enriched Sandstone Woodland		1								
BARGO1-Bird Survey (site 5)	50m inside edge of old farm paddock	56	275000	6197600	Outside	Woodland	Nepean Enriched Sandstone Woodland		1								
BARGO1-Bird Survey (site 6)	Cave Ck walking track starting 100m east of railway and road	56	269500	6197500	Outside	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1								
BARGO1-Bird Survey (site 7)	Tributary of Woodhouse Ck 3Km west of Bargo River. Part of Cave Creek Walking track	56	270400	6197700	Outside	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1								
BARGO1-Bird Survey (site 8)	Ridge area almost due east from the beginning of cave creek walking track	56	269500	6197000	Outside	Woodland	Nepean Enriched Sandstone Woodland		1								
BARGO1-Elliott Trapping (Area1	Off Fire Road No P2	56	274000	6200300	Outside	Woodland	Exposed Burragorang Sandstone Shrub Woodland				1						
BARGO1-Elliott trapping (Area2	South of Fire road P2B	56	274600	6198000	Outside	Woodland	Nepean Enriched Sandstone Woodland				1						
BND04G	Wanganderry - Approx. 1.5km south of Folwer's Flats (WRG026)	56	245870	6207350	Nattai NP	Other	Scattered Trees & Regenerating Vegetation		1	1						1	
BND05O	Wanganderry - Adjacent to Wollondilly river south side on Fowlers Flat (WRG027)	56	246000	6209040	Nattai NP	Open Forest	Tablelands River Oak Forest		1	1						1	

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
BRG19W	Bargo SCA- where Moore creek crosses 4WD track. Site end is river crossing and edge is road	56	271183	6204100	Bargo SCA	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1				1	1	1	
BRG20W	Bargo- Unmarked track running to Little River where it meets track that runs along river near gate to Nattai NP	56	270710	6205724	Bargo SCA	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
BRG45W	Bargo River catchment- on Fire trail no. P3 approx 250m east of Woodhouse creek (NB02)	56	270937	6197095	Outside	Woodland	Nepean Enriched Sandstone Woodland		1							1	
BRG46W	Bargo River catchment- on track running east off Fire trail P3 approximately 800m west of oval (NB03)	56	270978	6195882	Outside	Woodland	Nepean Enriched Sandstone Woodland		1							1	
BRG47H	Bargo SCA- Little River crossing of unnamed 4WD trail. Approximately 460m south west of quarry at northern boundary of reserve	56	270838	6205797	Bargo SCA	Woodland	Exposed Burragorang Sandstone Shrub Woodland								1		
BRG48O	Bargo SCA- Bolins road fire trail crossing of Moore creek	56	270859	6200050	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest								1		
BRR01W	Wanganderry - Off Wombeyan Caves rd(WRG-25)	56	245149	6196230	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest		1	1				1		1	
BRR05W	Wanganderry - midslope of low ridge running North-West from Burnt Flat Creek road	56	246599	6204406	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland		1	1				1		1	
BRR08O	Wanganderry - bottom of scarp approx 1km west of Burragorang lookout(WRG-23)	56	241476	6196314	Nattai NP	Woodland	Devonian Red Gum-Yellow Box Woodland		1	1						1	
BRR10W	Bullio - saddle of ridge west of Myrtle creek (WRG-50)	56	241227	6198408	Nattai NP	Other	Scattered Trees & Regenerating Vegetation			1				1		1	
BRR11W	Bullio - immediately south of SCA cabin West of junction of Basket creek with Wollondilly river (WRG-51)	56	240971	6200085	Nattai NP	Other	Cleared-Modified Land			1						1	
BRR33O	Wanganderry - on unmarked trail north off Wombeyan Caves Rd (Wanganderry Camp)	56	246200	6196400	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest		1	1			1			1	
BRR36W	Nattai NP- on unmarked trail running north off Wombeyan Caves road (NBH17)	56	246149	6196240	Nattai NP	Other	Cleared-Modified Land						1				
BRR37W	Nattai NP- on trail running north off Wombeyan Caves road approximately 200m north of junction (NBH18)	56	245129	6196333	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest						1				

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
BRR41W	Wollondilly valley- off public road running along bottom of escarpment at most easterly point before road turns to north. Site towards escarpment (Woody 1)	56	244424	6197498	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland		1	1				1		1	
BRR42W	Wollondilly valley - public road along Burragorang escarpment. On park between Lot 12 and Lot 40 (Woody 2)	56	243684	6197226	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland		1	1						1	
BRR44W	Wollondilly valley- off road. North of Lot 15 in national park (Woody 4)	56	242518	6198217	Nattai NP	Other	Scattered Trees & Regenerating Vegetation		1							1	
BRR49W	Wollondilly valley- off track leading to river on National Park Lot 77 western side (Woody 9)	56	240396	6198781	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland			1							
BRR50W	Wollondilly valley - on ridge off road leading down to hut on Wollondilly river northern end of Lot 77 (Woody 10)	56	241363	6199529	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland			1						1	
BRR53O	Wingecarribee catchment- Wombeyan Caves road above tunnel	56	243261	6195906	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest		1				1				
BRR99W	Nattai NP - on Burnt Flat Creek FT (parallel to Burnt Flat Creek) on westerly bend south of lot 51.	56	244883	6204249	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland				1						
BUR11O	Wanganderry Walls - on main fire trail crossing creek. Site runs along creek (Owl 3)	56	258730	6221370	Nattai NP	Woodland	Dry Alluvial Paperbark Woodland							1			
BUR12O	Wanganderry Walls - on main fire trail along lake at creek crossing (Owl 4)	56	261130	6224510	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1			
HLL01O	Wanganderry - Burnt Flat creek beside Wanganderry road (WRG-18)	56	247269	6201999	Nattai NP	Tall Forest	Escarpment Grey Gum Forest		1	1				1		1	
HLL03W	Wanganderry -At gate ~2km south Fowlers Flats between Wollondilly river and Bonnum Pic Ck (WRG14)	56	247320	6206488	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland		1	1				1		1	
HLL04O	Wanganderry - on Burnt Flat Creek (Spot 4)	56	247650	6200990	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest									1	
HLL07O	Bargo SCA: Iron creek gully eastern side of powerlines - walk off end of 4WD track off Rocky Waterholes rd	56	264850	6196300	Bargo SCA	Tall Forest	Nattai Sandstone River Peppermint Forest							1			
HLL09W	S Nattai - Old rd to McArthurs flat. Site runs along road.	56	258504	6204023	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
HLL10W	South Nattai - Long Nose Ridge road	56	262169	6205925	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest							1			
HLL11W	South Nattai- on Long Nose Ridge road approximately 600m north of Rocky Ground area	56	262967	6205034	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest		1	1						1	
HLL12O	South Nattai - Long Nose Ridge rd lightly built Nattai sandstone dry shrub forest 2.8km north of gate	56	263675	6203677	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest				1			1			
HLL13O	Bargo SCA-In moist gully north of unmarked trail off Western Break Fire trail 1km west of Little River (NB01)	56	268449	6202812	Bargo SCA	Tall Forest	Nattai Sandstone River Peppermint Forest		1					1		1	
HLL14W	Bargo SCA- on unmarked trail that comes off Main West Break Fire trail approximately 1km due east of Edina Falls (NB04)	56	268423	6194610	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest	1	1	1						1	
HLL15O	Bargo SCA- 100m north of Main West Break Fire trail (NB05)	56	267418	6193453	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1	1						1	
HLL16O	Bargo SCA- on Trig Road Fire trail approximately 450m south-east of trig (NB06)	56	267004	6195333	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest	1	1	1						1	
HLL17W	Bargo SCA- West Road Fire trail 300m south of Bolins Road Fire trail	56	269319	6198879	Outside	Woodland	Nepean Enriched Sandstone Woodland		1							1	
HLL18W	Bargo SCA- East off Yabbies Fire trail approximately 600m north of intersection of Yabbies and West Road Fire trails (NB10)	56	269333	6200674	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1							1	
HLL19W	Bargo SCA- Off eastern side of Western Break Fire trail approximately 1.8km from intersection with Wattle Ridge road	56	268188	6200816	Bargo SCA	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1						1	
HLL20O	Nattai NP- 250m east off Long Nose Ridge road approximately 1.7km north of intersection with Wattle Ridge road (NB13)	56	264431	6202835	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest	1	1	1						1	
HLL21W	Nattai NP- on sandy road that runs parallel to and west of Long Nose Ridge. 2.5km north of Camelot Boundary (NB14)	56	263606	6203339	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1			1		1	1	
HLL22W	Nattai NP- on Nattai road at big triangular boulder on steep slope. Site runs along road (NB18)	56	258094	6206459	Nattai NP	Tall Forest	Escarpment Tall Box Forest		1	1						1	
HLL23O	Nattai NP- on Nattai road approximately 800m south-east of ford of Nattai River tributary	56	259044	6205595	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest		1	1				1		1	

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
HLL24W	Nattai NP- on Nattai road approximately 500m south-east of locked gate on map (NB20)	56	259822	6204617	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest			1							
HLL25W	Nattai NP- 250m north of Wattle Ridge boundary and road. Perpendicular to road (NB21)	56	263086	6202032	Nattai NP	Woodland	Nepean Enriched Sandstone Woodland			1						1	
HLL26W	Bargo SCA- on track off Western Break Fire trail just east of fire trail (NBH11)	56	267811	6202297	Bargo SCA	Open Forest	Nattai Sandstone Dry Shrub Forest						1				
HLL27W	Bargo- Powerline access track off the Western Break Fire trail approximately 100m south-east of fire trail (NBH10)	56	269546	6197570	Outside	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest						1		1		
HLL28W	Bargo- Rocky Waterholes creek at boundary of SCA park (NBH09)	56	266546	6197570	Outside	Heaths and Swamps	Highlands Swamp Gum-Tea Tree Heath-Woodland: Form B (Melaleuca)						1				
HLL29W	Bargo SCA- on Trig Road Fire trail just west of turnoff to Trig (NBH08)	56	266464	6195571	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest						1				
HLL30W	Bargo SCA- on unmarked trail on ridge south of Blackguard gully (NBH7)	56	266367	6193527	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest						1				
HLL31W	Nattai NP- on track off Long Nose Ridge road approximately 100m east of Long Nose Ridge road (NBH06)	56	263871	6203438	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest						1				
HLL32W	Nattai NP- on first track north of gate off Long Nose Ridge road to east of Long Nose Ridge (NBH05)	56	264676	6201304	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest						1				
HLL33W	Nattai NP- on boundary of Camelot (Wattle Ridge) near large dam (NBH04)	56	262643	6201424	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland						1				
HLL34O	Nattai NP- at ford of Nattai river tributary on Nattai road by log bridge (NBH03)	56	258300	6205978	Nattai NP	Tall Forest	Nepean Gorge Moist Forest						1				
HLL35W	Nattai NP- at beginning of starlights trail approximately 200m south-west of Nattai road (NBH01)	56	261834	6201061	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest						1				
HLL36O	Nattai NP- on unmarked trail to west off Nattai road (NBH02)	56	260068	6204354	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest						1				
HLL37W	Bargo- Quarry pond just south of Rocky Waterholes creek (NBA7)	56	266870	6197349	Outside	Woodland	Exposed Burragorang Sandstone Shrub Woodland	1									
HLL38W	Bargo SCA- Power line easement just north of Western Break Fire trail (NBA8)	56	266790	6199914	Bargo SCA	Woodland	Exposed Burragorang Sandstone Shrub Woodland	1									

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HLL39W	Nattai NP- across water on tributary of Nattai river. On Nattai road (NBA4)	56	258104	6206442	Nattai NP	Tall Forest	Escarpment Tall Box Forest	1									
HLL40W	Nattai- on border of Nattai NP on road to Mt Jellore	56	257214	6193146	Outside	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant		1	1						1	
HLL41O	Nattai- on south west slope of Mt. Jellore on walking track (NB25)	56	257815	6193390	Outside	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant			1							
HLL42O	Nattai NP- on tributary of Jellore creek off track to north-West of Mt Jellore just south of inholding Lot 5 (NB26)	56	257394	6194105	Nattai NP	Tall Forest	Highlands Shale Tall Open Forest: Form A Tall Gully Variant		1	1	1			1		1	
HLL43O	Nattai- south off north-east running trail above Jellore creek (NB28)	56	259523	6195490	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest		1	1						1	
HLL44W	Nattai- on road running along High Range approximately 500m from gate (road to Temporali property) (NB29)	56	256064	6194685	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest		1							1	
HLL45O	Nattai- Forest Red Gum dominated woodland slope off start of track to High Range. North-west corner of lot 5B (NB30)	56	256980	6195246	Nattai NP	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant		1	1	1					1	
HLL46O	Jellore- on road to Wanganderry lookout approximately 2.8km south of lookout. Approx 1.5km NW of inholding #58 (NB31)	56	256520	6196287	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest		1	1						1	
HLL47O	Nattai- at junction of tributary of Wanganderry creek approximately 1.5km south-east of Wanganderry lookout (NB32)	56	255682	6197435	Nattai NP	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1	1	1						
HLL48O	Nattai- in gully approximately 400m north-east of junction with Jocks creek (NB34)	56	254439	6197763	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest		1								
HLL49W	Nattai NP- on track north of Jellore creek approximately 300m south-west of helipad (NBH12)	56	259943	6196195	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest						1	1			
HLL50W	Nattai NP- on road to Wanganderry lookout approximately 100m south of junction. West side of road (NBH13)	56	256619	6196037	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest						1				
HLL51W	Nattai NP- on side road going to west of road to Wanganderry lookout (NBH14)	56	256728	6195381	Nattai NP	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant						1				
HLL52W	Nattai NP- on road through private property approximately 600m south of road junction (NBA10)	56	257815	6194369	Nattai NP	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant	1									

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
HLL53W	Nattai- at base of Mt. Jellore on rock outcrop on south-west side (NBA11)	56	257849	6193317	Outside	Woodland	Highlands Transitional Shale Woodland	1									
HLL54G	Nattai- Dam on private property approximately 50m west of Park boundary	56	255655	6194236	Outside	Tall Forest	Highlands Shale Tall Open Forest: Form B Open Red Gum Variant	1									
HLL55R	Nattai NP- Jocks creek rainforest gully approximately 650m off road to Wanganderry lookout (NATPE01)	56	254250	6197500	Nattai NP	Rainforest	Sandstone Warm Temperate Rainforest		1								
HLL62W	Nattai NP- Nattai road approximately 480m west of driveway entrance to Camelot property on boundary of private property and park	56	262806	6201651	Nattai NP	Woodland	Nepean Enriched Sandstone Woodland						1				
HLL63O	Bargo SCA- on 4WD track approximately 200m west of junction with Wattle Ridge road. Approximately 350m south east of Todea Falls	56	267728	6198280	Bargo SCA	Woodland	Rocky Sandstone Heath Woodland						1				
HLL64W	Bargo- Travelling stock reserve. Dam at end of fire trail approximately 300m west of junction with west road fire trail and 4WD track	56	268407	6197128	Outside	Heaths and Swamps	Highlands Swamp Gum-Tea Tree Heath-Woodland: Form B (Melaleuca)		1						1	1	
HLL65O	Bargo SCA- Todea Falls. On tributary of Rocky Waterholes creek approximately 1.25km north east of creek junction 50m north of 4WD track	56	267419	6198469	Bargo SCA	Open Forest	Nattai Sandstone Dry Shrub Forest		1						1		
HLL66S	Bargo- just south of boundary of Bargo SCA. Between disused quarry and Rocky Waterholes creek (southern bank of creek). Approximately 250m south of 596m highpoint	56	266840	6197428	Outside	Woodland	Exposed Burragorang Sandstone Shrub Woodland								1		
HLL67O	Nattai National Park - Wanganderry area. At junction of creeklines. Approx 600m ENE of NE corner of Jim Samsons property	56	250633	6201587	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest			1						1	
HLL68W	Nattai National Park - Wanganderry Area. Along rock outcrop cliff line running NE/SW. East of Allum River. Approx 2km NE of NE corner of Samson property (AR04)	56	251027	6203069	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest			1							
HLL70G	Nattai National Park - Wanganderry area. Dam on western boundary of Jim Samsons property.	56	248639	6201049	Nattai NP	Heaths and Swamps	Highlands Melaleuca Thicket	1									
HLL71O	Nattai National Park - Wanganderry area. In gully approx 750m NE of corner of Jim Samsons property	56	250830	6201581	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			

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HLL72O	Nattai National Park - 100m east of eastern boundary of Jim Samsons property. Wanganderry area.	56	249567	6200300	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest			1						1	
HLL73O	Nattai National Park - southern edge of park approx 50m north of boundary of Jim Samsons property	56	248891	6201622	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest									1	
HLL74O	Nattai National Park - Wanganderry area. On outcrop overlooking tributary of Allum River. Approx 450m north of Samsons property.	56	248876	6202052	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
HLL75W	Nattai National Park - Wanganderry area. On Allum River. Approx 600m north of Jim Samsons boundary.	56	249336	6202153	Nattai NP	Tall Forest	Nepean Gorge Moist Forest			1							
HLL76O	Nattai National Park - Wanganderry area. On southern branch of tributary of Wanganderry Creek. Approx 1.1km east of Samsons boundary.	56	250451	6200259	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest			1							
HLL77W	THE ROCK - Nattai NP - Large rock outcrop overlooking gully on Nattai Valley fire trail west of Camelot	56	260493	6202787	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
HLL78W	Nattai NP - Wanganderry Lookout approximately 1km north of Jocks Creek (OWL1)	56	254462	6198869	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest							1		1	
HLL79O	Nattai NP - approximately 2km south east of Wanganderry Lookout off trail to lookout. 100m NE of trail before drops into gully (OWL2)	56	255600	6197200	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest							1			
HLL80O	Nattai NP - north of High Range on Jocks Creek approximately 100m from private property boundary (OWL3)	56	255497	6195024	Nattai NP	Tall Forest	Highlands Shale Tall Open Forest: Form A Tall Gully Variant							1			
HLL81O	Nattai NP - approximately 1.5km E/NE of Kallawarra off Wombeyan Caves Rd and 500m E of head of Wilsons Creek (WAR1)	56	252250	6194850	Outside	Open Forest	Highlands Sandstone Dry Shrub Forest							1			
HLL82O	Nattai NP - Head of Wilsons Creek off Wombeyan Caves Road. Approximately 800m NE of Kallawarra (WAR2)	56	251500	6195150	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest									1	
HLL83O	Nattai NP - 1.4km north of Mount Jellore on trail to Russells Needle (Camp)	56	258350	6194994	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest				1					1	

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HLL84O	Nattai NP - approximately 200m from gate entry to High Range Road (Natt2)	56	255870	6194358	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest				1						
HLL85W	Nattai NP - approximately 1km south of the end of Russells Needle fire trail (Russells Needle)	56	259843	6196055	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest				1						
HLL86W	Nattai NP - Wanganderry Lookout fire trail along rocky outcropping approximately 600m north of trail leading to Jocks Creek (Natt 3)	56	256609	6196048	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest				1						
HLL87O	Nattai NP - gully line west of Russells Needle Fire Trail. Eventually runs into Nattai River 2km SSW of Russells Needle (SpotNat1)	56	259400	6195800	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest									1	
HLL88W	Nattai NP - Rock ledge about 50m above Wanganderry Creek at the junction with the tributary coming from the south approximately 2.5km N of lot 103 (OWL4)	56	250445	6198705	Nattai NP	Woodland	Rocky Sandstone Heath Woodland							1		1	
HLL89W	Nattai NP - along gully line approximately 600m east of Old Wanganderry running into park from border with Lot 63 (WAR4)	56	249855	6196626	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest									1	
HLL90O	Nattai NP - border with private property (WAR5)	56	250872	6196046	Nattai NP	Other	Cleared-Modified Land									1	
HLL91W	Nattai NP - off western Break Fire Trail (Bargo Owl 2)	56	268010	6200406	Bargo SCA	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest							1			
HLL92O	Nattai NP - on Burnt Flat Creek at Wanganderry gate (Wgate1)	56	247760	6200812	Nattai NP	Tall Forest	Nattai Sandstone River Peppermint Forest				1						
HLL93O	Nattai NP - on Burnt Flat Creek approximately 1km north of Wanganderry gate (Wgate 2)	56	247330	6201187	Nattai NP	Tall Forest	Escarpment Grey Gum Forest				1						
HLL94W	Nattai NP - across dry gully approximately 150m south of Bonnum Pic gate (Wgate 5)	56	247255	6206309	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland				1						
HLL95O	Nattai NP - Fire Trail to Bonnum Pic approximately 800m west of Bonnum Pic	56	246836	6205516	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1		1	
LJMP98021904	Nattai, 0.2km from River Lodge, continue for 2kms	56	248175	6208575	Nattai NP	Other	Cleared-Modified Land										1
LJMP9802190Q	nattai	56	259450	6216075	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland										1
LJMP98021918	nattai NP, along rd to colliery #3	56	260875	6219775	Nattai SCA	Rainforest	Sandstone Warm Temperate Rainforest										1
MTT01W	Nattai- along Jellore creek tributary on unmarked track off road to Mt Jellore (NB23)	56	255700	6192510	Outside	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest		1							1	

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MTT02W	Nattai NP- on road to Mt. Jellore approximately 1.5km south-west of base of mountain (NBH15)	56	256666	6193031	Nattai NP	Open Forest	Highlands Sandstone Dry Shrub Forest						1				
MTT03W	Nattai- on side track to west of road to Mt. Jellore approximately 500m south-west of park boundary (NBH16)	56	255818	6192534	Outside	Tall Forest	Highlands Shale Tall Open Forest: Form A Tall Gully Variant						1				
NTT07W	Jooriland on trail to river crossing in remnant ironbark/white box	56	249745	6211965	Nattai NP	Other	Scattered Trees & Regenerating Vegetation		1	1			1			1	
NTT08W	Jooriland - Douglas creek trail E side of river in foothills (WRGDSB)	56	250318	6210276	Nattai NP	Woodland	Douglas Scarp Woodland									1	
NTT09W	Wanganderry - start of track to hut (Wollondilly)	56	247855	6208503	Nattai NP	Other	Scattered Trees & Regenerating Vegetation						1			1	
NTT10W	Wanganderry - Along rock face of Douglas scarp near turnoff to Jooriland homestead (WRG-30)	56	250260	6211200	Nattai NP	Woodland	Douglas Scarp Woodland						1				
NTT15O	Wanganderry - upper slopes below west edge of Wanganderry Walls (WRG-46)	56	252010	6210187	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland			1							
NTT16W	Wanganderry - below Wanganderry Walls scarp (WRG-47)	56	249989	6208781	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland			1							
NTT17W	Jooriland - dry drainage/creek line near NTT18O which is about 1.6km SE of NTT07W (WRG-48)	56	249440	6210361	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland						1				
NTT18O	Jooriland - set amongst Cypress pines in drainage line near harp trap NTT17W (WRG-49)	56	249508	6210361	Nattai NP	Woodland	Devonian Red Gum-Grey Box Woodland						1				
NTT19W	Burragorang - Coleman's creek 200m E of Lake Burragorang edge (WRG-52)	56	253112	6213941	Nattai NP	Woodland	Dry Alluvial Paperbark Woodland			1				1		1	
NTT20O	Burragorang - 1.8km south of Bridge Point (WRG-53)	56	253618	6215891	Nattai NP	Woodland	Douglas Scarp Woodland			1				1			
NTT23O	Wanganderry Walls - main fire trail crossing Green Wattle Creek on east side of road (burnt) (Owl 2)	56	255310	6217755	Nattai NP	Open Forest	Permian Footslopes Grassy Red Gum-Box Forest							1			
NTT24O	Nattai East - Sheehys Creek Road approx. 1.2km NW of bridge over Lake Burragorang (Kyliz 01)	56	264438	6220737	Nattai SCA	Tall Forest	Escarpment Grey Gum Forest							1			
NTT25O	Nattai East - on Sheehys Creek Fire trail at creek crossing approx. 1km from Sheehys Crk Rd (Kyliz03)	56	269280	6218833	Outside	Open Forest	Nattai Sandstone Dry Shrub Forest									1	

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
NTT27W	Nattai East - Buxton Plateau on main fire trail (Kyliz10)	56	268968	6208794	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
NTT28W	Nattai East - Blue Gum Creek on road south of ford (Kyliz12)	56	265853	6213921	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1			
NTT29O	Nattai East - Blue Gum Creek where fire trail crosses tributary (Kyliz13)	56	264750	6215950	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1			
NTT30O	Nattai East - OLD CRA SITE (s-f-syd-43-075-g). On road adjacent to Blue Gum Crk in severely burnt area	56	267875	6212275	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest									1	
NTT31W	Nattai NP- Nattai road 150m north of catchment boundary north-west of Middle Flat (NB16)	56	256559	6208334	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland		1	1							
NTT32W	Nattai NP- approximately 150m south of Nattai River and Middle Flat (NB17)	56	256354	6207575	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland		1	1							
NTT33W	Nattai NP- Pool in Nattai river on bend south of Middle Flat (NBA3)	56	256387	6207622	Nattai NP	Tall Forest	Burragorang River Flat Forest	1									
NTT34W	Nattai NP- on Blue Gum Mountain trail about 200m east of Perrott Bluff trail (Nattai 2 ridge only)	56	267781	6215107	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland									1	
NTT35W	Nattai NP- Off Hoddles track approximately 1km along unnamed trail follows creekline parallel to Blue Gum Mountain (Smooth)	56	267770	6216044	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest									1	
NTT36O	Nattai NP north- near end of track to Perrott Bluff (NAT01)	56	267937	6213983	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1							1	
NTT37O	Nattai NP- Blue Gum-Turpentine gully of Couridjah creek off Blue Gum Mountain fire trail (Nattai 2)	56	267983	6214970	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest		1					1			
NTT38W	Nattai NP- side track running south west of Long Nose Ridge road to Nattai Walls above Martins creek. 1.2km south west of road junction side track comes off Long Nose Ridge Road approximately 600m north of Centre Ridge track	56	261300	6208400	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest			1							
NTT39W	Nattai NP- Centre Ridge road approximately 1.1km east of junction with Long Nose Ridge Road	56	263510	6209111	Nattai NP	Heaths and Swamps	Rock Plate Heath-Mallee			1							
NTT40W	Nattai NP- Long Nose Ridge road approximately 3.5km north by road of junction with Centre Ridge road. On Nattai Tableland	56	262887	6211640	Nattai NP	Heaths and Swamps	Rock Plate Heath-Mallee			1							

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
NTT41W	Nattai NP- Rocky outcrop of ridge south of Wild Goat Plateau. 475m due west of headwater of McKenzie Creek	56	262951	6212795	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland			1							
NTT44W	Nattai NP - Eastern end of northern most fire trail	56	265955	6212548	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
NTT45O	Nattai NP - Hook bend on northern most fire trail	56	263349	6212294	Nattai NP	Open Forest	Sheltered Sandstone Blue-leaved Stringybark Forest							1			
NTT46W	Nattai NP - Eastern end of centre ridge fire trail overlooking deep northern gully	56	266479	6210044	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
NTT47O	Nattai NP - Small trail south off centre ridge trail	56	264377	6208640	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest							1			
NTT48O	Nattai NP - Nattai Valley fire trail in valley slopes	56	256884	6207456	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1		1	
NTT49O	HOOK SITE - Nattai NP - Right hand hook on Hoddles fire trail	56	266466	6217148	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest							1			
NTT50O	HOOBIT – Hoddles fire trail northern end	56	267840	6216827	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest									1	
NTT51O	CAMP 3 – Nattai NP - Northern end Hoddles fire trail	56	266312	6217984	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest									1	
PCT02O	Nattai East - at end of Sheehys Creek Fire Trail at locked gate (Kyliz04)	56	269746	6218546	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest							1			
PCT06O	Nattai East - Blue Gum Creek where road departs from creek in Blue Gum Forest site located on creek (Kyliz08)	56	270740	6209840	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest							1		1	
PCT07W	Nattai East - Buxton Plateau approx. 100m north of fire trail down power easement (Kyliz11)	56	271420	6207980	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland							1			
PCT08O	Nattai NP- on Wam FT between Wam and Alice lane. 250m east of Wam intersection	56	270638	6215025	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest		1								
PCT10R	Nattai NP- on westerly branch of Couridjah creek approximately 500m off Wam fire trail (Nattai05)	56	269760	6214115	Nattai NP	Rainforest	Sandstone Warm Temperate Rainforest		1					1		1	
PCT11R	Nattai NP- on tributary of Sandy Flat creek south-west of junction of Wam Fire trail and Sandy Flat creek Fire trail (DCPRT01)	56	270512	6215938	Nattai NP	Rainforest	Sandstone Warm Temperate Rainforest		1					1		1	
PCT16O	Nattai NP- Blue Gum creek north side of creek. Approximately 600m west of locked gate	56	271624	6209953	Nattai NP	Open Forest	Nattai Sandstone Dry Shrub Forest								1		
s-f-syd-43-066-r	near 'River Lodge'	56	248225	6208700	Nattai NP	Other	Scattered Trees & Regenerating Vegetation		1	1		1	1	1			1
s-f-syd-43-067-m	Wollondilly River, east side near 'River Lodge'	56	248175	6209650	Nattai NP	Other	Scattered Trees & Regenerating Vegetation		1	1		1		1			

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
s-f-syd-43-070-r	on the top of a crest on road to Douglas Creek	56	251462	6210755	Nattai NP	Woodland	Douglas Scarp Woodland		1	1		1		1			
s-f-syd-43-071-m	nattai	56	251470	6211625	Nattai NP	Woodland	Douglas Scarp Woodland		1	1				1		1	1
s-f-syd-43-072-g	along a dry creek bed that runs into Douglas Creek	56	250625	6210500	Nattai NP	Woodland	Douglas Scarp Woodland		1	1				1	1		
s-f-syd-43-074-g	On the Blue Gum Creek track	56	267825	6213250	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest		1	1				1			1
s-f-syd-43-075-g	Along Blue Gum trail	56	267875	6212275	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest		1	1				1			
s-f-syd-43-076-g	Along Blue gum trail	56	267975	6211275	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest		1	1				1			
s-f-syd-43-078-r	On road along east bank of the Nattai R., Site on a flat area adjacent to river. Not really a ridge site.	56	258825	6214350	Nattai NP	Open Forest	Permian Footslopes Grassy Red Gum-Box Forest		1	1				1			
s-f-syd-43-079-m	On road along east bank of the Nattai R. Escarpment overlooking river - site on upper slope of this.	56	259175	6215175	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland		1	1				1			
s-f-syd-43-080-g	On the road along the east bank of the Nattai River, Gully running down in to Nattai R.	56	259400	6216025	Nattai NP	Woodland	Exposed Permian Sandstone Woodland		1	1				1			1
s-f-syd-43-082-r	On Long Nose Ridge Rd	56	261800	6210625	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1							
s-f-syd-43-083-m	On the Nattai tableland, along the ridge	56	262125	6209750	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1				1			1
s-f-syd-43-084-g	On Nattai tableland along long nose ridge rd	56	262125	6209050	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland		1	1				1			
t-f-syd-43-002	nattai, 3.3km E of sheeps ck gate	56	267161	6219187	Nattai NP	Woodland	Rocky Sandstone Heath Woodland							1			
t-f-syd-43-003	nattai, 4.3 km W sheeps ck gate	56	266403	6219159	Nattai NP	Woodland	Escarpment Slopes Dry Ironbark Woodland							1		1	
t-f-syd-43-004	nattai	56	260600	6219325	Nattai SCA	Woodland	Escarpment Slopes Dry Ironbark Woodland							1			
t-f-syd-43-005	nattai np	56	262925	6222675	Outside	Other	Cleared-Modified Land							1			
t-f-syd-43-006	nattai, on camp at river	56	262350	6218875	Nattai NP	Other	Cleared-Modified Land							1		1	
t-f-syd-43-007	nattai, colliery 2	56	262925	6222675	Outside	Other	Cleared-Modified Land							1			
t-f-syd-43-008	nattai, 3.2km along blue gum ck rd from rain gauge	56	264375	6217775	Nattai NP	Open Forest	Permian Footslopes Grassy Red Gum-Box Forest							1			
t-f-syd-43-058	Nattai west	56	250225	6211075	Nattai NP	Woodland	Douglas Scarp Woodland				1						
t-f-syd-43-060	nattai	56	262925	6222675	Outside	Other	Cleared-Modified Land			1							
t-f-syd-43-061	nattai np	56	262400	6208550	Nattai NP	Heaths and Swamps	Rock Plate Heath-Mallee			1							
t-f-syd-43-062	nattai np	56	262000	6208200	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland			1							

Site Number	Location	Zone	Easting	Northing	Reserve	Broad Vegetation	Vegetation Community	Bat Ultrasound	Diurnal Bird	Diurnal Herps	Elliott Trapping	Hair Tube	Harp Trapping	Nocturnal Playback	Nocturnal Streamside	Site Spotlight	Transect Spotlight
t-f-syd-43-098	blue gum creek, nattai	56	267950	6211475	Nattai NP	Open Forest	Couridjah Sheltered Sandstone Forest				1						
t-f-syd-43-099	nattai river, nattai NP	56	259050	6215775	Nattai NP	Tall Forest	Burragorang River Flat Forest				1						
t-f-syd-43-100	nattai, trk W of hut along escarpment	56	263250	6219100	Nattai SCA	Tall Forest	Escarpment Grey Gum Forest				1						
t-f-syd-43-130	nattai	56	260800	6219550	Nattai SCA	Tall Forest	Escarpment Grey Gum Forest						1				
t-f-syd-43-131	nattai	56	259700	6218375	Outside	Tall Forest	Escarpment Grey Gum Forest						1				
t-f-syd-43-132	nattai	56	262500	6208650	Nattai NP	Woodland	Exposed Burragorang Sandstone Shrub Woodland						1				

APPENDIX B

Fauna Species of the Nattai and Bargo Reserves.

The following is a complete species list for the study area from the Atlas of NSW Wildlife. Separate fields show species for each of Nattai NP and SCA, Bargo SCA and for records outside these reserves. Introduced species are indicated by an asterisk*.

Family	Scientific Name	Common Name	Legal Status	Reserve		
				Nattai NP and SCA	Bargo SCA	Elsewhere
Frogs						
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet	P	31	20	5
Myobatrachidae	*Heleioporus australiacus*	Giant Burrowing Frog	V	0	3	0
Myobatrachidae	*Limnodynastes dumerilii*	Bullfrog	P	4	6	0
Myobatrachidae	*Limnodynastes peronii*	Striped Marsh Frog	P	3	3	0
Myobatrachidae	*Paracrinia haswelli*	Haswell's Froglet	P	0	0	1
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V	1	2	0
Myobatrachidae	*Pseudophryne bibronii*	Bibron's Toadlet	P	12	0	0
Myobatrachidae	*Uperoleia laevigata*	Smooth Toadlet	P	0	1	1
Myobatrachidae	*Uperoleia* sp.		P	1	0	0
Hylidae	*Litoria citropa*	Blue Mountains Tree Frog	P	3	8	1
Hylidae	*Litoria dentata*	Keferstein's Tree Frog	P	6	3	1
Hylidae	*Litoria lesueuri*	Lesueur's Frog	P	14	11	
Hylidae	*Litoria peronii*	Peron's Tree Frog	P	12	6	2
Hylidae	*Litoria phyllochroa*	Green Stream Frog	P	4	12	0
Hylidae	*Litoria verreauxii*	Verreaux's Tree Frog	P	3	8	1
Reptiles						
Chelidae	*Chelodina longicollis*	Eastern Snake-necked Turtle	P	2	0	0
Gekkonidae	*Oedura lesueurii*	Lesueur's Velvet Gecko	P	46	9	1
Gekkonidae	*Phyllurus platurus*	Broad-tailed Gecko	P	5	2	1
Gekkonidae	*Underwoodisaurus milii*	Thick-tailed Gecko	P	10	0	0
Agamidae	*Amphibolurus muricatus*	Jacky Lashtail	P	22	0	1
Agamidae	*Physignathus lesueurii*	Eastern Water Dragon	P	10	2	1
Agamidae	*Tympanocryptis diemensis*	Mountain Heath Dragon	P	9	3	0
Varanidae	*Varanus* sp.	Unidentified Goanna	P	1	1	0
Varanidae	*Varanus varius*	Lace Monitor	P	28	0	0
Scincidae	*Bassiana platynota*	Red-throated Cool-skink	P	9	4	0
Scincidae	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	P	14	1	0
Scincidae	*Ctenotus robustus*	Robust Ctenotus	P	7	0	0
Scincidae	*Ctenotus taeniolatus*	Copper-tailed Ctenotus	P	21	8	2
Scincidae	*Cyclodomorphus michaeli*		P	0	1	0
Scincidae	*Egernia cunninghami*	Cunningham's Spiny-tailed Skink	P	2	0	0
Scincidae	*Egernia whitii*	White's Rock-skink	P	9	0	0
Scincidae	*Eulamprus quoyii*	Eastern Water-skink	P	13	1	1
Scincidae	*Eulamprus* sp.	Unidentified Eulamprus	P	2	0	0
Scincidae	*Eulamprus tenuis*	Bar-sided Forest-skink	P	2	0	0
Scincidae	*Hemiergis decresiensis*	Three-toed Earless Skink	P	1	0	0

Family	Scientific Name	Common Name	Legal Status	Reserve		
				Nattai NP and SCA	Bargo SCA	Elsewhere
Scincidae	*Lampropholis delicata*	Dark-flecked Garden Sunskink	P	13	3	1
Scincidae	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	P	1	5	0
Scincidae	*Lygisaurus foliorum*	Tree-base Litter-skink	P	13	0	0
Scincidae	*Pseudemoia entrecasteauxii*	Tussock Cool-skink	P	1	0	0
Scincidae	*Saproscincus mustelinus*	Weasel Shadeskink	P	4	1	0
Scincidae	*Tiliqua scincoides*	Common Bluetongue	P	1	1	0
Typhlopidae	*Ramphotyphlops nigrescens*	Blackish Blind Snake	P	2	1	0
Boidae	*Morelia spilota spilota*	Diamond Python	P	2	2	0
Elapidae	*Demansia psammophis*	Yellow-faced Whipsnake	P	2	0	0
Elapidae	*Drysdalia coronoides*	White-lipped Snake	P	0	3	0
Elapidae	*Drysdalia rhodogaster*	Mustard-bellied Snake	P	0	2	0
Elapidae	*Hoplocephalus bungaroides*	Broad-headed Snake	E1	0	2	0
Elapidae	*Notechis scutatus*	Mainland Tiger Snake	P	2	1	0
Elapidae	*Pseudechis porphyriacus*	Red-bellied Black Snake	P	10	1	0
Elapidae	*Pseudonaja textilis*	Eastern Brown Snake	P	0	1	0
Elapidae	*Rhinoplocephalus nigrescens*	Small-eyed Snake	P	3	0	0
Birds						
Casuariidae	*Dromaius novaehollandiae*	Emu	P	16	0	0
Phasianidae	*Coturnix pectoralis*	Stubble Quail	P	1	0	0
Phasianidae	*Coturnix ypsilophora*	Brown Quail	P	0	1	0
Anatidae	*Anas castanea*	Chestnut Teal	P	1	0	0
Anatidae	*Anas gracilis*	Grey Teal	P	1	0	0
Anatidae	*Anas rhynchotis*	Australasian Shoveler	P	1	0	0
Anatidae	*Anas superciliosa*	Pacific Black Duck	P	14	0	1
Anatidae	*Biziura lobata*	Musk Duck	P	5	0	0
Anatidae	*Chenonetta jubata*	Australian Wood Duck	P	11	0	5
Anatidae	*Cygnus atratus*	Black Swan	P	9	0	1
Podicipedidae	*Podiceps cristatus*	Great Crested Grebe	P	7	0	0
Podicipedidae	*Poliocephalus poliocephalus*	Hoary-headed Grebe	P	1	0	0
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	P	8	0	1
Anhingidae	*Anhinga melanogaster*	Darter	P	1	0	0
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	P	1	0	0
Phalacrocoracidae	*Phalacrocorax melanoleucos*	Little Pied Cormorant	P	4	1	0
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant	P	4	0	0
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	P	5	0	0
Ardeidae	*Ardea alba*	Great Egret	P	4	0	0
Ardeidae	*Ardea intermedia*	Intermediate Egret	P	1	0	0
Ardeidae	*Egretta novaehollandiae*	White-faced Heron	P	8	1	1
Ardeidae	*Nycticorax caledonicus*	Nankeen Night Heron	P	1	1	
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	P	1	0	0
Threskiornithidae	*Platalea regia*	Royal Spoonbill	P	3	0	0
Threskiornithidae	*Threskiornis molucca*	Australian White Ibis	P	3	0	0
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis	P	2	0	0
Accipitridae	*Accipiter fasciatus*	Brown Goshawk	P	1	0	0
Accipitridae	*Aquila audax*	Wedge-tailed Eagle	P	32	6	0
Accipitridae	*Circus approximans*	Swamp Harrier	P	1	0	0

Family	Scientific Name	Common Name	Legal Status	Reserve		
				Nattai NP and SCA	Bargo SCA	Elsewhere
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	P	4	0	0
Accipitridae	*Haliastur sphenurus*	Whistling Kite	P	1	0	0
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	P	2	0	0
Falconidae	*Falco berigora*	Brown Falcon	P	1	0	0
Falconidae	*Falco cenchroides*	Nankeen Kestrel	P	8	0	0
Falconidae	*Falco longipennis*	Australian Hobby	P	1	0	0
Falconidae	*Falco peregrinus*	Peregrine Falcon	P	4	0	0
Rallidae	*Fulica atra*	Eurasian Coot	P	2	0	0
Rallidae	*Gallinula tenebrosa*	Dusky Moorhen	P	2	0	0
Rallidae	*Gallirallus philippensis*	Buff-banded Rail	P	0	1	1
Rallidae	*Porphyrio porphyrio*	Purple Swamphen	P	1	0	0
Turnicidae	*Turnix varia*	Painted Button-quail	P	2	2	0
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E1	0	3	0
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	P	1	0	0
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	P	1	0	0
Charadriidae	*Vanellus miles*	Masked Lapwing	P	7	1	1
Laridae	*Larus novaehollandiae*	Silver Gull	P	2	0	0
Columbidae	*Columba livia*	Rock Dove*	U	1	0	0
Columbidae	*Geopelia cuneata*	Diamond Dove	P	2	0	0
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove	P	1	0	0
Columbidae	*Geopelia placida*	Peaceful Dove	P	5	2	1
Columbidae	*Leucosarcia melanoleuca*	Wonga Pigeon	P	34	1	2
Columbidae	*Macropygia amboinensis*	Brown Cuckoo-Dove	P	2	0	0
Columbidae	*Ocyphaps lophotes*	Crested Pigeon	P	1	0	2
Columbidae	*Phaps chalcoptera*	Common Bronzewing	P	16	3	1
Columbidae	*Phaps elegans*	Brush Bronzewing	P	1	0	0
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo	P	15	5	8
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	P	41	2	4
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo	P	18	2	4
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-cockatoo	V	41	2	1
Cacatuidae	*Eolophus roseicapillus*	Galah	P	1	0	1
Psittacidae	*Alisterus scapularis*	Australian King-Parrot	P	31	2	7
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	P	1	0	0
Psittacidae	*Lathamus discolor*	Swift Parrot	E1	2	0	0
Psittacidae	*Neophema pulchella*	Turquoise Parrot	V	6	0	0
Psittacidae	*Platycercus adscitus eximius*	Eastern Rosella	P	13	2	2
Psittacidae	*Platycercus elegans*	Crimson Rosella	P	65	18	16
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	42	14	4
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo	P	5	0	1
Cuculidae	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	P	0	1	0
Cuculidae	*Chalcites lucidus*	Shining Bronze-Cuckoo	P	11	2	0
Cuculidae	*Cuculus pallidus*	Pallid Cuckoo	P	5	5	0
Cuculidae	*Eudynamys orientalis*	Pacific Koel	P	3	0	0
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo	P	7	2	0
Strigidae	*Ninox boobook*	Southern Boobook	P	50	14	8
Strigidae	*Ninox strenua*	Powerful Owl	V	21	1	2
Tytonidae	*Tyto alba*	Barn Owl	P	5	0	0

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Tytonidae	*Tyto novaehollandiae*	Masked Owl	V	6	0	0
Tytonidae	*Tyto tenebricosa*	Sooty Owl	V	13	0	1
Podargidae	*Podargus strigoides*	Tawny Frogmouth	P	23	2	0
Caprimulgidae	*Eurostopodus mystacalis*	White-throated Nightjar	P	11	1	0
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar	P	55	3	0
Alcedinidae	*Alcedo azurea*	Azure Kingfisher	P	6	0	0
Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra	P	35	13	7
Halcyonidae	*Todiramphus macleayii*	Forest Kingfisher	P	1	0	0
Halcyonidae	*Todiramphus sanctus*	Sacred Kingfisher	P	16	6	0
Meropidae	*Merops ornatus*	Rainbow Bee-eater	P	6	0	0
Coraciidae	*Eurystomus orientalis*	Dollarbird	P	2	1	0
Menuridae	*Menura novaehollandiae*	Superb Lyrebird	P	59	22	4
Climacteridae	*Climacteris erythrops*	Red-browed Treecreeper	P	12	1	0
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subsp.)	V	36	1	0
Climacteridae	*Cormobates leucophaeus*	White-throated Treecreeper	P	90	23	26
Maluridae	*Malurus cyaneus*	Superb Fairy-wren	P	46	11	4
Maluridae	*Malurus lamberti*	Variegated Fairy-wren	P	8	4	3
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote	P	104	19	21
Pardalotidae	*Pardalotus* sp.	Unidentified Pardalote	P	0	1	0
Pardalotidae	*Pardalotus striatus*	Striated Pardalote	P	19	2	1
Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P	13	8	1
Acanthizidae	*Acanthiza lineata*	Striated Thornbill	P	49	17	8
Acanthizidae	*Acanthiza nana*	Yellow Thornbill	P	13	2	0
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill	P	63	9	10
Acanthizidae	*Acanthiza reguloides*	Buff-rumped Thornbill	P	18	4	1
Acanthizidae	*Aphelocephala leucopsis*	Southern Whiteface	P	1	0	0
Acanthizidae	*Calamanthus pyrrhopygius*	Chestnut-rumped Heathwren	P	1	2	0
Acanthizidae	*Gerygone fusca*	Western Gerygone	P	2	0	0
Acanthizidae	*Gerygone mouki*	Brown Gerygone	P	19	1	0
Acanthizidae	*Gerygone olivacea*	White-throated Gerygone	P	2	2	0
Acanthizidae	*Origma solitaria*	Rockwarbler	P	30	5	1
Acanthizidae	*Pycnoptilus floccosus*	Pilotbird	P	20	0	1
Acanthizidae	*Pyrrholaemus sagittatus*	Speckled Warbler	V	13	0	0
Acanthizidae	*Sericornis citreogularis*	Yellow-throated Scrubwren	P	1	0	0
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	P	38	9	3
Acanthizidae	*Smicrornis brevirostris*	Weebill	P	14	0	0
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	89	43	34
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird	P	27	9	13
Meliphagidae	*Anthochaera chrysoptera*	Little Wattlebird	P	12	5	12
Meliphagidae	*Lichenostomus chrysops*	Yellow-faced Honeyeater	P	73	18	11
Meliphagidae	*Lichenostomus fuscus*	Fuscous Honeyeater	P	6	0	1
Meliphagidae	*Lichenostomus leucotis*	White-eared Honeyeater	P	50	17	8
Meliphagidae	*Lichenostomus melanops*	Yellow-tufted Honeyeater	P	26	0	0
Meliphagidae	*Lichenostomus penicillatus*	White-plumed Honeyeater	P	3	0	0
Meliphagidae	*Manorina melanocephala*	Noisy Miner	P	16	2	0
Meliphagidae	*Manorina melanophrys*	Bell Miner	P	25	0	0
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	P	18	2	1

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Meliphagidae	*Melithreptus brevirostris*	Brown-headed Honeyeater	P	26	2	2
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subsp.)	V	3	0	0
Meliphagidae	*Melithreptus lunatus*	White-naped Honeyeater	P	52	2	4
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater	P	1	0	0
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird	P	37	4	3
Meliphagidae	*Phylidonyris nigra*	White-cheeked Honeyeater	P	1	0	0
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater	P	29	36	42
Meliphagidae	*Phylidonyris pyrrhoptera*	Crescent Honeyeater	P	1	0	0
Meliphagidae	*Xanthomyza phrygia*	Regent Honeyeater	E1	4	0	0
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	P	87	18	7
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern subsp.)	V	14	0	0
Petroicidae	*Microeca fascinans*	Jacky Winter	P	23	2	0
Petroicidae	*Petroica boodang*	Scarlet Robin	P	13	5	3
Petroicidae	*Petroica phoenicea*	Flame Robin	P	2	0	0
Petroicidae	*Petroica rosea*	Rose Robin	P	7	0	0
Eupetidae	*Cinclosoma punctatum*	Spotted Quail-thrush	P	25	4	2
Eupetidae	*Psophodes olivaceus*	Eastern Whipbird	P	32	8	4
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	P	15	3	0
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	P	85	23	11
Pachycephalidae	*Falcunculus frontatus*	Eastern Shrike-tit	P	14	1	0
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	P	55	14	12
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	P	52	15	4
Dicruridae	*Grallina cyanoleuca*	Magpie-lark	P	11	1	2
Dicruridae	*Monarcha melanopsis*	Black-faced Monarch	P	13	3	0
Dicruridae	*Myiagra inquieta*	Restless Flycatcher	P	14	0	0
Dicruridae	*Myiagra rubecula*	Leaden Flycatcher	P	13	2	0
Dicruridae	*Rhipidura albiscapa*	Grey Fantail	P	66	20	5
Dicruridae	*Rhipidura leucophrys*	Willie Wagtail	P	22	3	3
Dicruridae	*Rhipidura rufifrons*	Rufous Fantail	P	8	0	0
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P	22	5	3
Campephagidae	*Coracina papuensis*	White-bellied Cuckoo-shrike	P	5	1	0
Campephagidae	*Coracina tenuirostris*	Cicadabird	P	6	0	0
Campephagidae	*Lalage tricolor*	White-winged Triller	P	5	0	0
Oriolidae	*Oriolus sagittatus*	Olive-backed Oriole	P	15	3	0
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow	P	19	6	1
Artamidae	*Artamus superciliosus*	White-browed Woodswallow	P	3	3	0
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird	P	1	0	0
Artamidae	*Cracticus torquatus*	Grey Butcherbird	P	29	6	1
Artamidae	*Gymnorhina tibicen*	Australian Magpie	P	27	4	7
Artamidae	*Strepera graculina*	Pied Currawong	P	43	15	13
Artamidae	*Strepera versicolor*	Grey Currawong	P	3	1	0
Corvidae	*Corvus coronoides*	Australian Raven	P	20	16	12
Corcoracidae	*Corcorax melanorhamphos*	White-winged Chough	P	18	1	0
Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird	P	1	0	0
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird	P	27	1	2
Ptilonorhynchidae	*Sericulus chrysocephalus*	Regent Bowerbird	P	1	0	0
Alaudidae	*Alauda arvensis*	Eurasian Skylark*	U	1	0	0

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Motacillidae	*Anthus australis*	Australian Pipit	P	8	7	1
Passeridae	*Passer domesticus*	House Sparrow*	U	0	0	1
Estrildidae	*Neochmia temporalis*	Red-browed Finch	P	40	4	3
Estrildidae	*Stagonopleura bella*	Beautiful Firetail	P	2	0	1
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V	12	1	0
Estrildidae	*Taeniopygia bichenovii*	Double-barred Finch	P	8	0	0
Estrildidae	*Taeniopygia guttata*	Zebra Finch	P	1	0	0
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoebird	P	29	2	1
Hirundinidae	*Hirundo neoxena*	Welcome Swallow	P	17	3	2
Hirundinidae	*Petrochelidon ariel*	Fairy Martin	P	2	0	0
Hirundinidae	*Petrochelidon nigricans*	Tree Martin	P	3	2	0
Sylviidae	*Acrocephalus australis*	Australian Reed-Warbler	P	1	0	0
Sylviidae	*Cincloramphus cruralis*	Brown Songlark	P	1	0	0
Sylviidae	*Cincloramphus mathewsi*	Rufous Songlark	P	4	0	0
Sylviidae	*Megalurus gramineus*	Little Grassbird	P	1	0	0
Zosteropidae	*Zosterops lateralis*	Silvereye	P	22	0	4
Muscicapidae	*Turdus merula*	Eurasian Blackbird*	U	1	0	0
Muscicapidae	*Zoothera lunulata*	Bassian Thrush	P	3	2	0
Sturnidae	*Acridotheres tristis*	Common Myna*	U	1	0	1
Sturnidae	*Sturnus vulgaris*	Common Starling*	U	4	0	1
Mammals						
Ornithorhynchidae	*Ornithorhynchus anatinus*	Platypus	P	1	0	0
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked Echidna	P	11	2	3
Dasyuridae	*Antechinus flavipes*	Yellow-footed Antechinus	P	0	1	0
Dasyuridae	*Antechinus* sp.	Unidentified Antechinus	P	1	0	0
Dasyuridae	*Antechinus stuartii*	Brown Antechinus	P	22	8	0
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	1	0	0
Dasyuridae	*Dasyurus* sp.	Quoll	P	1	0	0
Dasyuridae	*Dasyurus viverrinus*	Eastern Quoll	E1	0	6	0
Dasyuridae	*Sminthopsis murina*	Common Dunnart	P	3	0	0
Peramelidae	*Isoodon/Perameles* sp.	Unidentified Bandicoot	P	1	1	0
Peramelidae	*Perameles nasuta*	Long-nosed Bandicoot	P	1	1	0
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	20	2	1
Vombatidae	*Vombatus ursinus*	Common Wombat	P	72	8	9
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	75	3	4
Petauridae	*Petaurus breviceps*	Sugar Glider	P	60	5	2
Petauridae	*Petaurus breviceps\norfolcensis*	Sugar\Squirrel Glider	P	1	0	0
Pseudocheiridae	*Petauroides volans*	Greater Glider	P	63	6	3
Pseudocheiridae	*Pseudocheirus peregrinus*	Common Ringtail Possum	P	28	5	2
Acrobatidae	*Acrobates pygmaeus*	Feathertail Glider	P	3	1	2
Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum	P	45	2	0
Macropodidae	*Macropus giganteus*	Eastern Grey Kangaroo	P	63	1	2
Macropodidae	*Macropus robustus*	Common Wallaroo	P	27	0	1
Macropodidae	*Macropus rufogriseus*	Red-necked Wallaby	P	40	0	0
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E1	11	1	0
Macropodidae	*Wallabia bicolor*	Swamp Wallaby	P	48	7	5

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Rhinolophidae	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	P	3	1	1
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	2	0	2
Molossidae	*Mormopterus* sp 1	Undescribed mastiff-bat	P	4	1	2
Molossidae	*Nyctinomus australis*	White-striped Freetail-bat	P	43	2	5
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	11	0	1
Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat	P	21	2	3
Vespertilionidae	*Chalinolobus morio*	Chocolate Wattled Bat	P	22	3	3
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	0	0	1
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	V	33	1	1
Vespertilionidae	*Myotis adversus*	Large-footed Myotis	V	9	0	0
Vespertilionidae	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	P	12	0	1
Vespertilionidae	*Nyctophilus gouldi*	Gould's Long-eared Bat	P	36	0	1
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	3	0	0
Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat	P	2	0	1
Vespertilionidae	*Vespadelus darlingtoni*	Large Forest Bat	P	7	2	3
Vespertilionidae	*Vespadelus regulus*	Southern Forest Bat	P	7	1	2
Vespertilionidae	*Vespadelus vulturnus*	Little Forest Bat	P	82	20	6
Muridae	*Hydromys chrysogaster*	Water-rat	P	2	0	0
Muridae	*Mus musculus*	House Mouse*	U	12	0	1
Muridae	*Rattus fuscipes*	Bush Rat	P	16	4	0
Muridae	*Rattus norvegicus*	Brown Rat*	U	0	1	0
Muridae	*Rattus rattus*	Black Rat*	U	3	4	1
Leporidae	*Oryctolagus cuniculus*	Rabbit*	U	28	0	8
Canidae	*Canis lupus*	Dingo, Domestic Dog	U	26	0	3
Canidae	*Canis lupus dingo*	Dingo	U	3	0	0
Canidae	*Canis lupus familiaris*	Dog*	U	3	5	0
Canidae	*Vulpes vulpes*	Fox*	U	25	1	5
Felidae	*Felis catus*	Cat*	U	5	0	0
Equidae	*Equus caballus*	Horse*	U	4	0	0
Suidae	*Sus scrofa*	Pig*	U	14	0	0
Bovidae	*Bos taurus*	European Cattle*	U	2	0	0
Bovidae	*Capra hircus*	Goat*	U	7	1	0




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