5 THREATENED SPECIES PROFILES

This section provides a profile of each of the threatened fauna species that is known to occur within north-western Wollemi NP, together with threatened species that have been recorded within a five kilometre radius of the area and are considered highly likely to occur within it. The aim of these profiles is to provide: 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 the surrounding five kilometres (as at 19th June 2006); and an appraisal of the distribution and status of the species in north-western Wollemi and the surrounding area. Due to the spatial inaccuracy of records from the first Birds Australia atlas, these records have not been included on the species distribution maps contained herein. Similarly, records with a low reliability of identification have not been included on the maps.

The list of threatened vertebrate fauna for the study area 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 DEC Atlas of NSW Wildlife as occurring within the area. Only species that have been directly and reliably observed within the study area, or have been recorded on the Atlas of NSW Wildlife within two kilometres and considered likely to occur within the area, have been afforded a species profile. Table 5 presents all of the threatened species recorded on the Atlas of NSW Wildlife within five kilometres of the study area, together with annotation for each species regarding the latest record, reliability of identification and a rationale for the generation of a species profile.

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area[1]		No. of locations within a five kilometre radius of study area[1]	Notes on reliability and date of last record	Species profile generated?
				DEC[2]	Other[3]			
Frogs								
Heleioporus australiacus	Giant Burrowing Frog	V	V	6	0	7	Adult seen in 1997 and several tadpoles seen in 2005-06.	Y
Mixophyes balbus	Stuttering Frog	E	V	2	0	0	Heard calling and tadpoles located during DEC surveys in December 2005.	Y
Pseudophryne australis	Red-crowned Toadlet	V	-	20	0	9	Observed on a number of occasions, mostly recently in December 2005.	Y
Litoria booroolongensis	Booroolong Frog	E	-	0	1	1	Australian Museum specimens collected in 1980 at "Simpsons Gorge", north of Nullo Mountain and in 1979 at Wollemi Creek, just east of the study area.	Y
Reptiles								
Varanus rosenbergi	Rosenberg's Goanna	V	-	5	0	0	Reliably observed within the study area during DEC surveys, most recently in January 2006.	Y
Hoplocephalus bungaroides	Broad-headed Snake	E	V	1	2	1	Historical records exist, and an individual was seen by DEC in September 2005.	Y
Hoplocephalus stephensii	Stephens' Banded Snake	V	-	0	2	0	Reported near Dunns Swamp in 2003, but identification uncertain.	N
Diurnal Birds								
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	0	1	0	Recorded by Birds Australia at Dunns Swamp in May 2001.	Y
Hamirostra melanosternon	Black-breasted Buzzard	V	-	0	0	1	Recorded once flying over Wollemi Creek 4.5 km east of the study area in 2003. Likely to be only an infrequent visitor to the study area and unlikely to rely on habitats therein.	N
Lophoictinia isura	Square-tailed Kite	V	-	0	1	2	Recorded once within the vicinity of Lee Creek in 1985 and twice south-west of the study area in the Capertee Valley.	Y
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	149	23	36	Regularly observed within and around the study area, most recently in April 2006.	Y
Calyptorhynchus banksii	Red-tailed Black-cockatoo	V	-	0	0	1	Highly likely to be a mis-identification. Out of known species range.	N
Calyptorhynchus lathami	Glossy Black-cockatoo	V	-	83	10	19	Regularly observed within and around the study area, most recently in May 2006.	Y
Lathamus discolor	Swift Parrot	E	E	0	0	10	Frequently recorded in the Capertee Valley, south-west of the study area, most recently in 2001. Potential habitat present within the study area.	Y
Neophema pulchella	Turquoise Parrot	V	-	38	5	20	Regularly observed within and around the study area, most recently in February 2006.	Y
Climacteris picumnus victoriae	Brown Treecreeper (eastern subsp.)	V	-	90	21	97	Regularly observed within and surrounding the study area, most recently in May 2006.	Y

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area[1]		No. of locations within a five kilometre radius of study area[1]	Notes on reliability and date of last record	Species profile generated?
				DEC[2]	Other[3]			
Pyrrholaemus sagittatus	Speckled Warbler	V	-	47	17	31	Regularly observed within and surrounding the study area, most recently in February 2006.	Y
Grantiella picta	Painted Honeyeater	V	-	3	1	3	Reliably observed within the study area during DEC surveys, most recently in February 2006.	Y
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subsp.)	V	-	47	2	39	Recorded within the study area on numerous occasions, most recently in March 2006.	Y
Xanthomyza phrygia	Regent Honeyeater	E	E	1	8	60	Reliably recorded within and around the study area, most recently in September 2005.	Y
Melanodryas cucullata cucullata	Hooded Robin (south-eastern subsp.)	V	-	5	5	34	Reliably recorded within and around the study area, most recently in February 2006.	Y
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subsp.)	V	-	1	4	10	Reliably recorded within and around the study area, most recently in September 2005.	Y
Stagonopleura guttata	Diamond Firetail	V	-	23	8	55	Frequently recorded within and around the study area, most recently in February 2006.	Y
Nocturnal Birds								
Ninox connivens	Barking Owl	V	-	0	1	7	Recorded once in the study area by Birds Australia in 1979. Reliably recorded around the study area, and potential habitat present within.	Y
Ninox strenua	Powerful Owl	V	-	23	6	3	Frequently recorded within and around the study area, most recently in April 2006.	Y
Tyto novaehollandiae	Masked Owl	V	-	1	0	1	Heard calling during DEC surveys on Towinhingy Creek in March 2006 and in Baerami Valley, approximately 3 km east of the study area, in May 2005	Y
Tyto tenebricosa	Sooty Owl	V	-	7	4	1	Reliably and repeatedly recorded within study area, most recently in March 2006.	Y
Mammals								
Dasyurus maculatus	Spotted-tailed Quoll	V	E	1	2	7	Infrequently recorded in study area, most recently by hair collected in March 2006.	Y
Phascolarctos cinereus	Koala	V	-	1 (prob. only)	0	2	Scat probably belonging to Koala recorded in 2005. Historical record from Nullo Mountain and traces detected to the south-east of the study area during CRA. Potential habitat present.	Y
Cercartetus nanus	Eastern Pygmy-possum	V	-	3	0	0	Identified from remains during DEC surveys in November 2005.	Y
Petaurus australis	Yellow-bellied Glider	V	-	101	0	24	Regularly observed within and surrounding the study area, most recently in May 2006.	Y
Petaurus norfolcensis	Squirrel Glider	V	-	6	0	4	Reliably recorded within the study area, most recently in March 2006.	Y

Scientific name	Common name	Status in NSW (TSC Act 1995)	Status in Australia (EPBC Act 1999)	No. of locations within study area[1]		No. of locations within a five kilometre radius of study area[1]	Notes on reliability and date of last record	Species profile generated?
				DEC[2]	Other[3]			
Potorous tridactylus	Long-nosed Potoroo	V		0	0	1	Recorded once in 1970, but spatial reliability is uncertain. Not likely to persist within study area.	N
Macropus parma	Parma Wallaby	V	-	0	0	1	Hair collected and identified as 'possible' Parma Wallaby during CRA surveys in 1997 on south-eastern side of Mount Coricudgy. Very limited potential habitat present within the study area.	N
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	7	11	6	Reliably recorded within the study area, most recently in May 2006.	Y
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	1	0	1	Observed once during DEC surveys in November 2005 and once 4 km east of the park boundary in 1998.	Y
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	1	0	0	Identified from ultrasonic call in January 2006.	Y
Mormopterus norfolkensis	East-coast Freetail-bat	V	-	1	0	5	Identified from ultrasonic call at boundary of park in November 2005.	Y
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	51	2	8	Reliably recorded within the study area, most recently in February 2006.	Y
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	14	0	12	Reliably recorded within the study area, most recently in January 2006.	Y
Miniopterus australis	Little Bentwing-bat	V	-	0	0	1	Detected by Anabat near Wollemi Creek, 4.5 km east of the study area, during CRA surveys in 1998. Likely to be only an infrequent visitor to the study area, and unlikely to rely on or breed in habitats located therein.	N
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	18	0	16	Regularly and reliably recorded within and surrounding the study area, most recently in December 2005.	Y
Myotis adversus	Large-footed Myotis	V	-	0	0	3	Most recently recorded by DEC in November 2005 on the Capertee River, 1.5 km west of the study area. Potential habitat present within the study area.	Y
Nyctophilus timoriensis	Greater Long-eared Bat	V	V	1	0	2	Reliably recorded by DEC in and around the study area, most recently in September 2005.	Y
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	3	0	3	Reliably recorded in and around the study area, most recently in February 2006.	Y
Vespadelus troughtoni	Eastern Cave Bat	V	-	3	0	2	Reliably recorded in and around the study area, most recently in September 2005.	Y

E Endangered V Vulnerable

[1] Numbers indicate the number of locations for the species, rather than the number of individuals

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

[3] Includes records on the NSW Wildlife Atlas obtained from sources other than DEC systematic survey

Table 6: Threatened fauna species recorded within and around north-western Wollemi National Park on the Atlas of NSW Wildlife, as at 19th June 2006

GIANT BURROWING FROG

Species Profile

The Giant Burrowing Frog (*Heleioporus australiacus*) is a large (up to ten centimetres) rotund ground-dwelling frog. Its powerful limbs are used to excavate burrows where they can stay 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 2001d). It has been suggested that this disjunct distribution may reflect two separate species, though at present evidence is inconclusive (Penman *et al.* 2004).

Plate 18: Giant Burrowing Frog © N. Williams/DEC

Threats

The primary threat to the Giant Burrowing Frog in NSW is development of its preferred habitat for housing and agriculture (NPWS 2001d). Other threats are not well known but may include alteration of drainage patterns, infection by Chytrid fungus, road mortality, water pollution, frequent fire and forestry operations (DEC 2006c). As a large, slow moving species, it is also likely to be vulnerable to predation by Foxes and Feral Cats. Long wall mining may be a significant future threat (NSW Scientific Committee 2005a) as it can drain upland swamps that have been shown to be important breeding habitat for the Giant Burrowing Frog.

Local and Regional Conservation Status

The Giant Burrowing Frog is listed as Vulnerable under the NSW TSC Act (1995) and 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). The species has been recorded within a number of Sydney Sandstone reserves including Royal, Ku-ring-gai Chase, Garigal and Brisbane Waters National Parks and across the Woronora Plateau. Fewer records have been obtained in Blue Mountains, Nattai and Yengo NPs and Bargo State Conservation Area, as well as the southern section of Wollemi National Park. Penman *et al.* (2004) consider the Giant Burrowing Frog to be well represented within the reserve system in the Sydney Basin Bioregion.

The Giant Burrowing Frog was first recorded within the study area during CRA surveys in 1997, when an adult was seen on the Hunter Main Trail, approximately three kilometres east of Mount Coricudgy. A tadpole was located very close to this locality in 2005, in an upland swamp just north of the Hunter Main Trail (Map 9). Tadpoles of the species have been recorded at four further locations in the park, including Myrtle Creek, a small drainage channel running east of Cottage Rock, Numietta Creek west of Glen Alice and Gospers Creek (Map 9). The locations in which the species has been recorded in the park fall into two main habitat types: within or in the vicinity of upland swamps and near the headwaters of minor drainage channels; or on larger creeklines with alluvial sand and rocky pools surrounded by tall moist forest. The frog is likely to breed in a number of other locations within the reserve, particularly along sandy creeklines with rock pools, such as Wollemi and Koondah Creeks, and in upland swamps that occur in seepage areas on the sandstone plateaux.

Northern Wollemi National Park lies at the extreme north-western limit of the range of Giant Burrowing Frog, with the northern and western escarpments appearing to form the boundary of the species distribution. The role that Wollemi and neighbouring Yengo National Parks play in the conservation of this species is therefore highly significant, and pivotal to ensuring that the species persists at this north-western edge of its distribution. The frog appears to currently be secure within the study area, and does not require any immediate management actions. Management may be required in the future if Chytrid is discovered to be affecting populations, or if scientific research confirms that feral predators and/or frequent fire impose a significant threat to the species in wilderness areas.

STUTTERING FROG

Species Profile

The Stuttering Frog (*Mixophyes balbus*) is a large frog (reaching up to eight centimetres) that is highly camouflaged in the wet leaf-litter of the forest floor. After summer rains the males make a call that includes a soft stuttering, from which the species gets its common name. The thin barring on the limbs in combination with the blue crescent above the iris distinguishes it from other *Mixophyes* in NSW (Barker *et al.* 1995). It is usually associated with small flowing streams, often in rainforest or wet sclerophyll forests (Anstis 2002), where it feeds on insects and smaller frogs (Gilmore and Parnaby 1994). It breeds in spring and summer and has very long-lived tadpoles that are capable of surviving over autumn and winter (Anstis 2002). This frog was once found along the coast and ranges between northern NSW and Victoria, though it is now found only patchily throughout its former distribution (Daly 1998, Anstis 2002). Recent research has identified genetic divergence and isolation between populations north and south of the Taree district (N. Doak unpubl. data in Hunter & Gillespie 2006).

Plate 19: Stuttering Frog © N. Williams

Threats

The threats to this species are poorly understood. However, the main ones are thought to be habitat fragmentation and degradation, leading to the isolation of sub-populations and increased vulnerability to other threats and to local extinction (NSW Scientific Committee 2002b). The Stuttering Frog is threatened by the introduced pathogen, Chytrid fungus (Hunter & Gillespie 2006). This fatal disease particularly affects higher altitude frog populations and stream-breeding frog species (NSW Scientific Committee 2003b). The disease is known to have seriously affected populations of the closely related Fleay's Barred Frog (*M. fleayi*) (Berger *et al.* 1998), and has been recorded in Stuttering Frog tadpoles and metamorphs in the southern Blue Mountains (DEC 2004b) and Macquarie Pass (Gaia Research 2006a). This frog is also potentially threatened by predation by exotic fish including Plague Minnow (*Gambusia holbrooki*) (NSW Scientific Committee 1999a) and Brown Trout (*Salmo trutta*) (Daly *et al.* 2002). Climate change is likely to have a negative impact on the Stuttering Frog in the future (Hunter & Gillespie 2006).

Local and Regional Conservation Status

The Stuttering Frog is listed as Endangered under the NSW TSC Act (1995) and Vulnerable under the Commonwealth EPBC Act (1999). Within NSW, nearly all records are within the three eastern Bioregions (DEC 2006b). Within the southern portion of its range, particularly south of Sydney, the frog has declined dramatically in recent times (Daly *et al.* 2002, Gaia Research 2006b) and within the greater southern Sydney region only two localities are known to continue to support the species (DEC 2006a). North of Sydney the species is more widely distributed, but still with only very patchy occurrence (NSW Scientific Committee 2002b). Between the Hunter River and Sydney, known populations are concentrated between Gosford and the Watagan Mountains, with the closest site north of the Hunter being in Barrington Tops (NSW Scientific Committee 2002c). In the Sydney Basin Bioregion this frog is known to persist within a few public lands including Watagan, Blue Mountains and Macquarie Pass National Parks, as well as within Olney, Strickland and Awaba State Forests (DEC 2006b).

Three frogs were heard calling in December 2005 near the convergence of two minor tributaries of Wollemi Creek, south of the Hunter Main Trail (Map 9). One of these individuals was then sighted (Plate 6) in dense leaf litter located on a ledge approximately one metre above a small deep pool of water (Plate 20). Stuttering Frog tadpoles were discovered at a second location, in a rock pool near the headwaters of Blackwater Creek (Map 9). Photographs of the tadpoles were shown to G. Daly and A. White to gain their opinion on identification. Based on their size, these tadpoles are thought to be in the range of nine months old (estimated by G. Daly, pers. comm.). The surrounding habitat at both locations is warm temperate rainforest with Coachwood and Sassafras in the canopy and Treeferns in the understorey. The elevation of both sites is approximately 700 metres asl. This elevation is significant as there is only one other known upland population of the species south of the Hunter Valley, at Mount Werong in the southern Blue Mountains (DEC 2004b).

These sightings indicate that at least one or two breeding populations of Stuttering Frog currently occur within north-western Wollemi National Park. This discovery is very significant, as populations of the species have not previously been recorded in the region. The closest known extant population is located at Barrington Tops, north of the Hunter River, while historic accounts of the species derive from Australian Museum specimens collected in Newnes State Forest in the 1960s and 1970s. In addition, a single individual was sighted at Victoria Falls (40 kilometres south of the Capertee River) in 2002, but it is unknown whether this represents a surviving population. The species appears to be close to extinction in the greater southern Sydney region, though once it was not uncommon through the wetter forests and rainforests of the Blue Mountains and, in particular, the Illawarra Escarpment (G. Daly pers. comm. in DEC 2006a).

The discovery of the population(s) in northern Wollemi yields important information on the current distribution of the species. Further populations are considered highly likely to occur within remote sheltered gorges and canyons in the south-eastern third of the study area, and indeed elsewhere within inaccessible parts of Wollemi National Park. The persistence of the Stuttering Frog in the reserve has extremely high conservation significance and, like all extant populations (Hunter & Gillespie 2006) is considered critical to the long term survival of the species as a whole, and particularly to its survival within the southern half of its current range.

Plate 20: Site of adult Stuttering Frog sighting © N.Williams/DEC

The Stuttering Frog is known to have disappeared from numerous protected areas, and reservation of habitat alone will not guarantee its survival. The greatest threat to the survival of the Stuttering Frog in Wollemi National Park is infection by Chytrid fungus. This virulent disease is thought to have severely affected populations of the species at Macquarie Pass and Mount Werong, where tadpoles carrying the disease appear to die during or shortly after metamorphosis, drastically limiting recruitment to the adult population (DEC 2004b, G. Daly pers. comm.). Neither the Stuttering Frog, nor any other frog species located within the study area, has been tested for Chytrid fungus. It is possible that the minimal amount of human visitation and disturbance has limited the spread of the disease in the park, as in other regions humans are a well-recognised vector for the fungus (which can be transported on wet shoes, car tyres, etc). However, given the widespread occurrence of the pathogen in eastern Australia, it is almost certain to occur at some localities within the study area. It is highly recommended that swabbing be undertaken to test for Chytrid fungus in the adults and tadpoles of the Hunter Range Stuttering Frog population, together with further surveys to assess the extent and approximate size of the population (see Section 4.6.1 of this report). Such surveys must be undertaken with strict adherence to frog hygiene protocols to ensure diseases are not spread between populations or catchments. The Hygiene Protocol for the Control of Disease in Frogs (NPWS 2001e) should be used as a guideline, as should consultation with recognised experts who are up to date with research into frog diseases.

Management actions for the species should be considered in the very near future, in consultation with the NSW species recovery team and the national recovery plan (Hunter & Gillespie 2006). In the mean time, visitation to breeding sites should be restricted and the frogs should remain undisturbed as much as possible.

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, generally only occurring on the Hawkesbury and Narrabeen sandstone geologies of the Sydney Basin. The Red-crowned Toadlet lays its eggs in moist leaf litter, relying on rain to wash the eggs into ephemeral ponds where they can complete their development (NPWS 2001f). The species is gregarious, being found in colonies of up to 30 individuals (Barker *et al.* 1995). It will breed at any time of year in order to take advantage of unpredictable rainfall events (Thumm and Mahony 2002).

Plate 21: Red-crowned Toadlet © A. Dudley

Threats

Development of ridgetop land and creek headwaters is the primary threat to the Red-crowned Toadlet. Other threats may include habitat alteration due to frequent fire, bush rock removal, water pollution and Chytrid fungus (NPWS 2001f). The Red-crowned Toadlet has a high level of reproductive failure (Thumm & Mahony 2002) and due to its size and morphology, has only a limited ability to disperse, which is likely to make populations vulnerable to local extinction. The species may also be impacted upon by the removal of dead wood and trees and by habitat alteration due to longwall mining (NSW Scientific Committee 2003c, 2005a).

Local and Regional Conservation Status

The Red-crowned Toadlet is listed as Vulnerable under 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 reserves, from Yengo and Wollemi National Parks in the north to Barren Grounds Nature Reserve in the south (DEC 2006b), including some within the Sydney urban area, such as Lane Cove National Park (DEC 2004f).

The Red-crowned Toadlet was first recorded within the study area during CRA surveys in 1997, when it was detected at two locations near Mount Monundilla and one location west of Gospers Mountain (Map 9). During this time, the species was also detected at several locations further east on the Hunter Main Trail, indicating the species to be fairly common along the Hunter Range, within the headwaters of creeklines that flow both north and southwards. The 2005-06 surveys located Red-crowned Toadlets at additional locations on the Hunter Range, and found the species to also be relatively common in the south-eastern third of the study area (Map 9). This little frog was seen or heard calling in a number of localities on the sandstone plateaux, including seepage areas around the base of pagoda rock formations and in first and second order creeks and drainage channels.

The records of Red-crowned Toadlet in north-eastern and north-western Wollemi National Park are the most north-westerly known localities of the species. The northern and western escarpments appear to comprise the limit of the species distribution, providing further evidence to the assertion that the species is entirely restricted to the sandstone geologies of the Sydney Basin Bioregion. The species has recently been recorded within southern and eastern Wollemi, Yengo, Blue Mountains and Nattai National Parks, providing contiguous habitat for the species around the western edge of the Sydney Basin. The large amount of potential habitat conserved within the sandstone geologies of northern Wollemi National Park is vital to the conservation of the species at the northern extremity of its range, while the largely uninterrupted connection with other reserves contributes to preservation of the full variation of the species across its distribution.

As the majority of threatening processes known for this species are not present throughout the majority of north-western Wollemi National Park, the Red-crowned Toadlet appears to currently be secure within the study area and does not require any immediate management actions. Management may be required in the future if Chytrid fungus is discovered to be affecting populations or if scientific research confirms that frequent fire imposes a significant threat to the species in wilderness areas.

BOOROOLONG FROG

Species Profile

Plate 22: Booroolong Frog © M. Pennay

The Booroolong Frog (*Litoria booroolongensis*) is a medium-sized frog that is similar to others in the *lesueuri* group (*L. lesueuri, L. wilcoxi and L. jungguy*) (Donnellan and Mahony 2004). The Booroolong Frog may be reliably distinguished by the extension of the webbing to the base of the first inner toe pad on the hind foot, a mottled dorsum with a scattering of salmon-coloured flecks, and an indistinct black stripe passing through the eye and over the tympanum to the shoulder (Gillespie 1999); and by its call. The species was formerly known from the tablelands and slopes of New South Wales, from catchments draining the Northern Tablelands to the Tumut River in the Southern Highlands and other tributaries of the Murrumbidgee River, and has recently been discovered in Victoria (Gillespie 1999). This frog typically inhabits rocky western-flowing creeks and their headwaters, although a small number of animals have also been recorded in eastern-flowing streams (NSW Scientific Committee 1998b). Adults are typically found sheltering under boulders or cobbles near riffles along the stream bank, in both forested areas and open pasture (Gillespie 1999). In spring, eggs are deposited in rock crevices in the stream or in isolated streamside pools and tadpoles metamorphose in January and February (Gillespie 1999).

Threats

Tadpoles of the Booroolong Frog are vulnerable to predation by exotic fish species including Brown Trout, Rainbow Trout (*Oncorhynchus mykiss*) and European Carp (*Cyprinus carpio*) (NSW Scientific Committee 1998b, DEH 2004d). Nearly all streams occupied by the Booroolong Frog are also inhabited by introduced fish, particularly Trout, which may be stocked in very high numbers (DEH 2004d). Land and water degradation, flow modification and weed invasion of riparian areas (particularly by Willow (*Salix* spp.)) each pose a threat to the species across its range (DEH 2004d). Another significant threat is infection by Chytrid fungus (DEH 2004d), listed as a Key Threatening Process on the NSW TSC Act (1995) and the federal EPBC Act (1999). This disease has had a particularly dramatic impact on stream-dwelling species at high altitudes in recent years (NSW Scientific Committee 2003b, DEH 2004d).

Local and Regional Conservation Status

The Booroolong Frog is classified as Endangered under the NSW TSC Act (1995) and is currently under nomination for inclusion as an Endangered species under the EPBC Act (1999). Formerly, the species was present in three main concentrations: the New England Tablelands, the Central Tablelands and the western side of Kosciusko National Park (DEC 2006b, DEH 2004d). Aside from two locations near Tamworth, Booroolong Frog have not been found in the northern part of their range since 1994 (Anstis 2002, DEH 2004d) and it is suspected that the species is virtually extinct in this area (NSW Scientific Committee 1998b, DEH 2004d). The Booroolong Frog has also declined severely across the remainder of its range (DEH 2004d), with only a handful of recent records from the Central Tablelands area. The species is not well represented within conservation reserves, though it is known from Abercrombie River, Turon, Kosciusko and Woomargama National Parks. There are historical records from within Blue Mountains National Park, though populations in these areas appear to have been lost (NSW Scientific Committee 1998b).

The Booroolong Frog has not been recorded within the study area since 1980, when an Australian Museum specimen was collected north of Nullo Mountain (Map 9). This location is in the catchment of the Hunter River, though given the time that it was collected, the spatial accuracy is likely to be low. Specimens were also collected in neighbouring areas, including from the junction of Wollemi Creek, Capertee and Colo River in 1979, and Goulburn River National Park in 1980 (DEC 2006b). The nearest known extant population is located in Turon National Park, west of the Capertee Valley.

Extensive surveys for the Booroolong Frog were not undertaken during 2005-06, due to time and weather limitations. Central Tablelands environments extend some way into the western edge of Wollemi National Park. It is possible that the species persists within one or more of the permanent western-flowing creeks, but has gone undetected. Further survey work is required to ascertain this, in the form of nocturnal surveys in late spring/summer after heavy rain.

ROSENBERG'S GOANNA

Species Profile

Rosenberg's Goanna (*Varanus rosenbergi*) (also known as Heath Monitor) is a large, powerful lizard that occurs in the greater Sydney Basin and the Southern Highlands, but then discontiguously through Victoria, South Australia and south-western Western Australia (King and Green 1999). It is superficially similar to the commonly encountered Lace Monitor though morphologically and taxonomically it is closer to the Sand Monitor (*Varanus gouldii*). It can be distinguished from the Lace Monitor by the fine barring on its lips and tail and the spots on front and back legs, and from the Sand Monitor by the lack of a distinctive plain yellow tail tip. This goanna is known to be associated with sandstone environments, but is relatively cryptic and can be difficult to detect. It is usually found in heath and woodlands where it shelters in burrows, hollow logs and rock crevices (Cogger 1996).

Plate 23: Rosenberg's Goanna © N. Corkish/DEC

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 1080 baits (Thomson and Kok 2002) and thus may be impacted upon by Dog and Fox control programs. Nests and juveniles of the species may also be vulnerable to predation by Feral Cats and Dogs (DEC 2005i). Rosenberg's Goanna is listed as a species adversely affected by the Key Threatening Process removal of dead wood and dead trees (NSW Scientific Committee 2003c).

Local and Regional Conservation Status

Rosenberg's Goanna is listed as Vulnerable under the NSW TSC Act (1995). It is a poorly understood species and there is still much to be learnt about its distribution and habitat preferences. Previously the NSW population was thought to be restricted to the Hawkesbury and Narrabeen sandstones, particularly coastal areas such as Ku-ring-gai Chase, Dharug and Morton National Parks and the Woronora Plateau. Survey work conducted by DEC over the last few years has confirmed it to be present elsewhere in the region, with confirmed sightings from Abercrombie River, Turon and northern Wollemi National Parks. In addition, there are records of this species from the south-western slopes as far west as Bathurst and for the region around Goulburn (R. Wells pers. comm.), Braidwood and parts of the ACT (M. Schulz pers. comm.).

Rosenberg's Goanna was first recorded within the study area on the Growee Trail in 1997, and detected at five further locations during the BSP surveys (Map 9). While all of these sightings were made on the sandstone plateaux, they are quite widely dispersed, ranging from just above the sandstone escarpment above the Myrtle Creek and Bylong River Valleys, to south of Mount Coricudgy and Tayan Peak. The Goanna has not been recorded by any other park visitors, suggesting that it is likely to have gone undetected in parts of the park where systematic surveys have not been undertaken. Rosenberg's Goanna is highly likely to be patchily distributed across the sandstone plateau, particularly on rocky ridges and upper slopes. However, the density of occurrence is unknown and would only be able to be determined by further survey.

The records of Rosenberg's Goanna in north-western Wollemi National Park constitute the most north-westerly occurrence recorded on the Atlas of NSW Wildlife (DEC 2006b). This suggests that the Hunter and Goulburn Valley escarpments form the northern boundary of the species distribution in central New South Wales, and provides further evidence that in this region it is restricted to sandstone environments. Further survey within potential habitat would be required to determine the status of the species at this far north-western limit of its range. No immediate management actions are currently required for the species.

BROAD-HEADED SNAKE

Species Profile

Plate 24: Broad-headed Snake © A. Dudley

The Broad-headed Snake (*Hoplocephalus bungaroides*) is a semi-arboreal species that spends the cooler part the year under sandstone exfoliations and around rock outcrops, and the summer sheltering in tree hollows in woodland (Webb and Shine 1997). 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*).

Threats

A key threat to the Broad-headed Snake is the collection of bush rock for landscaping (Shine and Fitzgerald 1989, NSW Scientific Committee 1999b). 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 and hence collection of specimens from the wild is also a threat (NPWS 1999a). Other potential threats include urbanisation of sandstone ridgetops, altered fire regimes and the impacts of feral animals, through both predation and disturbance (NPWS 1999a). In particular, disturbance of rock outcrops by Feral Goats has been highlighted as a potential threat (Murphy 1996). Webb and Shine (1997) also note that this species may be vulnerable to logging operations due to its reliance on tree hollows for part of the year. Habitat alteration by longwall mining and the removal of dead wood and dead trees are other Key Threatening Processes thought to impact upon this snake (NSW Scientific Committee 2005a, 2003c). It is also postulated that increase in vegetation density due to long term fire suppression has resulted in a reduction in winter habitat (Pringle *et al.* 2003).

Local and Regional Conservation Status

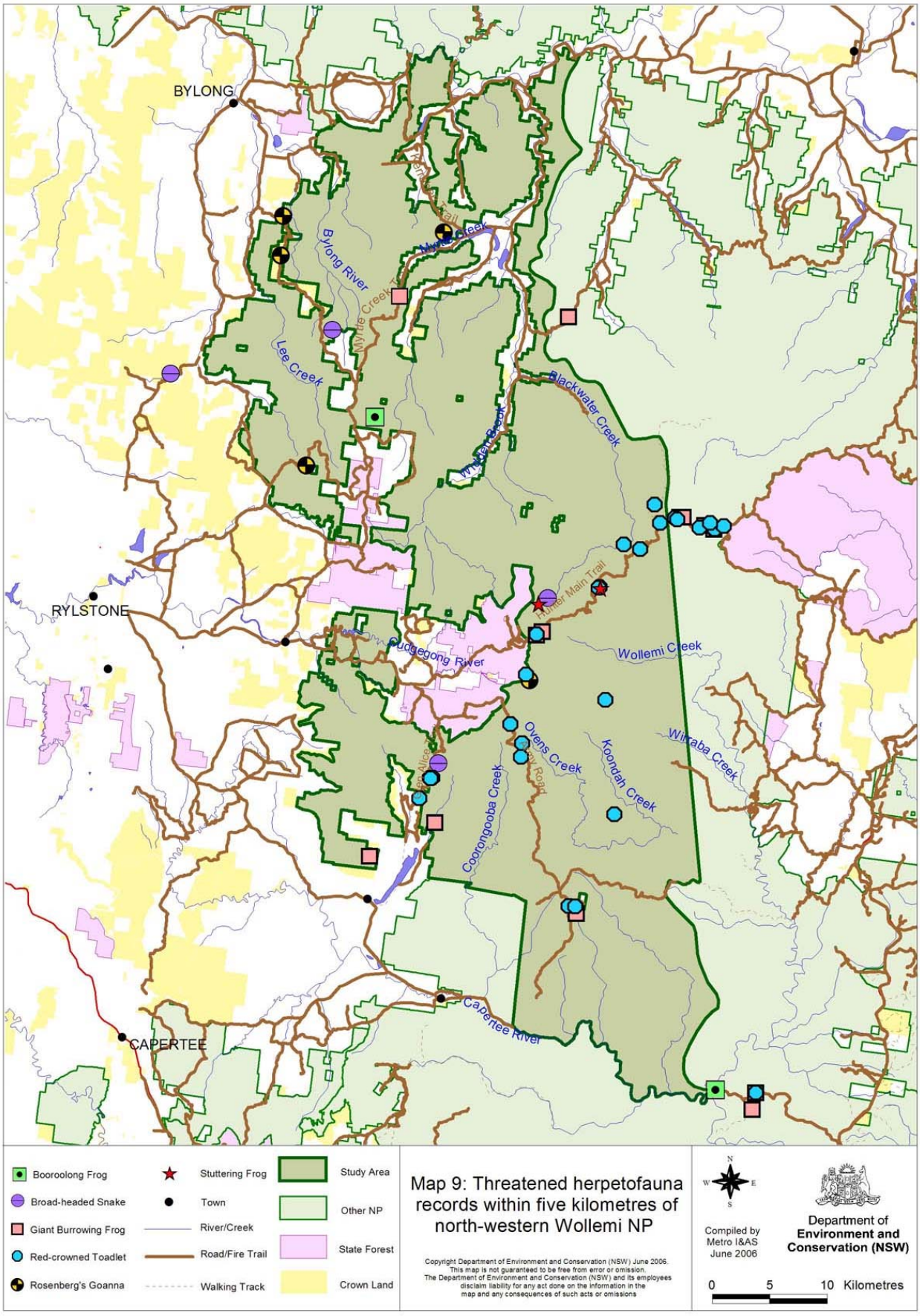
The Broad-headed Snake is listed as Endangered under the NSW TSC Act (1995) and Vulnerable under the Commonwealth EPBC Act (1999). It is restricted to the Hawkesbury and Narrabeen sandstones of the Sydney Basin Bioregion and has disappeared from many locations where it was once well-known to occur. Remaining strongholds appear to be the upper Blue Mountains, southern Wollemi and Royal National Parks extending on to the Woronora Plateau. There is also a population in eastern Morton National Park, west of Nowra, where the species is regularly observed.

The Broad-headed Snake has been observed on three occasions within the study area and reported once during the 1980s from three kilometres to the west (Map 9). One of these study area records is an historical account of the snake in Blackwater Creek from 1963, and the second is of uncertain reliability. The third sighting was made during the BSP surveys, when the snake was positively identified on a rocky sandstone bench north-west of 'Box Ridges' in mid-September. The location of the sighting conforms to known habitat preferences of the species, being exposed rock outcrops in the winter and early spring and more sheltered vegetated areas in the summer. The Broad-headed Snake is likely to also persist in other parts of the Narrabeen sandstone plateaux where such habitat features abound, particularly remote sections located far from roads and access points.

The discovery of the Broad-headed Snake in 2005 was very significant as it confirmed that this rarely recorded species persists in the study area. Furthermore the record constitutes a small north-westerly range extension of the species known distribution. The closest confirmed recent sightings of Broad-headed Snake are located east of Wollemi Creek (just over five kilometres east of the study area), where it was detected at two locations in 1998 (DEC 2006b). Elsewhere in the region, it has been sighted on the Wolgan River in 1999 and at several sites north-east of Blackheath in the late 1990s (DEC 2006b). As far as is known, however, monitoring has not been undertaken at these sites to

ascertain whether the snake remains extant. The scarcity and age of other records in the region highlights the significance of the 2005 sighting, and the importance of the information it provides on the current range of the species.

The greatest threats to the Broad-headed Snake in north-western Wollemi National Park are removal of bush rock, removal of dead wood and disturbance of rock outcrops by Feral Goats. The first two of these threats are only likely to be significant in the vicinity of roads and access points, such as the trail between Bylong River and Myrtle Creek, the Hunter Main Trail and the Army Road. Remote sections of the park are much less subject to such impacts, and are not currently known to be inhabited by Feral Goats. However, it is unknown if or where the species occurs in these parts. Further survey would be required to approximate the status of the Broad-headed Snake in the park. Conservation of the snake at this north-western edge of its range is very important to the species as a whole. The only management actions currently required are Feral Goat control and continued limitation of access to extensive areas of habitat.



Map 9: Threatened herpetofauna records within five kilometres of north-western Wollemi National Park

BLACK-NECKED STORK

Species Profile

The Black-necked Stork (*Ephippiorhynchus asiaticus*) is a large conspicuous black and white bird with an iridescent green and blue sheen on its glossy black head and neck, a large straight black bill and long red legs. It stands at over one metre tall and has a wingspan of around two metres (Marchant and Higgins 1990). The species occurs from Pakistan, India and Sri Lanka to Vietnam, north Malaysia, New Guinea and Australia (Marchant and Higgins 1990), with its core distribution in Australia being the tropical and warm-temperate north. The species also occurs down the east coast, becoming increasingly uncommon further south into NSW, but having been recorded as far south as Victoria and inland to the Macquarie Marshes and Griffith (NSW Scientific Committee 1998c). The range of the Black-necked Stork has contracted to the north and east since European colonisation, while the number of birds recorded at the southern and western limits of its range has declined significantly (NSW Scientific Committee 1998c). Individuals are now only occasionally recorded south of Sydney or west of the Great Dividing Range during favourable conditions, and breeding has not been recorded south of Port Stephens for many years (NSW Scientific Committee 1998c). It inhabits permanent freshwater or occasionally inter-tidal shorelines or estuaries, feeding in shallow still water on fish, frogs, turtles, crustaceans and snakes (Marchant and Higgins 1990). Individuals are largely sedentary, though some birds, particularly immature ones, move long distances outside their normal range. To breed it constructs a very large stick nest in the top of a tall tree, usually laying two to four eggs (Marchant and Higgins 1990).

Threats

The greatest threat apparent to the Black-necked Stork in NSW is clearing and disturbance of river valleys, inhibiting successful breeding and increasing competition with other birds for the limited remaining nesting resources (NSW Scientific Committee 1998c). Loss of dead trees and of nest trees from wetland areas is a significant problem. Wetland destruction, modification and degradation are threats, together with alteration of natural flow regimes, as although artificial water sources provide areas of new habitat, these are often sub-optimal for the species (NSW Scientific Committee 1998c). The species is sensitive to disturbance and so is unlikely to breed in waterbodies adjacent to residential development. Several birds are killed or injured each year as a result of collision with powerlines, comprising a high percentage of the total population within each northern river valley and thereby posing a threat to the ongoing viability of the species in NSW (NSW Scientific Committee 1998c).

Local and Regional Conservation Status

The Black-necked Stork is listed as Endangered under the NSW TSC Act (1995), on the basis of contraction in its range and reduction in numbers and in breeding success at the southern and western extremities of its distribution. In NSW the largest concentration of records is within the NSW North Coast Bioregion, with fewer records in the Sydney Basin Bioregion and scattered records west of the Great Dividing Range (DEC 2006b). Most of the sightings in the Sydney Basin Bioregion have been made in coastal habitats north of Gosford, particularly around the lakes and swamps of the Central Coast (DEC 2006b). Few of these records fall within conservation reserves, though the species has been seen within Hexham Swamp Nature Reserve and Munmorah State Conservation Area.

Black-necked Stork has been observed on one occasion within north-western Wollemi National Park, by a Birds Australia observer just south of the Kandos Weir in May 2001 (Map 10). This is a significant record, as the species has rarely been observed so far west in recent years (DEC 2006b). The species is probably only a rare visitor to the park, and is unlikely to breed within the area. Dunns Swamp provides the largest amount of suitable habitat within the study area, though it is possible that the species also visits the creeks and artificial water bodies within the valleys that intrude into the northern boundary of the park, as well as the Capertee River. North-western Wollemi National Park provides only marginal habitat for the Black-necked Stork and is unlikely to make a significant contribution to the overall conservation of the species in NSW. The habitat is likely be significant on a local scale, however, and may provide an important stop-over site for individuals moving through the region.

SQUARE-TAILED KITE

Species Profile

The Square-tailed Kite (*Lophoictinia isura*) is a medium-sized, long-winged raptor with a diagnostic white face (Marchant and Higgins 1993). It is endemic to the Australian mainland, where it is most often recorded within 250 kilometres of the coast (Garnett and Crowley 2000). In southern Australia it is most regularly recorded in open eucalypt forest and woodland, where it hunts at canopy level feeding on birds, including eggs and nestlings, and insects (Marchant and Higgins 1993). Breeding pairs utilise a large home range (up to 100 square kilometres) during the breeding season. Square-tailed Kites migrate to northern Australia after breeding has completed, though the dispersal route is unknown (Marchant and Higgins 1993).

Plate 25: Square-tailed Kite © T. Tarrant

Threats

Loss of habitat through land clearance is likely to be a major threat (NPWS 1999b), though it has been suggested that the Square-tailed Kite may also have benefited from partial clearance (Garnett and Crowley 2000). NPWS (1999b) also lists illegal shooting, egg collection, disturbance of nest trees and inappropriate fire regimes as potential threats.

Local and Regional Conservation Status

The Square-tailed Kite is listed as Vulnerable under the NSW TSC Act (1995) due to a decline in abundance across this state. Within NSW, records are located in all Bioregions, though there are only scattered records from the South Eastern Highlands. Important locations within the Sydney Basin Bioregion are the Shoalhaven/Jervis Bay area and the drier woodlands on more fertile soils such as the Capertee Valley, Goulburn River area and the northern Cumberland Plain. Breeding has been recorded from all of these locations except the last, and records exist for a number of reserves including Jervis Bay and Goulburn River National Parks.

The Square-tailed Kite has only been recorded on one occasion within north-western Wollemi National Park, seen in the vicinity of Lee Creek in January 1985 (Map 10). The species is often sighted in the Capertee Valley (DEC 2006b), is known to breed in Goulburn River National Park (NPWS 2001b) and is occasionally seen flying over agricultural lands west of the park. Given this, the Square-tailed Kite is considered likely to occur elsewhere in the north-west of the study area in summer, particularly the woodlands on Permian geologies below the northern and western escarpments and the fringing valley floors. These areas have significance for the conservation of the species in the locality, but may only be of moderate significance on a regional scale.

GANG-GANG COCKATOO

Species Profile

The Gang-gang Cockatoo (*Callocephalon fimbriatum*) is a small, stocky cockatoo with dark grey feathers on its body, narrowly margined with pale grey, orange and red (Pizzey and Knight 1999). Both sexes have a wispy crest that is curved forward and twisted, with the males crest and head being a bright fiery red. The species is endemic to south eastern Australia, ranging from the mid north coast and central tablelands of NSW to far south west Victoria and occasionally into South Australia (Higgins 1999). Gang-gangs are seasonally nomadic, inhabiting tall mountain forests and woodlands in the summer then moving to lower altitudes to drier, open eucalypt forests and woodlands in the winter (Higgins 1999) when they may also be found in urban areas and farmlands. It is gregarious in nature and primarily arboreal, roosting in tall trees and foraging in pairs or family groups for seeds, berries, fruits, nuts and insects in the canopy or occasionally in the understorey or on the ground (Higgins 1999). The Gang-gang Cockatoo requires hollows in large trees for breeding, which occurs between October and January (Pizzey and Knight 1999).

Plate 26: Gang-gang Cockatoo © K. Madden/DEC

Threats

Threats to the Gang-gang Cockatoo are poorly known but are thought to include habitat destruction and degradation; in particular the loss of food trees and large old trees required for roosting and breeding (NSW Scientific Committee 2001a, 2005b). An important threat is that a large amount of winter habitat has been cleared for agricultural and urban development. Competition for nest hollows with other species may also be problematic (NSW Scientific Committee 2001a), while Psittacine Circoviral (Beak and Feather) Disease may threaten small populations that are already stressed (DEH 2004e). Climate change may alter the extent and nature of the cool temperate vegetation that the species utilises (Olsen *et al.* 2003, NSW Scientific Committee 2005b).

Local and Regional Conservation Status

The Gang-gang Cockatoo has recently been listed as a Vulnerable Species under the NSW TSC Act (1995). The listing was made on the basis of a decline in the reporting of this species across its distribution between 1984 and 2002, though the reliability of this trend was low (Barrett *et al.* 2003). In the Sydney Basin Bioregion it is abundant south of the Hunter River, though there are relatively few records in the Sydney and Wollongong urban areas. Numerous records of the species occur within many reserves, including (in addition to Wollemi) Kanangra-Boyd, Blue Mountains, Nattai and Yengo National Parks.

Within the study area the species has been recorded at over 150 locations between 1977 and 2006 (Map 10). This distinctive bird has been frequently recorded wherever systematic surveys have been undertaken, though the density of sightings decreases at lower elevations in the far north of the reserve. Records have been collected during various times of the year, including spring, summer, autumn and winter, suggesting that the study area provides habitat for the cockatoo all year round. At least one record of breeding was made during the BSP surveys, north of Gospers Mountain. The lower density of records at low elevations is a reflection of the fact the majority of surveys were undertaken in spring and summer, when Gang-gangs move to higher environments. The Box-Ironbark woodlands at lower elevations hold great importance, however, as they provide potential winter habitat for the species. Such habitat has been extensively cleared for agricultural and urban development, while much remaining habitat outside reserves is under ongoing pressure. Importantly, north-western Wollemi National Park lies towards the northern limit of the Gang-gang Cockatoo's range; the species has been recorded in only four reserves further north, including Goulburn River, Mount Royal and Barrington Tops National Parks and Manobalai Nature Reserve (DEC 2006b).

Conservation of the species within the study area is important to the continued conservation of species at the northern edge of its range. The species is widespread across the sandstone reserves of the Sydney Basin, and is currently considered to be relatively secure in the region. No management actions are currently required for the Gang-gang Cockatoo in north-western Wollemi National Park.

GLOSSY BLACK-COCKATOO

Species Profile

The Glossy Black-cockatoo (*Calyptorhynchus lathami*) is a medium to large 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).

Plate 27: Glossy Black-cocklatoo © N. Williams/DEC

Threats

The major threat appears to be habitat destruction for agricultural or residential development, causing the removal of nesting and feeding sites and also increased competition from more open habitat species such as Galahs (*Eolophus roseicapillus*). Because many *Allocasuarina* species are fire sensitive, inappropriate burning regimes may affect food supplies (NSW Scientific Committee 2000b). In addition, the removal of dead wood and dead trees is a Key Threatening Process that may impact on this species (NSW Scientific Committee 2003c), as is competition from feral Honeybees (*Apis mellifora*) (NSW Scientific Committee 2002d). Illegal trapping for aviculture may be a localised, minor threat (Garnett and Crowley 2000). In addition, DEH (2004e) lists the Glossy Black-cockatoo as a species that has exhibited symptoms of Psittacine Circoviral (Beak and Feather) Disease.

Local and Regional Conservation Status

The Glossy Black-cockatoo is listed as Vulnerable under the NSW TSC Act (1995). Being a large, conspicuous species there are numerous records in the coastal third of the state, though it is also found on the western slopes and an apparently isolated population occurs in the Narrandera-Lake Cargelligo area of the Riverina (NSW Scientific Committee 1999c). Relatively large areas of the Sydney Basin provide suitable habitat for the species and there are a large number of records throughout the Bioregion (DEC 2006b). Feeding habitat is well protected, occurring in numerous DEC reserves, including Morton, Nattai, Blue Mountains, Ku-ring-gai Chase, Yengo and southern Wollemi National Parks.

The Glossy Black-cockatoo has been recorded at over 80 locations within the study area between 1977 and 2006. Approximately half of these records derive from evidence of the birds activity (as opposed to direct observation) in the form of chewed *Allocasuarina* cones that are left behind after feeding. The locations of sightings are shown in Map 10 and range from the far north of the study area to Army Road. The large majority of the records lie on Narrabeen Sandstone, where Forest Oak (*Allocasuarina torulosa*) or Black She-oak (*Allocasuarina littoralis*) form a component of the small tree layer, particularly in sheltered locations. Of the areas where systematic survey has been undertaken, the number of birds actually observed appears to be lowest along the Hunter Main Trail and at Dunns Swamp, and highest on the Glen Alice Trail, Army Road and Growee Trail, though it is not certain whether this reflects true abundance patterns. In addition to *Allocasuarina* species, the bird was seen in River Oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) and Cypress (*Callitris* sp.) trees, and appeared to be feeding on seeds of the latter on one occasion. The study area is clearly important to the local protection of the species and contributes significantly to its regional conservation. The species is widespread across the sandstone reserves of the Sydney Basin, and is currently considered to be relatively secure in the region. No management actions are currently required for the Glossy Black-cockatoo in north-western Wollemi National Park.

SWIFT PARROT

Species Profile

The Swift Parrot (*Lathamus discolor*) is a small to 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).

Plate 28: Swift Parrot © 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 of the breeding area the main threat is 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). Psittacine Circoviral (Beak and Feather) Disease has been confirmed in wild Swift Parrots in NSW and has a high potential to adversely impact on the population (NSW Scientific Committee 2002e).

Local and Regional Conservation Status

The Swift Parrot is listed as Endangered under the NSW TSC Act (1995) and as Endangered under the Commonwealth EPBC Act (1999). A national recovery plan has been implemented in order to identify and protect key habitat and reverse population declines (Swift Parrot Recovery Team 2001). The majority of records in NSW occur in the three coastal Bioregions and the NSW South West Slopes Bioregion. Most of the records of Swift Parrots in the Sydney Basin Bioregion are in coastal habitats, particularly the Central Coast. The species has also been regularly recorded in drier areas of the Hunter and Capertee Valleys and the Cumberland Plain. Few records occur within reserves, though important sites include Nattai and Werakata National Parks. Intensive surveys in recent years have greatly increased the understanding of habitat usage by Swift Parrots in their wintering grounds in NSW (D. Saunders pers. comm.).

The Swift Parrot has not been recorded within north-western Wollemi National Park on the Atlas of NSW Wildlife. However, the bird is frequently recorded in the Capertee Valley, where it regularly flocks in the winter months to feed in the grassy Box – Ironbark woodlands (DEC 2006b) (Map 11). It is possible that parts of the study area form a component of the winter feeding habitats within the region, even though it may only be visited on occasion. The species is likely to have gone unnoticed within the study area because very few surveys have been undertaken in the winter months. The study area contains many winter-flowering tree species, most importantly White Box, a favoured food tree for the Swift Parrot. When these trees are in heavy flower, or when other food sources in the region are limited, it is likely that Swift Parrots visit sections of the park where it grows. Such areas are likely to include lower rainfall basalt caps and diatremes, such as that between 'Box Ridges' and Bylong River, and some of the talus slopes and flats on Permian sediments. It is recommended that targeted surveys be undertaken in White Box-dominated areas such as these during flowering times, to determine if, and the extent to which, the habitat is used. Such surveys need to be undertaken by experienced observers familiar with the species call. Any sightings of the Swift Parrot within the reserve should immediately be reported to the species Recovery Team. Such sightings may trigger the need for development of specific management actions in consultation with the Recovery Team, such as annual monitoring or fire management.

The presence of this habitat within the reserve has high conservation significance, as much of the known winter habitat areas for the species are not located on public lands.

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. The bird 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 & Crowley 2000).

Plate 29: Turquoise Parrot © DEC

Threats

Garnett & Crowley (2000) summarise the main threats as: clearing for agriculture, which has greatly reduced the overall distribution of the species; 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. The species is listed as potentially threatened by the removal of dead wood and dead trees (NSW Scientific Committee 2003c). Psittacine Circoviral (Beak and Feather) Disease is not known from this species, but has been recorded in the congeneric Orange-bellied Parrot (*N. chrysogaster*) (DEH 2004e). The species may also be threatened by competition for nesting sites with introduced birds, such as the Common Myna, as well as feral Honeybees.

Local and Regional Conservation Status:

The Turquoise Parrot is listed as Vulnerable under the NSW TSC Act (1995). Within NSW the number of records is highest along the western slopes (Nandewar, Brigalow Belt South and NSW South West Slopes Bioregions) and in the Sydney Basin Bioregion (DEC 2006b). In the latter, the species is most commonly found within dry grassy woodland environments in the Hunter and Capertee Valleys and to a lesser extent the Cumberland Plain. Important conservation reserves for this species in this Bioregion include, in addition to Wollemi, Yengo and Goulburn River National Parks, Munghorn Gap Nature Reserve and Yerranderie State Conservation Area.

The Turquoise Parrot has been recorded at 40 locations within the study area between 1979 and 2006 (Map 11), with more than two individuals observed at most locations. Most records were collected during the DEC surveys between September 2005 and May 2006, where the parrot was observed in Box – Red Gum – Ironbark – Rough-barked Apple woodlands. Habitat for the species is concentrated below the northern and western escarpments, particularly the alluvial flats and adjacent talus slopes on Permian sediments in the Widden Valley (including lower Blackwater Creek), Lee Creek, Glen Alice and Capertee Valleys. These habitats form part of the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Large amounts of Turquoise Parrot habitat within the Goulburn, Capertee and Hunter Valleys have been cleared in the past for agriculture or are still under threat from urban development and expansion of mining activities. The preservation of habitat within Wollemi National Park, together with neighbouring reserves such as Yengo and Goulburn River National Parks, is therefore vital to the local and regional conservation of the species.

BROWN TREECREEPER (EASTERN SUBSPECIES)

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 distinctive call. It is typically a bird of eucalypt woodlands with a grassy or open shrub understorey and abundant fallen timber and/or dead trees. Unlike most treecreepers, the species spends approximately half of the time on the ground feeding 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 further west (*picumnus*) or further 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) estimated that the population has declined by at least twenty percent in the last fifteen years. Studies have shown that populations cannot persist in habitat fragments smaller than 300 hectares. As with most treecreepers, once extinction occurs in an isolated vegetation remnant, natural recolonisation is unlikely (Garnett and Crowley 2000). The problem is compounded by competition for tree hollows from introduced species like the Common Starling, Common Myna and feral Honeybee (Higgins *et al.* 2001, NSW Scientific Committee 2001b). Stock grazing impacts on the species by decreasing the diversity of ground-dwelling invertebrates, which reduces food availability (NSW Scientific Committee 2001b). The Brown Treecreeper is also listed as a species threatened by the removal of dead wood and dead trees (NSW Scientific Committee 2003c).

Local and Regional Conservation Status

The eastern subspecies of the Brown Treecreeper is listed as Vulnerable under the NSW TSC Act (1995). It is found through all the eastern Bioregions in NSW, though 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 Capertee and Hunter Valleys and the Cumberland Plain (DEC 2006b). These environments are all characterised by agricultural and urban clearing with scattered small isolated fragments of native vegetation. The species is very close to extinction from the Cumberland Plain, with recent sightings consisting of only a small isolated population in the south (DEC 2006a). Habitat for the species is contained within a limited number of reserves within the Sydney Basin Bioregion, including, in addition to Wollemi, Yerranderie State Conservation Area, Nattai National Park (Burragorang and Nattai Valleys), northern Yengo, Blue Mountains and Goulburn River National Parks and Manobalai Nature Reserve.

The Brown Treecreeper (eastern subspecies) has been recorded at close to 100 locations within north-western Wollemi National Park (Map 11). These records are very restricted in extent, however, with the species almost entirely restricted to lower altitude dry woodlands on higher fertility soils, where Box species (*Eucalyptus albens, E. moluccana, E. dawsonii*) and or Ironbarks (e.g. *E. crebra*) make up a component of the immediate or surrounding canopy. These habitats form part of the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1). Little of the Brown Treecreeper habitat remaining within the Goulburn, Capertee or Hunter Valleys is located within public lands or reserves, so the extent of habitat included within the northern and western edge of Wollemi National Park has high conservation significance and is important to the continued conservation of the subspecies.

The Brown Treecreeper also utilises private lands adjacent to the park, and landowners should therefore be strongly encouraged to retain the integrity of the habitat within this agriculture-bushland interface. Activities that alter the structure of the vegetation or reduce the density of hollow-bearing trees, such as clearing, firewood collecting, burning and over-grazing activities should be discouraged. These areas on private land may play a buffering role for threats to the Brown Treecreeper. A significant portion of occupied habitat bordering cleared land is infested with mistletoe (due to ecosystem stress), which is of concern for the long-term viability of these populations. The retention of healthy Box woodlands on the talus slopes of the reserve and adjoining valleys is paramount to the protection of the subspecies.

SPECKLED WARBLER

Species Profile

Plate 30: Speckled Warbler © N. Williams/DEC

The Speckled Warbler (*Pyrrholaemus sagittata*) is a small, primarily ground-dwelling bird. It is similar in size to the Buff-rumped Thornbill (*Acanthiza reguloides*) but can be identified by its boldly streaked underbody, distinctive facial pattern, noticeably longer tail and distinctive call. It usually occurs in low shrub thickets and adjacent grassy understorey of dry sclerophyll forests and woodlands dominated by eucalypts. It feeds 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, usually under logs or other cover. Two to four (usually three) eggs are laid, though breeding success can be low. The Speckled Warbler is endemic to south-eastern Australia, occurring between Maryborough in south-eastern Queensland western 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). Populations in small isolated vegetation patches may experience local extinction due to natural fluctuations (Garnett and Crowley 2000). Extinction occurs in areas that do not support vegetation patches greater than 100 hectares in area (NSW Scientific Committee 2001c). The species nests and forages on the ground and hence is susceptible to predation by exotic mammalian predators and loss of ground cover by stock and Rabbit grazing and weed invasion (NSW Scientific Committee 2001c, Garnett and Crowley 2000). Speckled Warbler is listed as potentially adversely affected by the Key Threatening Process of invasion of native plant communities by exotic perennial grasses (NSW Scientific Committee 2003d), as well as by inappropriate fire regimes that alter vegetation structure.

Local and Regional Conservation Status

The Speckled Warbler is listed as Vulnerable under 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 most records are in areas supporting dry woodlands, including the Burragorang Valley, lower Hunter Valley and Goulburn River Valley. Its preference for woodlands on higher fertility soils means that it mostly occurs outside the reserve system. Habitat is contained within a limited number of reserves in the Sydney Basin Bioregion including, in addition to Wollemi National Park, Nattai, Yengo and Goulburn River National Parks and Munghorn Gap and Manobalai Nature Reserves (DEC 2005a). The majority of records within these reserves occur near the edges adjacent to more fertile land.

The 64 records of Speckled Warbler are concentrated around the northern and north-western perimeter of the park, near the interface between agricultural land and bushland (Map 11). Scattered records also occur on the lower slopes of the Glen Alice valley, and on fertile soils on and to the north of Mount Towinhingy (Map 11). Habitat for the Speckled Warbler would once have spread across the valleys that border and indent the north, north-west and south-west perimeter of the park. Clearing for agriculture has reduced the available habitat to remnants of Box-Red Gum-Ironbark Woodland on creek flats and lower escarpment slopes, both in the reserve and on adjacent private lands. Much of the habitat for the Speckled Warbler lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes, which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Protection of the species remaining habitat requires close cooperation between reserve managers and adjoining landholders. Landowners should be strongly encouraged to retain the integrity of the habitat on their land and reduce threatening processes such as clearing, shrub thicket removal, burning and grazing activities. The retention of dry woodlands on the northern and north-western creek flats and talus slopes of the reserve and adjoining valleys is primary to the protection of the species. The conservation of Speckled Warbler habitat and the abundance of the species in the study area has high local and regional conservation significance, as the majority of habitat elsewhere in the Goulburn, Capertee and Hunter Valleys remains threatened by agricultural, industrial and urban development.

PAINTED HONEYEATER

Species Profile

The Painted Honeyeater (G*rantiella picta*) is a small to medium sized bird with yellow edging to the flight feathers and a distinctive pink bill. Males exhibit black and white plumage and dark streaks on the flanks, while females are smaller, browner birds with no flank streaks (Simpson and Day 1996). It is a specialist feeder, foraging almost exclusively on the berries and flowers of mistletoes of the genus *Amyema*, although it will also take some nectar and insects (Garnett and Crowley 2000). It inhabits dry forests and woodlands, preferring Boree, Brigalow and Box-Gum woodlands and Box-Ironbark forests (ACT Government 1999, Oliver *et al.* 2003). It is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory, with the greatest concentration and almost all breeding records on the inland slopes of the Great Dividing Range in Victoria, NSW and southern Queensland (Garnett and Crowley 2000, Oliver *et al.* 2003). It is nomadic throughout both breeding and non-breeding seasons, in response to the fruiting of mistletoes and the abundance of rainfall (Keast 1968, Pizzey and Knight 1999).

Threats

The main threats to the Painted Honeyeater are associated with habitat removal, modification and isolation, particularly of the Box-Ironbark and Boree woodlands (Garnett and Crowley 2000). Much of the habitat used during the breeding season has been disturbed, through the clearing of woodlands and open forests, the removal of large trees with heavy mistletoe infestations and inappropriate fire regimes. Non-breeding habitat also continues to be cleared for purposes of agriculture and urban development. The species is negatively impacted by fragmentation of habitat, as it is less likely to be found in remnant strips of vegetation than in wider blocks (Robinson 1994). Heavy grazing and the application of pesticides and fertiliser are also likely to impact on the honeyeater (ACT Government 1999, Garnett and Crowley 2000).

Local and Regional Conservation Status

The Painted Honeyeater is listed as Vulnerable under the NSW TSC Act (1995). Records for the species on the Atlas of NSW Wildlife are sparsely scattered through the centre of NSW, with concentrations in the Cobar Peneplain, Darling Riverine Plain and NSW South West Slopes Bioregions (DEC 2006b). Within the Sydney Basin Bioregion, records are concentrated between Sydney, Newcastle and Mudgee, particularly around the Hunter Valley (DEC 2006b). The species is very poorly represented in reserves in the Bioregion, but has been recorded in Munghorn Gap Nature Reserve, Wollemi National Park and at the boundary of Goulburn River National Park (DEC 2006b).

The Painted Honeyeater was first recorded within the region during the first Birds Australia surveys, in 1977. However, the exact location of the sighting was not recorded. The species was subsequently observed on three occasions during the 2005-06 systematic surveys, each within close vicinity of each other in the Lee Creek Valley (Map 11). The honeyeaters were all seen within Box or Box – Red Gum – Ironbark woodland on flats or lower slopes, and no more than 300 metres within the National Park boundary. The Painted Honeyeater would also be expected to occur in River Oak forest with mistletoe, such as occurs along Widden Brook. These environments form a component of the mosaic of foraging habitat for the species in the Goulburn, Hunter and Capertee Valleys, being visited when mistletoe or eucalypt species are in heavy flower. All of the Painted Honeyeater habitat in the study area lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Painted Honeyeater habitat would once have been extensive across the valleys that border and indent the north, north-west and south-western perimeter of the park. Clearing for agriculture has reduced the available habitat to remnants on creek flats and lower escarpment slopes. North-western Wollemi National Park contains only a small fraction of somewhat marginal habitat, with the greater extent of quality habitat located on private lands. Never-the-less much of the remaining preferred habitat is fragmented and continues to be degraded or under pressure from development, so the preservation of habitat within northern Wollemi National Park has high conservation significance. Even though the species may only visit the park on occasion, such habitats are likely to be vital to the survival of the species east of the Great Dividing Range in NSW. Ongoing conservation will require cooperation between wildlife managers and private landholders. Landowners should be strongly encouraged to retain the integrity of habitat on their land and in particular to retain key tree species. A key management issue is likely to be balancing the dependency of this species on mistletoes of the genus *Amyema*, against the heavy load of mistletoe that appears to be threatening the long term health of woodlands along the northern and north-western perimeters of the park.

BLACK-CHINNED HONEYEATER (EASTERN SUBSPECIES)

Species Profile

Plate 31: Black-chinned Honeyeater © P. Mahoney

The Black-chinned Honeyeater (*Melithreptus gularis*) is a small, 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. The species is nomadic, moving within and between drier eucalypt woodlands that feature Ironbark and/or Box species. It is usually found in pairs or small groups of up to twelve and feeds 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 along the inland slopes of the Great Dividing Range, extending to the coast in the Sydney Basin and Clarence River Valley of NSW, and again between Brisbane and Rockhampton, Qld, as well as westward into south-eastern South Australia. 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 fragmentation of woodland habitat and do not appear to use remnants less than 200 hectares in area (NSW Scientific Committee 2001d). The species appears to occur naturally at low densities (NSW Scientific Committee 2001d) and is relatively mobile, so the reason for this absence from small fragments is unknown (Garnett and Crowley 2000). The species is 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 the Pied Currawongs (*Strepera graculina*) (NSW Scientific Committee 2001d).

Local and Regional Conservation Status

The eastern subspecies of the Black-chinned Honeyeater is listed as Vulnerable under the NSW TSC Act (1995). Scattered records occur in the eastern half of the state, with the highest number in the Nandewar, Sydney Basin and NSW South West Slopes Bioregions (DEC 2006b). In the Sydney Basin region most records come from drier areas with fertile soils such as the Capertee and Hunter Valleys and western Sydney, where it is often associated with winter-flowering tree species such as White Box (*Eucalyptus albens*) and Spotted Gum (*Corymbia maculata*). All of these areas have been heavily cleared in the past and remain subject to numerous ongoing threatening processes. Most of the records for the species are outside of conservation areas. However, it has been recorded in a small number of DEC reserves, notably Goulburn River and Werakata National Parks and Munghorn Gap Nature Reserve, as well as northern Yengo and north-eastern Wollemi National Parks (DEC 2006b).

The Black-chinned Honeyeater has been recorded at just over 40 locations in the study area (Map 12). Sightings are concentrated on the flats and lower slopes of the Goulburn and Capertee River Valleys, particularly Widden Brook, Lee Creek and Glen Alice valleys. Consistent with records obtained across their range, the species has not been recorded within any sections of the study area that receive more than 700 millimetres of rain (NSW Scientific Committee 2001d), and is restricted to Box – Red Gum – Ironbark – Rough-barked Apple woodlands. The density and distribution of the species within these habitats will vary over time in response to major flowering events. These habitats form part of the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Habitat for this species would once have been widespread within the valleys of the Capertee, Goulburn and Hunter Rivers. These areas have been extensively cleared for agriculture, industry and settlements and as a result habitat is now largely restricted to remnant vegetation along creeklines and lower escarpment slopes. Many fragments are still under threat from development. The protection of Black-chinned Honeyeater habitat within Wollemi National Park therefore has high local and regional conservation significance and, together within neighbouring National Parks (particularly Goulburn River and Yengo NP) is vital to the ongoing survival of the species east of the Great Dividing Range in central NSW.

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 forests and coastal habitats such as Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) dominated forest. The species is semi-nomadic and seems to undertake complex movements, generally dependent on where flowering food trees are available. It feeds on nectar, lerps and insects and nests in the crown of eucalypts where it usually lays two or three eggs. It is endemic to south-eastern Australia, formerly occurring between central Queensland and South Australia. 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). There is thought to be only a single population of approximately 1500 individuals remaining, with numbers considered to be still decreasing (Garnett and Crowley 2000).

Plate 32: Regent Honeyeater © DEC

Threats

Land clearance for agriculture has removed about three-quarters of habitat suitable for the Regent Honeyeater. The remaining habitat is highly fragmented, and continues to be degraded by the removal of larger trees as well as grazing by domestic stock and rabbits (NPWS 1999c). Habitat alteration may also advantage more aggressive honeyeaters, such as miners (*Manorina* spp.) and friarbirds (*Philemon* spp.), which may displace the Regent Honeyeater.

Local and Regional Conservation Status

The Regent Honeyeater is listed as Endangered under the NSW TSC Act (1995) and as Endangered under the Commonwealth EPBC Act (1999). A national recovery plan for the species has been implemented in order to identify and reduce threatening processes and reverse population declines (Menkhorst *et al*. 1999). Within NSW the greatest numbers occur in the Sydney Basin, Nandewar and New England Tableland Bioregions (DEC 2006b). Important areas in the Sydney Basin are the Capertee and lower Hunter Valleys, the northern Cumberland Plain and the Central Coast. The species is primarily observed outside of reserves, although a small number of parks are regularly used, including Goulburn River and Nattai National Parks and Munghorn Gap Nature Reserves (DEC 2006b).

Regent Honeyeater has been recorded in the study area on nine occasions, between 1982 and 2005 (Map 12). All of these sightings are located on or immediately adjacent to the perimeter of the park, with two kilometres the maximum distance inside the boundary that a Regent Honeyeater has been spotted. One of these sightings was made in September 2005 during the DEC surveys, when two individuals were located within Box woodland on the northern side of Blackwater Creek. The Regent Honeyeater favours flowering food trees on the creeks and valley flats that support River Oak with mistletoe, Red Gum and Yellow Box, as well as lower escarpment and dry slopes that are dominated by Box species and Red Ironbark. It is significant that the Regent Honeyeater has been observed within the study area in spring, since this is within the breeding season and suggests that the species may breed within the park or surrounding areas. Much Regent Honeyeater habitat is encompassed within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Habitat for the Regent Honeyeater would once have spread across the valleys that border the north, north-west and south-west of the park. Clearing has destroyed about 75 percent of the Regent Honeyeater's habitat across its former range (Garnett and Crowley 2000) and has reduced the available habitat in the region to remnants on creek flats and lower escarpment slopes. North-western Wollemi National Park contains only a small fraction of somewhat marginal habitat, with the greater extent of quality habitat located on private lands. Never-the-less much of the remaining high quality habitat within the region is fragmented and continues to be degraded or under pressure from development. Therefore the preservation of habitat within the study area has high conservation significance. Such habitats are vital to the survival of the species as a whole. Targeted surveys during peak flowering periods of favoured food trees are required to ascertain the exact extent to which the species currently depends on these areas. Ongoing conservation will require cooperation between reserve managers and private landholders. The Widden, Goulburn, Myrtle, Growee and Capertee Valleys are considered primary habitat for this rarest of birds. Landuses that remove cover of preferred tree species are likely to constitute a significant impact on the species and warrant impact assessment under relevant legislation. Landowners should be made aware of their responsibilities in this regard and be strongly encouraged to retain the integrity of habitat on their land and in particular to retain key feed tree species, including Mugga Ironbark and Yellow Box.

HOODED ROBIN (SOUTH-EASTERN SUBSPECIES)

Species Profile

The Hooded Robin (*Melanodryas cucullata*) is a medium-sized bird that typically occurs in eucalypt woodland or *Acacia* shrubland. The adult male is distinctive, having a black hood and upper body combined with a white shoulder stripe. 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 and call, distinguish this species from the Jacky Winter (*Microeca fascinans*) and female *Petroica* Robins. The species utilises dead or fallen timber as perches, from which they pounce to feed mainly on insects and small lizards (Garnett and Crowley 2000). The species 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. The two subspecies in New South Wales are *picata,* which extends from north-western NSW through to the Kimberleys in Western Australia, and the nominate (*cucullata*) which occurs 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 size 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 a reduction in food availability through grazing by stock and weed invasion may also be threats (NSW Scientific Committee 2001e, 2003d). Eggs and young have been known to be predated upon by native avian predators and possibly by the Fox (Higgins and Peter 2002), Feral Cat and Black Rat. The Key Threatening Process removal of wood and dead trees is also likely to adversely affect the species.

Local and Regional Conservation Status

The south-eastern subspecies of the Hooded Robin is listed as Vulnerable under the NSW TSC Act (1995). It has been recorded in most Bioregions in New South Wales, though is rare in the Australian Alps, South Eastern Highlands and Riverina Bioregions, and is restricted in the NSW North Coast Bioregion. Within the Sydney Basin Bioregion it is virtually restricted to the Hunter, Capertee and Burragorang Valleys where it is closely associated with the drier woodland habitats. Formerly it was well known from the Cumberland Plain however it has virtually disappeared from this area (DEC 2006b, Keast 1995). Within the Sydney Basin it has been recorded from a limited number of reserves including Wollemi, Nattai and Goulburn River National Parks and Munghorn Gap Nature Reserve, though most records are on the boundary of the reserves where higher fertility soils occur.

The Hooded Robin was recorded in the northern quarter of the study area, in the Goulburn River Valley, during the first Birds Australia Atlas between 1979 and 1981. An individual was also spotted between Bogee and Glen Alice, in the Capertee Valley, in 1997, just within the boundary of the park (Map 12). A total of twelve Hooded Robins were observed at three locations during the BSP surveys in 2005-06, including just inside the park boundary in the Glen Alice Valley, and immediately outside the park boundary in Lee Creek Valley (Map 12). The birds seen at Lee Creek included a male and female pair, suggesting that breeding may occur in the vicinity. The Hooded Robin is more frequently recorded on private lands adjacent to the national park. It remains quite common in the Capertee Valley, but appears to have suffered marked declines in the Hunter Valley (DEC 2005a, 2005b). It has a tendency to dwell at the interface between cleared and wooded land, often perching on fences and dead trees. The Hooded Robin has been described as a winter visitor to some areas of central eastern NSW (Higgins and Peter 2002), a time of year when few surveys have been conducted in the park. Hence the number of Hooded Robin records within the park in spring and summer may be an under representation of the areas actual value to the species. Potential habitat is widespread around the northern, north-western and south-western boundary of the study area, particularly within the Box-Red Gum-Ironbark woodlands. All of the habitat within the study area lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Habitat for the Hooded Robin would once have been widespread across the valleys that border and indent the north, north-west and south-west of the park. Clearing for agriculture has reduced the available habitat to isolated paddock trees and remnants of Box-Red Gum Woodland on creek flats and lower escarpment slopes, both in the reserve and on private lands. Landholders should be encouraged to retain paddock trees (even if they are dead) and other perch sites for the species. The protection of dry woodlands on creek flats both on the reserve and on adjoining private lands is vital to the survival of the species within the region.

GREY-CROWNED BABBLER (EASTERN SUBSPECIES)

Species Profile

Plate 33: Grey-crowned Babbler © N. Williams

The Grey-crowned Babbler (*Pomatostomus temporalis*) is the largest of the four Australian babbler species, and the only one with a light-coloured crown. Other distinctive features are a long, decurved bill and a dark band that passes from the bill through the eye, giving it a "masked" appearance (Higgins and Peter 2002). There are two subspecies in Australia, the nominate being *temporalis*, which occurs in eastern Australia from Cape York to north-east NSW then south and west through central NSW and Victoria to south-eastern South Australia (Higgins and Peter 2002). It is widespread on the inland slopes of the Great Dividing Range in NSW and on the western plains. The Grey-crowned Babbler lives in open forest and woodland, *Acacia* shrubland and adjoining farmland, preferring Box-Gum woodlands on slopes and Box-Cypress and open Box woodlands on alluvial plains (Garnett and Crowley 2000). The species feeds on invertebrates gleaned from vegetation or the ground (Garnett and Crowley 2000). The birds form family parties, consisting of a breeding pair and offspring from prior breeding years, which are thought to be vital for predator avoidance and co-operative feeding of the young (King 1980).

Threats

The Grey-crowned Babbler 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). Much remaining Babbler habitat occurs in isolated fragments, from which the species has gradually disappeared (Garnett and Crowley 2000). This disappearance has been attributed to the social consequences of habitat fragmentation, including smaller family-group sizes and reduced breeding success, as well as less effective immigration and emigration and higher rates of nest predation (Garnett and Crowley 2000). Once lost from a habitat fragment, natural recolonisation is unlikely (Robinson and Traill 1996). Agricultural practices such as grazing and associated weed invasion also pose a threat (NSW Scientific Committee 2003d), as does increased competitor abundance in disturbed habitats (NSW Scientific Committee 2004d), removal of important feeding sites in the form of dead wood and dead trees and possibly predation by Feral Cats.

Local and Regional Conservation Status

The eastern subspecies of the Grey-crowned Babbler is listed as Vulnerable under the NSW TSC Act (1995). It is most common in the central western Bioregions of NSW, particularly the NSW South Western Slopes and Brigalow Belt South, but also occurs in the NSW North Coast Bioregion in areas such as in the Clarence River Valley (DEC 2006b). Within the Sydney Basin Bioregion the species is largely restricted to the Hunter Valley, with a few records also in the Capertee Valley, where it is closely associated with the drier woodland habitats. Within the Bioregion it is poorly represented in reserves, but has been detected within Wollemi, Goulburn River, Yengo and Werakata National Parks and Munghorn Gap Nature Reserve (DEC 2006b).

The Grey-crowned Babbler was detected within the vicinity of the study area during both the first and second Birds Australia surveys (1978-79 and 2001), though the exact locations of these sightings are unknown. It was recorded once by DEC in September 2005, on a lower slope on the eastern side of Widden Brook, within Box-Red Gum woodland (Map 12). The species has also previously been seen in the Myrtle Creek valley (Bell 1997). The Grey-crowned Babbler is likely to occur at other locations along the northern and south-western boundary of the park, but is more frequently recorded on private lands adjacent to the study area than in the national park itself, particularly within the Capertee Valley. All of the habitat within the study area lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

Habitat for this species would once have been widespread within the valleys of the Capertee, Hunter and Goulburn Rivers. These areas have been extensively cleared for agriculture, industry and settlements and as a result habitat is now largely restricted to remnant vegetation along creeklines and lower escarpment slopes. Many fragments in these valleys are still under threat from further development. Thus, even though north-western Wollemi National Park contains only a small fraction of somewhat marginal habitat, it has high local and regional conservation significance and, together with habitat in neighbouring National Parks, is important to the ongoing survival of the species east of the Great Dividing Range in central NSW.

DIAMOND FIRETAIL

Species Profile

The Diamond Firetail (*Stagonopleura guttata*) is an attractive finch, 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 1999). 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). The Diamond Firetail is somewhat nomadic, in response to the distribution and abundance of seeding native grasses. The species is usually encountered in pairs, though is known to form small flocks in autumn, winter and early spring. It builds bottle-shaped nests in trees or sometimes mistletoe, usually producing four to six eggs (Pizzey and Knight 1999). The species is endemic to south-eastern Australia, with records extending from Rockhampton (Queensland) to the Eyre Peninsula and Kangaroo Island (South Australia) (Pizzey and Knight 1999). Most populations occur on the inland slopes of the Great Dividing Range with only small pockets of habitat occurring near the coast (Blakers *et al.* 1984).

Threats

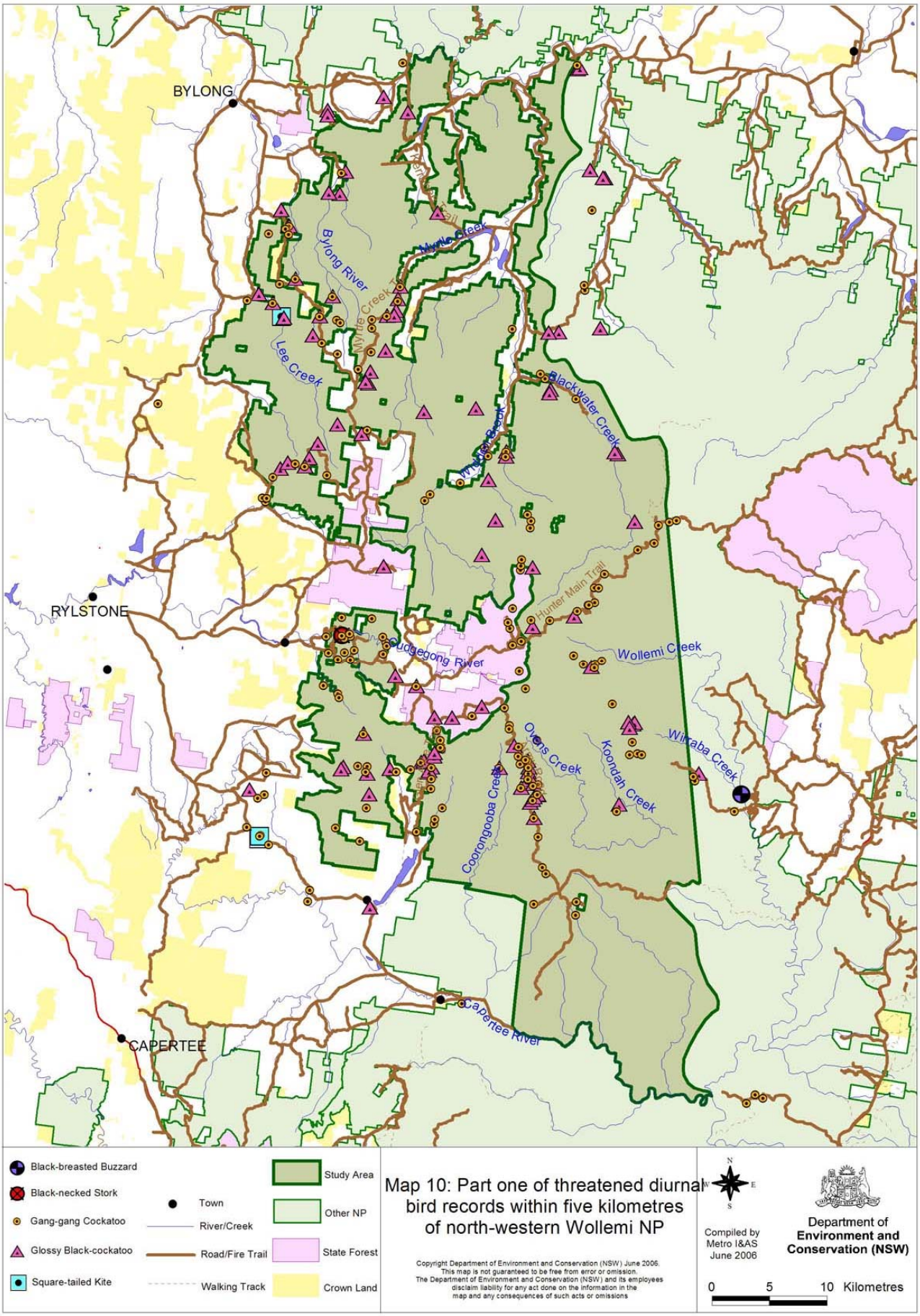
Much habitat suitable for the Diamond Firetail has been cleared and the species is therefore included in the suite of woodland birds that have declined in the sheep-wheat belt of central west NSW (Reid 1999). It appears unable to survive in areas that lack remnants larger than 200 hectares (NSW Scientific Committee 2001f). Much remaining habitat is threatened with degradation by over-grazing and the spread of exotic grasses, which may result in the loss of key food plants and possibly competition from flock-foraging Red-browed Finches (*Neochmia temporalis*) (Garnett and Crowley 2000, NSW Scientific Committee 2003d). Predation by Foxes and Feral Cats may be another threat (as the species forages on the ground) (Smith *et al.* 1995). Trapping for the pet trade is believed to have contributed to its rarity on the Cumberland Plain (Hoskin 1991).

Local and Regional Conservation Status

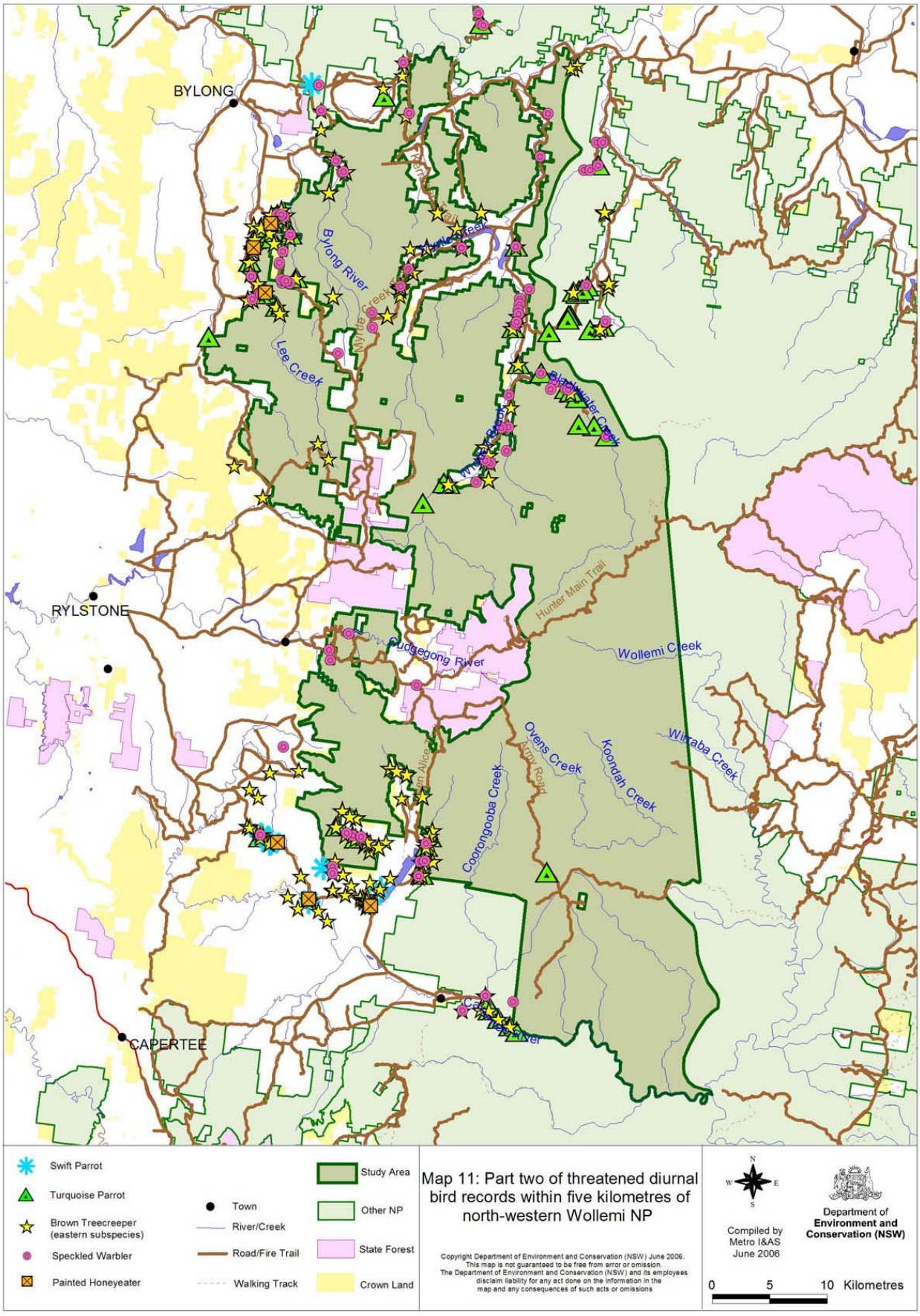
The Diamond Firetail is listed as Vulnerable under the NSW TSC Act (1995). It is widely recorded in the eastern two thirds of the state, although it is less frequently seen in the three coastal Bioregions and in the high country of the Australian Alps. Within the Sydney Basin Bioregion the species is closely associated with grassy box woodlands found on the more fertile soils on the inland valleys and plains, including the Capertee, upper Hunter and Burragorang Valleys, and occasionally on the Cumberland Plain. These environments are generally poorly represented in reserves, though records are known from the Burragorang Valley in Nattai National Park, near the northern boundary of north-eastern Wollemi National Park, as well as in Goulburn River National Park and Munghorn Gap Nature Reserve (DEC 2006b).

The Diamond Firetail has been recorded at 30 localities, concentrated around the northern and north-western perimeter of the park, near the interface between agricultural land and bushland (Map 12). Scattered records also occur on the lower slopes of the Glen Alice valley, and on fertile soils north of Mount Towinhingy (Map 12). Habitat for the Diamond Firetail would once have spread across the wider valleys that border and indent the north, north-west and south-western perimeter of the park. Clearing for agriculture has reduced the available habitat to remnants of Box-Red Gum-Rough-barked Apple Woodland or riparian River Oak forest with a grassy understorey on creek flats and lower escarpment slopes, both in the reserve and on adjacent private lands. All of the habitat within the study area lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

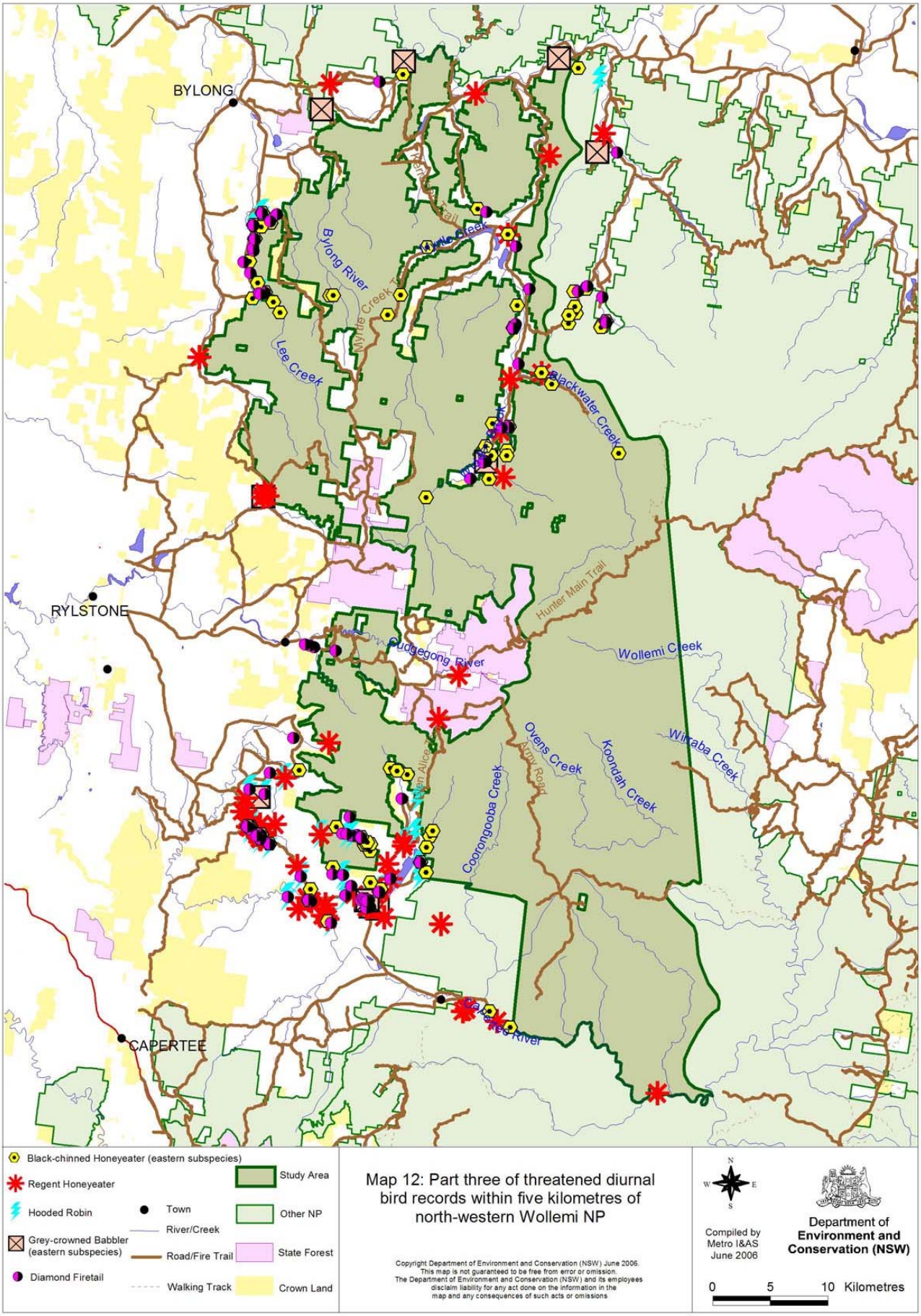
Protection of the species remaining habitat requires close cooperation between reserve managers and adjoining landholders. Landowners should be strongly encouraged to retain the integrity of the habitat on their land and reduce threatening processes such as further clearing, grazing and invasion of exotic grasses. The retention of dry woodlands on the northern, north-western and south-western creek flats and talus slopes of the reserve and adjoining valleys is essential to the protection of the species in the region. The conservation of Diamond Firetail habitat in the study area has high local and regional conservation significance, as the majority of habitat elsewhere in the Goulburn, Capertee and Hunter Valleys remains threatened by agricultural, industrial and urban development.



Map 10: Part 1 of threatened diurnal bird records within five kilometres of north-western Wollemi National Park



Map 11: Part 2 of threatened diurnal bird records within five kilometres of north-western Wollemi National Park



Map 12: Part 3 of threatened diurnal bird records within five kilometres of north-western Wollemi National Park

BARKING OWL

Species Profile

The Barking Owl (*Ninox connivens*) is 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 familiaris*) 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 (Higgins 1999).

Plate 34: Barking Owl © S. Cottrell/DEC

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 often subject to degradation through grazing or forestry operations that fell old-growth and over-mature trees, thus reducing available nest sites (NPWS 2003c). However, the owl is frequently located at the edge of forest blocks adjacent to cleared land, possibly due to increased prey availability at such locations (Taylor *et al.* 2002b). Other threats include predation (particularly of fledglings), mortality from collisions with fences and vehicles, secondary poisoning from rodenticides, collection of firewood and removal of dead wood and trees and competition from feral Honeybees (Garnet & Crowley 2000, NSW Scientific Committee 2003c). The long generation time of this species (ten years) is a further issue, as it compromises the ability to recover after suffering population declines (NSW Scientific Committee 1998d).

Local and Regional Conservation Status

The Barking Owl is listed as Vulnerable under the NSW TSC Act (1995). Records occur throughout NSW, though it is more rare in the far west and at higher altitudes in the south-east (DEC 2006b). Records are scattered throughout the Sydney Basin Bioregion, the most important locations appearing to be the Capertee and Hunter Valleys. Within this Bioregion very few records are located on conservation reserves, with most being on private lands (DEC 2006b). However, recent DEC surveys have obtained a small number of records from the dry woodlands on the periphery of northern Yengo and Wollemi National Parks (DEC 2005c, 2005a) as well as Manobalai Nature Reserve and Crown Lands (DEC 2005b).

The Barking Owl has been recorded in the study area on only one occasion on the Atlas of NSW Wildlife, during the first Birds Australia Atlas (1979). Neither the CRA or BSP systematic surveys detected the species, despite the undertaking of 84 nocturnal call playback surveys, of which 15 were located within potential Barking Owl habitat. This result was somewhat surprising, given that the species was located in similar habitat in north-eastern Wollemi and northern Yengo National Parks in 2004-05. There is, however, some evidence that the species occurs in the study area, as it has been reported on private lands at Lee Creek (P. Lonrigan pers. comm.), on the Glen Alice Trail (Washington & Mullins Imrie 1998) and near Wilsons Clearing (Goldney & Cardale 1993). Potential habitat for the owl is widespread in the woodlands on creek flats and lower slopes near the dry northern, north-western and south-western boundaries of the park, particularly the creeks that drain into the Goulburn River. The majority of the suitable habitat within the study area lies within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1). The absence of recent records from the study area or immediately adjacent lands is very concerning, and suggests that even if the species does persist, it only does so at low abundance. The owl was recorded on numerous occasions in the Capertee Valley in the 1990s, but has not been recorded on the Atlas of NSW Wildlife in that area since 2000 (DEC 2006b).

The preferred habitat of the Barking Owl in the Capertee, Goulburn and Hunter Valleys has been widely depleted by clearing for agriculture, industry and settlements and much remaining habitat is under continued pressure from these threats. This species is now rare in the Sydney Basin Bioregion and known localities that occur on reserve have very high conservation significance. It is recommended that further targeted nocturnal call playback surveys be undertaken to confidently ascertain the species' current distribution and status across northern Wollemi National Park. Management of the owl in the park and the region should be undertaken in accordance with the state-wide recovery plan (currently in draft form, NPWS 2003c).

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 dense forest types, 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*) (Kavanagh 2002a). This species usually nests in a hollow in a eucalypt within or below the canopy, and normally lays two eggs. It usually maintains a territory of between 300 and 1500 hectares, with size dependent on habitat quality and prey density. The species is endemic to eastern Australia, being recorded between Eungella (Queensland) to near the South Australia-Victoria border (Higgins 1999).

Plate 35: Powerful Owl © N. Williams

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 nest sites. The owl can, however, survive in areas with some levels of disturbance, such as in selectively logged forests (Kavanagh 1997) and suburban areas of Brisbane, Sydney and Melbourne (Garnett and Crowley 2000, DEC 2004f). Two of the determining factors for the species persistence in disturbed areas are the presence and suitable abundance of prey species (Chafer 1992) and suitable nesting/roosting sites (Debus and Chafer 1994). Other factors that may affect this species include predation of fledglings by Foxes and secondary poisoning, though neither is thought to be a significant cause of mortality (DEC 2005e). In addition, the foliage roosts of the Powerful Owl are vulnerable to regular hazard reduction burning (DEC 2005e).

Local and Regional Conservation Status

The Powerful Owl is listed as Vulnerable under the NSW TSC Act (1995). Within NSW, the majority of records occur within the three coastal Bioregions, but occasional sightings have also been made further west, particularly in the South Eastern Highlands Bioregion. It is regularly recorded throughout the Sydney Basin Bioregion, from the rural-urban fringes of the Sydney Metropolitan area to west of the Dividing Range onto the Central Tablelands. Recent work within the Sydney Catchment Authority Special Areas (Woronora and Warragamba) has found Powerful Owls to be in higher densities and more widespread within the sandstone country of the Sydney Basin than previously thought (DEC 2006a). Most reserves within the Sydney Basin Bioregion support known territories of this species, though they are at lower densities in the drier environments of the north-west (NPWS 2001b, DEC 2005a, b, c).

The Powerful Owl has been recorded at 20 locations in north-western Wollemi National Park between 1994 and 2006 (Map 13). These records are widely dispersed across the study area, but each within the vicinity of moister habitat types, either along creeklines and lower slopes in the north and west, in gullies that incise the sandstone plateaux or in higher elevation areas, including some of the basalt caps. Relative to other localities in the Sydney Basin, the habitat along the northern and north-western boundaries of the study area is not thought to be of particularly high quality for the Powerful Owl. The owls are likely to reach greater density at moderate to high elevations, where preferred prey items such as Greater Glider and Common Ringtail Possum are more abundant. The Powerful Owl has been recorded in few locations within five kilometres of the study area, as it does not occur in the agricultural lands that dominate the Capertee and Goulburn River Valleys.

The Powerful Owl is considered to be relatively secure when located in protected areas and no management actions are currently required for this species in the study area. However, known locations near the boundaries of the park should be considered during fire management planning. Management of the owl should be undertaken in accordance with the state-wide recovery plan (currently in draft form, DEC 2005e).

MASKED OWL

Species Profile

Plate 36: Masked Owl © M. Todd

The Masked Owl (*Tyto novaehollandiae*) is a large owl that is distinguished from the similar Barn Owl by its larger size, more thickset and hunchbacked appearance, fully feathered legs and larger feet (Higgins 1999). It inhabits a wide range of open forest and woodland habitats, requiring large hollows for roosting and nesting and open areas for hunting. It feeds mostly on ground-dwelling mammals such as rats and Antechinus, and occasionally on diurnal birds, Sugar Gliders and insects (Kavanagh 2002a). It appears to forage near ecotones, either at the boundary of forests of different structural composition or at the forest edge, and may thus benefit from the mosaic of burnt-unburnt patches in the landscape after fire (DEC 2005e). The owl has a home range of 800 to 1200 hectares (Kavanagh 2002b). It nests in hollow trees, usually eucalypts, where two to three eggs are the normal clutch (Higgins 1999). 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 2002b, Garnett and Crowley 2000). The species does not persist within fragments of forest less than 200 hectares (Kavanagh 2002b). The owl may be affected by logging, through removal of hollows or reduction in foraging habitat due to vigorous regrowth (Garnett and Crowley 2000). However it has been suggested that modern mosaic logging operations do not cause major changes to the abundance of the species (Kavanagh 2002b). The removal of dead wood and dead trees is considered to be a Key Threatening Process affecting this species (NSW Scientific Committee 2003c). The core areas of the species distribution in NSW are located on the Central Coast and Lower Hunter Valley and much habitat in these areas is not reserved and is under continued pressure from habitat fragmentation and clearance due to urban and industrial development.

Local and Regional Conservation Status

The Masked Owl is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in NSW are located within the three coastal bioregions (NSW North Coast, Sydney Basin and South East Corner), with a few scattered records west of the Divide (DEC 2006b). Within the Sydney Basin Bioregion, the woodlands of the coastal plains between Wyong and Port Stephens support high numbers of this species, with concentrations of records also occurring in the south and to a lesser extent across the southern Blue Mountains. Records of the Masked Owl are scattered within a number of DEC reserves, including, in addition to Wollemi NP, Royal, Blue Mountains, Nattai, Kanangra-Boyd, Brisbane Water and Dharug National Parks and Berowra Valley Regional Park (DEC 2006b).

The Masked Owl has been detected at just one location in the study area, where it responded to an owl call playback survey in March 2006 (Map 13). The species is not expected to occur on the rugged sandstone plateaux. However, its apparent scarcity in the dry woodlands along the northern talus slopes and creeklines was somewhat surprising, given its occurrence in similar habitats in north-eastern Wollemi National Park (DEC 2005a; one record shown on Map 13). The species may be present in the dry woodlands along the northern talus slopes and creeklines, but only at low abundance and hence has evaded detection. These data suggest that compared to the Lower Hunter Valley, the Upper Hunter, Goulburn and Capertee Valleys hold lesser importance for the Masked Owl.

Further targeted nocturnal call playback surveys would be necessary to confidently ascertain the distribution and status of the Masked Owl within northern Wollemi National Park and the contribution the area makes to conservation of the species in the region and on the western side of the Great Dividing Range. In the mean time, management of the owl in the region should be undertaken in accordance with the state-wide recovery plan (currently in draft form, DEC 2005e).

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 tree hollows (often located in old emergent trees) as well as in deep sandstone overhangs or dark caves (DEC 2005e). It is usually located within 100 metres of a stream (Kavanagh 1997). Pairs probably maintain permanent territories that are between 200 and 800 hectares in area, depending on the availability of prey (Higgins 1999). The species feeds on a wide range of arboreal and terrestrial mammals (Kavanagh 2002a). In Australia the subspecies *tenebricosa* is distributed along the east coast between Queensland and Victoria. A smaller subspecies (*arfaki*) occurs in New Guinea (Higgins 1999).

Threats

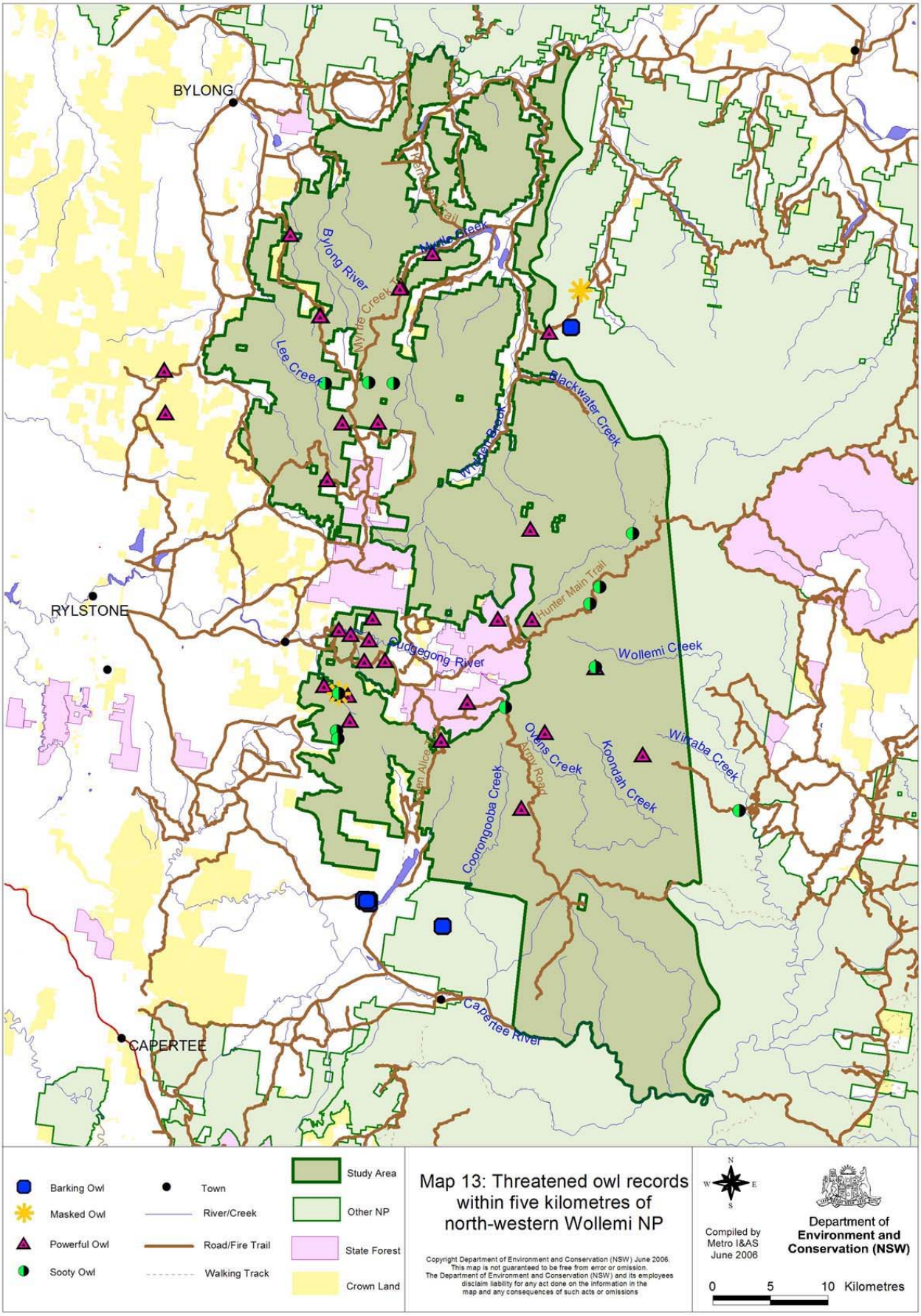
Garnett and Crowley (2000) list the main threat as habitat clearance for agriculture and urban development, along with additional fragmentation or degradation caused by logging, burning and dieback. The exact impacts of logging remain unclear (Higgins 1999). Where the species is at the margins of its ecological tolerance, frequent fire may threaten its occurrence when it results in the replacement of mesic plants with fire tolerant species and impacts on nest and roost sites. The Sooty Owl is a highly specialised species occupying a narrow range of habitats, which makes it particularly vulnerable to climate change (NSW Scientific Committee 2000c).

Local and Regional Conservation Status

The Sooty Owl is listed as Vulnerable under the NSW TSC Act (1995). Within NSW it is largely restricted to the three coastal Bioregions, with a few records in the extreme east of the South Eastern Highlands Bioregion. The distribution of this species in the Sydney Basin Bioregion is strongly tied to the presence of wet sclerophyll forests and rainforests. 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 most often recorded in Illawarra Escarpment and Jilliby State Conservation Areas, with other records in Royal, Blue Mountains and Bouddi National Parks (DEC 2006b).

The Sooty Owl has been recorded on eleven occasions within the study area, each located in or near gully lines that incise the central sandstone plateaux (Map 13). These animals were heard calling spontaneously or in response to call playback, or were directly observed in their roosting habitat. Three individuals were located in deep sandstone overhangs. These results correspond to known habitat preferences of the Sooty Owl, specifically areas with a high percentage of rainforest or moist forest with a mesic understorey and low levels of annual radiation, mostly on south-facing slopes (DEC 2006a). The owl is expected to be widespread within such habitats, particularly in the southern two-thirds of the study area within gully lines that contain an abundance of tree hollows or caves for roosting and preferred prey items such as Common Ringtail Possum and Sugar Glider (Kavanagh 2002a). The Sooty Owl has been recorded at just one other location within five kilometres of the study area, as it does not inhabit the agricultural lands that dominate the Capertee and Goulburn River Valleys. It is also absent from the dry lower slopes and gullies below the northern and western escarpments.

The observation made in north-western Wollemi National Park are the furthest west that the species has been recorded in central NSW (DEC 2006b), as the western sandstone escarpment forms the western boundary of the species distribution. Habitats within the park therefore play a significant role in the conservation of the species at the limit of its distribution, and in ensuring that the species persists across its current known distribution. The owl appears to currently be secure in the park, and to not require any immediate management actions. However, management of the owl in the region should be undertaken in accordance with the state-wide recovery plan (currently in draft form, DEC 2005e).



Map 13: Threatened nocturnal bird records within five kilometres of north-western Wollemi National Park

SPOTTED-TAILED QUOLL

Species Profile

Plate 37: Spotted-tailed Quoll © N. Fenton/DEC

The Spotted-tailed or Tiger Quoll (*Dasyurus maculatus*) is a medium-sized marsupial carnivore that is identifiable 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 will also take carrion and domestic poultry (NPWS 1999d). Two subspecies of Spotted-tailed Quolls have been recognised: *D. maculatus gracilis* from north Queensland and *D. m. maculatus* from south-eastern Queensland, New South Wales, Victoria and Tasmania (Edgar and Belcher 1995). However, genetic work has shown that the true genetic split occurs between Tasmania and the rest of the mainland (Firestone *et al*. 1999). Within NSW the species utilises a variety of habitats on both sides of the Great Dividing Range, including sclerophyll forest and woodlands, coastal heath and rainforest (NPWS 1999d). Habitat requirements include suitable den sites, an abundance of food and large areas of intact vegetation (NPWS 1999d).

Threats

The main problems confronting the Spotted-tailed Quoll are believed to be habitat loss, degradation and fragmentation (Belcher 2004). Other threats include: predation and competition by introduced predators such as Feral Cat, Fox and Wild Dog; disease such as toxoplasmosis; road mortality; 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 eastern Australia. In more recent years evidence has been collected to suggest that aerial, ground and mound baiting using 1080 (sodium monoflouroacetate) has significant negative impacts on Quoll populations (Belcher 2004, Murray and Poore 2004). Wild Dog/Dingo control also has the potential to indirectly impact on Quolls as it can result in greater numbers of Foxes and/or Feral Cats (Glen & Dickman 2005). The Spotted-tailed Quoll has been listed as a species affected by the following Key Threatening Processes: removal of dead wood and dead trees (NSW Scientific Committee 2003c); high frequency fire (NSW Scientific Committee 2000b); and removal of bushrock (NSW Scientific Committee 1999b).

Local and Regional Conservation Status

The Spotted-tailed Quoll is listed as Vulnerable under the NSW TSC Act (1995) and as Endangered under the Commonwealth EPBC Act (1999). The southern populations are believed to have contracted in range by up to 50 percent in recent years (Maxwell *et al.* 1996). Within NSW the species has been most frequently recorded in the NSW North Coast, Sydney Basin and South East Corner Bioregions (DEC 2006b). There are few recent records for the Sydney Basin Bioregion, though it is still seen with some regularity on the Central Coast between Hornsby and Newcastle, in the upper Blue Mountains and to a lesser extent in the Kangaroo Valley (DEC 2006b). It may have recently become extinct in other areas. The species has been recorded in a number of conservation reserves in the Sydney Basin Bioregion, most recently within Blue Mountains, Brisbane Water, Popran and Wollemi National Parks (DEC 2006b).

The Spotted-tailed Quoll is a very cryptic species. Where it occurs in low density, it is difficult to trap and can require an immense effort to detect using standard survey techniques (Lunney and Matthews 2001). The majority of recent records for the species in the Sydney Basin come from traces left by the animals (such as tracks, remains or scats), road kills and opportunistic sightings. This behaviour is reflected in the low number of Spotted-tailed Quoll records within north-western Wollemi National Park, where it has been definitely recorded on the Atlas of NSW Wildlife on just three occasions between 1992 and 2006. In addition to these records, however, there is much anecdotal evidence of the species occurrence. Many landholders adjacent to the park occasionally sight Quolls, including in Widden Valley (D. Alley pers. comm.), in Lee Creek Valley (S. Thorn pers. comm.), in Bylong River Valley (B. Kerney pers. comm.) and along Towinhingy Creek (M. Kirk pers. comm.). Furthermore, scats considered to 'probably' have come from the Spotted-tailed Quoll have been recorded on Myrtle

Creek and Kerry Mountain during 2005-06 DEC surveys, as well as by bushwalkers in diatremes south of the Hunter Range (Macqueen 2005). Spotted-tailed Quoll have been recorded on the Atlas of NSW Wildlife at five additional locations within five kilometres of the study area, including to the east of Mount Monundilla and to the west of the park (Map 15).

It is very important to note that some landholders that have lived in the area for decades have noticed a decline in Quoll numbers in recent times. Fifty years ago Spotted-tailed Quolls were a common sight on the boundary between cleared and forested land, where now they are rarely seen (M. Kirk pers. comm.). Like elsewhere in the Sydney Basin, Quolls have clearly declined in numbers within the region. The positive identification in March 2006 of Quoll hair from a hair tube located just off the Army Road was very exciting as it confirms that the species persists within the park. However, the current distribution, abundance and status of the species within the body of the park remain unknown. Potential habitat for the Spotted-tailed Quoll is widespread across the sandstone plateaux, particularly within moister vegetation types on gully lines and sheltered lower slopes. The paucity of records suggests that the study area supports only a low density of Spotted-tailed Quolls, though this pattern is typical of Sydney sandstone environments. Numbers may be underestimated due to the absence of targeted surveys and the remoteness of much of the study area. Further survey work, including extensive cage trapping and hair tubing over an extended time period, is required to confirm the species status and to determine the role that north-western Wollemi National Park plays in the regional conservation of the species.

Many processes threatening the Spotted-tailed Quoll operate across all tenures and protection of habitat alone does not guarantee the conservation of the species. The impact of Fox and Wild Dog predation and competition is still being researched, but likely to be significant on already stressed Quoll populations. Ironically, Fox and Wild Dog control programs also have the potential to negatively impact Quolls. The extent of this impact is widely debated, with different research programs arriving at conflicting conclusions (e.g. Belcher 2003 versus Kortner *et al.* 2003). As the Spotted-tailed Quoll population in Wollemi National Park appears to already be stressed, it is recommended that a cautionary approach to 1080 baiting be taken and that use of 1080 baiting in areas where Quolls are known be very carefully considered. Aerial baiting in particular is likely to negatively affect Quoll populations. Much research is currently being undertaken into this issue, and park managers should be sure to keep up to date with the latest findings as they relate to on-ground actions. In the mean time, burying baits deeper than seven centimetres below the ground surface (rather than burying them in raised mounds) will decrease the number of baits removed by Quolls (Glen & Dickman 2003).

Priority should be given to increasing public awareness of this species, its identification and conservation status, and to encouraging neighbours and park visitors to report any sightings, together with accurate location information.

KOALA

Species Profile

Plate 38: Koala © P. Madden

The Koala (*Phascolarctos cinereus*) is a distinctive 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. Historic records and recent research (DEC 2006a) suggest that Koalas generally have a preference for higher fertility soils. Individuals spend most of the day resting in the forks of trees, and are most active following sunset (NPWS 1999e). They generally move within a home range, the size of which varies on the density of food trees and population size, but ranges between 15 and 100 hectares (Lunney pers. comm.). 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 in Victoria, have possibly altered the genetic diversity of many of the populations (Martin and Handasyde 1995). Reed *et al*. (1990) reported that a survey in 1986-87 found 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 its distribution.

Threats

Threats to the Koala across its range include: 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 Wild Dogs and motor vehicles; and infection by *Chlamydia* which causes keratoconjunctivitis (an infection of the eyes) and infertility (NPWS 1999e, NPWS 2003d). In NSW, *Chlamydia* mostly afflicts animals that are already stressed and is not considered to be a major problem (Menkhorst 1995a, NPWS 2003d). Throughout its entire range loss, fragmentation and degradation of habitat is the species greatest threat (NPWS 2003d).

Local and Regional Conservation Status

The Koala is listed as Vulnerable under the NSW TSC Act (1995). The species is widespread across the eastern third of the state and, being an easily recognisable species, there are a number of records throughout the Sydney Basin Bioregion. In this Bioregion, concentrations of records occur around the Central Coast, Blue Mountains, the fringes of the Cumberland Plain and the Woronora Plateau (DEC 2006b). Records from reserves within the Sydney Basin are uncommon, though sightings have been made in Morton, Dharug, Nattai, Blue Mountains, Brisbane Water, Wollemi and Yengo National Parks (DEC 2006b).

The Koala has not positively been recorded within north-western Wollemi National Park, though a scat possibly deposited by this species was seen on lower Blackwater Creek during BSP surveys in 2005. This lack of records is somewhat surprising, as the Koala is known from similar habitats in north-eastern and southern Wollemi National Park (DEC 2006b). There is a historic record of the species near Nullo Mountain, and it was recorded east of the study area on Boorai Creek Track in 1997 (Map 14). Potential habitat for the Koala occurs on higher fertility soils along the creek flats and lower slopes on the perimeter of agricultural country, particularly the 'Upper Goulburn Valleys and Escarpment' where favoured feed trees such as Red Gums (*Eucalyptus tereticornis*/*E. blakelyi*) and Grey Gum (*E. punctata*) occur. Potential habitat is also present where Grey Gum occurs on sheltered sandstone slopes and gullies that incise the sandstone plateaux. It is possible that the species still persists in these areas, but has evaded detection due to low density. This would be ascertained only by further targeted survey. Such survey is recommended in the vicinity of the possible scat and elsewhere along the lower reaches of Blackwater Creek.

The Koala would once have been more abundant and widespread in the upper Hunter and Goulburn Valleys, particularly in the fertile valley floors and plains that have now been cleared for agriculture and settlements. The protection of habitat within northern Wollemi National Park therefore has high conservation significance, and gaining an understanding of the distribution of the Koala in the park is likely to be important to managing the regional conservation of the species in the future. Koalas, particularly males, can be wide ranging and it is likely that this species roams across the northern escarpment and east into northern Yengo National Park and Pokolbin State Forest. This stretch of contiguous habitat is highly important to the regional conservation of the species.

EASTERN PYGMY-POSSUM

Species Profile

The Eastern Pygmy-possum (*Cercartetus nanus*) is a very small possum that is found in a wide variety of habitats, including rainforest, sclerophyll forest and woodland and heaths. It is generally nocturnal, and is an opportunistic omnivore, including nectar, pollen, insects, seeds and fruit in its diet (Tulloch 2003). Each individual has a number of nests, which are usually constructed in tree hollows, throughout their territory. The species will move through tree, shrub and ground layers (Turner and Ward 1995). It is patchily distributed between far south east Queensland and the far south east of South Australia, and Tasmania, though it is only found at higher altitudes in the north of its range and is generally more abundant in southern latitudes (Bowen and Goldingay 2000, Menkhorst 1995b). It is very difficult to detect without the use of pitfall trapping (Tulloch 2001) and hence its distribution and abundance may often be underestimated.

Plate 39: Eastern Pygmy-possum
© K Gillett/DEC

Threats

The NSW Scientific Committee (2001g) listed the following potential threats to the Eastern Pygmy-possum: isolated sub-populations with little dispersal potential which increase the risk of local extinction; habitat loss and fragmentation caused 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 Feral Cats.

Local and Regional Conservation Status

The Eastern Pygmy-possum is listed as Vulnerable under 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. However, the survey techniques used in many of these surveys may have underestimated the abundance of this species. Kavanagh (2004) concluded that the species is inadequately studied in NSW for its conservation status to be accurately assessed. Records of the Eastern Pygmy-possum are sparsely distributed throughout eastern NSW and in the central west and north west of the state, with the majority of records from the South East Corner and Sydney Basin Bioregions (DEC 2006b). Within the Sydney Basin Bioregion records are concentrated within the Blue Mountains, Central Coast and the Woronora Plateau (DEC 2006b). The species has been recorded in a number of reserves including Morton, Royal, Blue Mountains, Ku-ring-gai Chase and Brisbane Water National Parks (DEC 2006b).

The Eastern Pygmy-possum was recorded for the first time in north-western Wollemi National Park during the 2005-06 systematic surveys. Bones and hair of the species were collected at two remote locations south of the Hunter Main Trail, while remains were identified from a Fox scat near Stack Ridge, above the Glen Alice valley (Map 14). The tiny possum has not been directly observed either within or five kilometres surrounding the study area. It is, however, a highly cryptic animal, and some survey techniques that target the species, particularly pitfall trapping, have not been undertaken. The Eastern Pygmy-possum is therefore highly likely to be more widespread than records indicate. Potential habitat is relatively widespread and food sources abound. Based on records elsewhere, the species is most likely to occur within woodlands that have a dense shrub layer and an abundance of flowers, or else within areas that contain Cypress (*Callitris* spp.) with very little understorey (Bladen *et al.* 2002, Shelley 1998).

An intensive targeted trapping program would be required in order to assess the abundance, distribution and conservation status of the Eastern Pygmy-possum within the locality and region. Trapping would need to include use of pitfall traps with drift fences, Elliott traps and nest boxes positioned against flowering shrubs and trees, as these techniques have been found to be the most effective capture method for the species in other areas (Bladen *et al.* 2002, Shelley 1998, M. Schulz pers. comm.). The largest threat to Eastern Pygmy-possum within the study area is likely to be predation by Foxes, and as such known locations of the species should be included in any Fox control programs.

YELLOW-BELLIED GLIDER

Species Profile

Plate 40: Yellow-bellied Glider © J. Winter/DEC

The Yellow-bellied Glider (*Petaurus australis*) is a medium-sized nocturnal mammal found in tall open sclerophyll forests and woodlands 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 1999f). 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 call, 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 south-eastern South Australia and central coastal Queensland with a separate subspecies isolated in the wet tropics of north Queensland (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 1999f). Predation by Feral Cats and Foxes is also thought to contribute to the species vulnerability. Impacts of fire regimes are poorly understood, although some studies suggest that high intensity fire reduces populations and the availability of food resources (NPWS 1999f, 2003e). The Yellow-bellied Glider is also listed as potentially negatively affected by the Key Threatening Process of competition from feral Honeybees (NSW Scientific Committee 2002d).

Local and Regional Conservation Status

The Yellow-bellied Glider is listed as Vulnerable under the NSW TSC Act (1995). Within NSW, records are largely concentrated within the coastal Bioregions, being NSW North Coast, Sydney Basin and South East Corner, as well as parts of the South East Highlands Bioregion (DEC 2006b). The species appears to have a patchy distribution within the Sydney Basin Bioregion (DEC 2006b), though recent surveys have significantly expanded the knowledge on its distribution and habitat preferences. For example, as little as ten years ago the species was thought to be uncommon in the greater southern Sydney region, however, the converse has been found to be the case (DEC 2006a). Here the species has been found to strongly associate with habitats that have a high cover of Grey Gum (*Eucalyptus punctata*) and Forest Red Gum (*E. tereticornis*), with large numbers located in the Blue Mountains escarpments and gullies (DEC 2006a). Population strongholds elsewhere in the Sydney Basin include the tall forests of the Central Coast and Watagan Ranges (DEC 2006b). Numerous records are known from a large number of reserves including Jervis Bay, Morton, Nattai, Blue Mountains, Yengo, Watagans and Wollemi National Parks amongst others (DEC 2006b). In fact, the large number and wide distribution of records of Yellow-bellied Glider that have been collected in the past decade, together with the extent to which threatening processes (logging and land clearing) have been controlled, has led some researches to suggest that the conservation status accorded to the species should be reviewed and possibly down-listed (Kavanagh 2004).

The importance of dedicated survey for the detection of the Yellow-bellied Glider is highlighted by the fact that the species was not detected prior to DEC surveys, but since has been found to be widespread and relatively abundant in the park (Map 14). The species has been seen or heard calling at 60 locations, and detected by the distinctive 'V'-shaped incisions that it leaves in feed trees at a further 40 sites. Within the study area these feeding notches (used to extract sap from eucalypts) have most commonly been recorded on Grey Gum (*E. punctata*), but also on Mountain Blue Gum (*E. deanii*) and Manna Gum (*E. viminalis*). Yellow-bellied Gliders have also been observed in flowering Box trees, as well as catching and consuming grubs. The glider is expected to inhabit the majority of tall gully forests and adjacent forests/woodlands across the sandstone plateaux. They are also widespread in the drier forests and woodlands located on the northern, north-western and south-western alluvial gullies and sheltered lower slopes, so long as preferred food resources, such as Grey Gum, and suitable shelter are present.

The recent surveys of northern Wollemi (including the north-east and north-west) and northern Yengo National Parks have revealed the Yellow-bellied Glider to be widespread in the sandstone reserves that border the southern escarpment of the upper Hunter Valley. This result concurs with recent findings in the greater southern Sydney region (DEC 2006a) that Yellow-bellied Gliders are widespread and common throughout the moderate to high rainfall areas in the large sandstone reserves of the Sydney Basin. Most threats outlined in the species recovery plan are not present within large sections of these reserves. The Yellow-bellied Glider can thus be considered relatively secure in the Sydney Basin Bioregion.

SQUIRREL GLIDER

Species Profile

The Squirrel Glider (*Petaurus norfolcensis*) is a small to medium-sized nocturnal mammal that inhabits dry sclerophyll forests and woodlands where it shelters in leaf-lined nests in tree hollows. It is similar in appearance to the smaller and more common Sugar Glider (*P. breviceps*). However, the Squirrel Glider is larger, has a longer more pointed face, longer and narrower ears and a bushier tail, particularly at the base. It also lacks the persistent yapping call of the Sugar Glider, instead infrequently emitting a deeper call. It has a varied diet comprised of insects, nectar, pollen, seeds, *Acacia* gum and sap from eucalypts (Suckling 1995b). The Squirrel Glider usually occurs in family groups of up to ten, consisting of one male, one or more females and their dependant young. Home ranges vary between 0.65 and 8.55 hectares and individuals have been known to move up to 500 metres in one night. It is patchily distributed along the east coast and inland slopes between north Queensland and northern Victoria (NPWS 1999g) in habitats that comprise sufficient numbers of hollow-bearing trees for shelter and winter flowering plant species for food (Quin 1995).

Plate 41: Squirrel Glider © N. Williams

Threats

The greatest threat to the Squirrel Glider is loss of habitat by broadscale clearing for agriculture (Kavanagh 2004). Most clearing in NSW has fallen on open forests and woodlands growing on relatively fertile soils on gentle topography, especially in river valleys (Lunney & Leary 1988), which comprises the prime habitat of the Squirrel Glider. Clearing of land for mining has also resulted in habitat loss in the Hunter Valley (N. Williams pers. comm.). NPWS (1999g) lists further threats to the Squirrel Glider as: loss of nesting resources when the availability of hollow bearing trees are lost through fragmentation or timber extraction; predation by Feral Cats and Foxes; and the entanglement of individuals on barbed-wire fences. The species is also listed as susceptible to the following Key Threatening Processes: removal of dead wood and trees (NSW Scientific Committee 2003c); ecological consequences of high frequency fire (NSW Scientific Committee 2000b); and competition for tree hollows with feral Honeybees (NSW Scientific Committee 2002d).

Local and Regional Conservation Status

The Squirrel Glider is listed as Vulnerable under the NSW TSC Act (1995). It occurs patchily throughout the eastern Bioregions of NSW, and is only recorded regularly in the NSW North Coast, Nandewar and Sydney Basin Bioregions (DEC 2006b). Across its range, habitat for the Squirrel Glider appears to occur primarily outside of public lands (Kavanagh 2004). In the Sydney Basin Bioregion the dry woodlands of the Central Coast provide very high quality habitat and the area has been well documented as a stronghold for the species (Smith and Murray 2003). Elsewhere in the Bioregion the species has only been patchily recorded at very low densities, including in a small number of reserves such as Yengo, Wollemi, Blue Mountains, Dharug, Goulburn River and Werakata National Parks (DEC 2006b).

The Squirrel Glider was definitively recorded within the study area for the first time during the 2005-06 surveys, with sightings made at six locations (Map 14). A seventh record from the CRA exists on the road leading to Mount Monundilla, however due to identification uncertainties and the fact that suitable habitat is not present in this area, the species is considered unlikely to occur here. This latter record has therefore not been included on Map 14. It is well recognised that the Squirrel Glider prefers dry woodlands, generally below 300 metres asl, and is not found in tall forest or closed forest (e.g. Goldingay and Jackson 2004). Although four of the records collected in the study area lie at slightly higher elevation than expected (between 400 and 500 metres asl), all of the sightings were made in low rainfall woodlands on alluvial creeklines or lower slopes, as is normal for the species. The Squirrel Glider is expected to be moderately widespread in such habitats across the northern and north-western perimeters of the reserve, and may also occur in the Glen Alice valley. They are likely to inhabit areas with Box, Red Gum or Rough-barked Apple in the canopy, wherever hollow-bearing trees and at least one winter-flowering tree or shrub species occur. However, the sparsity of records suggests the species only persists at moderately low abundance. There is anecdotal evidence of the glider in paddock trees in the Widden Valley. Habitat of the Squirrel Glider in the study area is located

almost entirely within the ‘Upper Goulburn Valley and Escarpment’ and the ‘Sydney Basin Western Escarpment’ Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

The Squirrel Glider would once have been abundant and widespread throughout the valleys of the Hunter and Goulburn Rivers. However, large amounts of primary habitat have been lost through clearing for agriculture, urban and industrial development, while remaining habitat is under ongoing pressure. Squirrel Glider populations in and adjoining the reserve (together with those in the adjoining north-east Wollemi, Yengo and Goulburn River National Parks) will increase in importance as remaining coastal strongholds are cleared or fragmented for urban and industrial expansion. These reserves will become vital to the survival of the species in the region. Predation by Foxes and possibly by Feral Cats are likely to be the major threats to the Squirrel Glider in north-western Wollemi National Park and adjacent reserves, and should be actively managed accordingly. In addition, adjoining landholders should be encouraged to maintain paddock trees near the park boundaries, even if dead, in order to ensure a sufficient supply of tree hollows.

BRUSH-TAILED ROCK-WALLABY

Species Profile

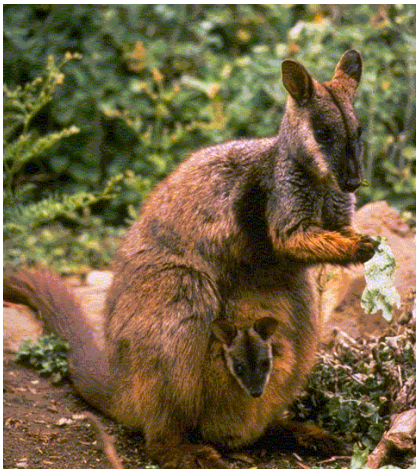


Plate 42: Brush-tailed Rock-wallaby © E. Holland/DEC

The Brush-tailed Rock-wallaby (*Petrogale penicillata*) is a medium-sized macropod, characterised by its distinctive facial markings, black paws, and long thickly furred tail which has a distinctive brush-like appearance near the tip (NSW Scientific Committee 2003a, 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 Brush-tailed Rock-wallaby was once abundant and ubiquitous throughout the mountainous country of south-eastern Australia, from the Grampians in western Victoria to Nanango in south-east Queensland (Short and Milkovits 1990). This wallaby has declined significantly in the west and south of its former range, and populations have become more fragmented throughout (NSW Scientific Committee 2003a). It was thought to be extinct in Victoria until small populations were rediscovered in the Grampians and near the Snowy River (Eldridge and Close 1995).

Threats

The 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 (especially Feral Goat (*Capra hircus*), Rabbit (*Oryctolagus cuniculus*) and domestic stock) (NSW Scientific Committee 2003a). The major threats continuing to impact on the species include ongoing predation and competition with feral species such as Goats (*Capra hircus*), Foxes (*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 2003a) and inbreeding (Environment ACT 1999). The species typically exhibits low migration rates between colonies, impeding persistence and recovery of populations affected by these threatening processes.

Local and Regional Conservation Status

The Brush-tailed Rock-wallaby is listed as Endangered under the NSW TSC Act (1995) and as Vulnerable under the Commonwealth EPBC Act (1999). In the Sydney Basin Bioregion the species forms part of one of the three Evolutionary Significant Units (ESU) that summarise genetically distinctive groups on the basis of DNA. The nominate ESU encompasses closely related populations in central NSW including Kangaroo Valley, Jenolan Caves, the Hunter Valley and the Warrambungles. This central ESU is one of the most fragile in NSW and all sites within it are of very high conservation significance (NSW Scientific Committee 2003a). Recent records from reserves within the Sydney Basin are mostly confined to Yengo, Wollemi, the Watagans and Morton NPs and Parr SCA (DEC 2006b) as well as a recently discovered colony in Nattai National Park (DEC 2004c).

Plate 43: Habtiat in the vicinity of Brush-tailed Rock-wallaby sighting on Myrtle Creek in March and May 2006 © N. Williams/DEC

The Brush-tailed Rock-wallaby is well known in the northern end of Wollemi National Park. Rock-wallabies were noted by explorers to the Doyles Creek Valley in the early 1800s (Macqueen 2005), by landholders in the 1960s (e.g. B. Tindale of 'Myrtle Grove') and by researchers visiting the Colo, Capertee and Wollemi Gorges in the 1970s (Australian Museum 1979). A report produced in 1994 summarised the known distribution of the species in the area at the time (Wong 1994). This distribution included three colonies in the Widden Valley, one colony in Kings Creek Valley, and one colony on the eastern side of Martindale Valley (Wong 1994) (the latter two being to the east of the current study area). Since the mid-1990s, the Wallaby has been recorded at six further widely spaced locations in north-western Wollemi, including rocky escarpments on the central sandstone plateau, north of Glen Alice, and on the south-west slope of

Mount Barker (Map 15). BSP surveys in 2004-05 detected evidence of the species on the ridgeline between the Baerami and Widden Valleys (as well as further east in the Appletree Creek, Turnbull Creek, Doyles Creek and Martindale Valleys) (DEC 2005a).

The DEC 2005-06 surveys detected fresh evidence of the Brush-tailed Rock-wallaby at two locations, and undertook searches in a wide range of potential habitats. A summary of the 2005-06 findings follows.

- Myrtle Creek. The most significant sighting of Brush-tailed Rock-wallaby made during the DEC surveys was in the vicinity if Myrtle Creek approximately two kilometres south of 'Myrtle Grove'. Two animals were directly observed in March 2006, in dry rainforest vegetation dominated by Grey Myrtle (*Backhousia myrtifolia*) and Rusty Fig (*Ficus rubiginosa*). On returning to the area to undertake more extensive targeted searches in May 2006, two further individuals were seen at the base of a cliff line approximately 300 metres east of the first sighting (Map 15). Brush-tailed Rock-wallaby scats were identified from twelve locations in the vicinity of the sightings, including up to one kilometre to the east of west of the creek (Map 15). At least five individuals currently appear to be using this section of Myrtle Creek and the surrounding escarpment, where there is a network of crevices and overhangs for shelter, ledges for sunning, and connecting habitat corridors such as lines of boulders. One of the individuals observed was a sub-adult, indicating that breeding has occurred in the area recently. Twenty-two Wild Dog and five Fox scats were collected from the vicinity of the sightings, but Brush-tailed Rock-wallaby remains were not identified from within any of them.
- Box Hole Clearing. Fresh scats were collected from the north-western corner of the clearing, west of the Army Road. The scats were located on ledges and overhangs in rock faces. Brush-tailed Rock-wallaby tracks were also seen, but the density of the tracks and scats suggests that only a few animals are currently using the site.
- Red Creek. In May 2006 Brush-tailed Rock-wallaby scats were identified from three locations on Red Creek, between one and a half and two kilometres upstream of Widden Brook. One of these sets of scats was quite fresh, while those further upstream were reasonably old. The areas where the scats were located consist of large boulders alongside the creekline, surrounded by wet sclerophyll forest with a dense mesic understorey and scattered Rusty Fig. Red Creek is spring fed, providing a permanent source of water for many fauna, including the Brush-tailed Rock-wallaby.
- Bylong River. In March and May 2006 Brush-tailed Rock-wallaby scats were identified from two locations near the ford, including around rock outcrops and overhangs and near the river itself. However these scats were quite old, and there is no evidence of recent Brush-tailed Rock-wallaby activity. Feral Goat droppings and prints were found near the old Brush-tailed Rock-wallaby scats.
- Lovers Leap. In May 2006 searches were undertaken around Lovers Leap, the sight of historic Brush-tailed Rock-wallaby records (Wong 1994). Sadly, only old Brush-tailed Rock-wallaby scats were located between 'Myrtle Grove' homestead and Lovers Leap, suggesting that the species does not currently utilise the area.

The findings of the 2006 surveys are both encouraging and alarming. While the confirmation that a breeding colony of Brush-tailed Rock-wallabies persists around Myrtle Creek is very exciting, the low density and distribution of fresh scats elsewhere in north-western Wollemi National Park suggests that only a few small colonies are extant and that distribution is very patchy. Potential habitat for the Brush-tailed Rock-wallaby remains widespread across the northern and western escarpment of the study area and it is possible that more colonies exist in remote escarpments and rocky areas that have not been visited or surveyed. Never-the-less, the 2006 surveys, together with experiences elsewhere in the state, suggest that the long term survival of the known Brush-tailed Rock-wallaby colonies in the park will depend in careful targeted management.

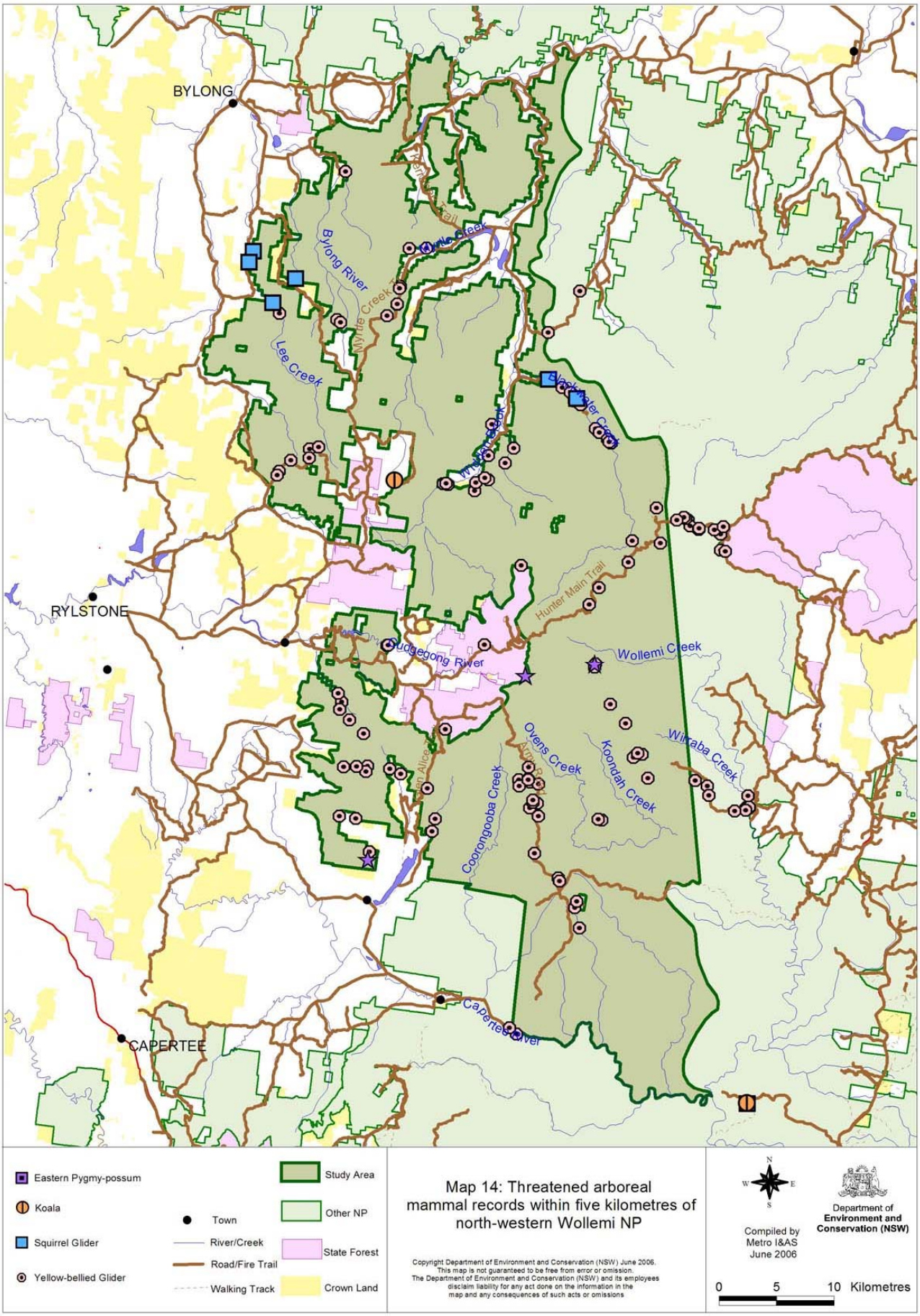
Plate 44: Crevice site in use by Brush-tailed Rock-wallaby on the eastern side of Myrtle Creek © N. Williams/DEC

Colonies of the Brush-tailed Rock-wallaby within northern Wollemi National Park, together with those in northern Yengo National Park, are highly significant as the area encompasses one of the few remaining strongholds for the species, not only within the region but also within the central ESU. These colonies are important to the conservation of the species across the state. These Rock-wallabies can be linked to populations in the south of Wollemi and southern Yengo by contiguous rocky terrain. A significant population also

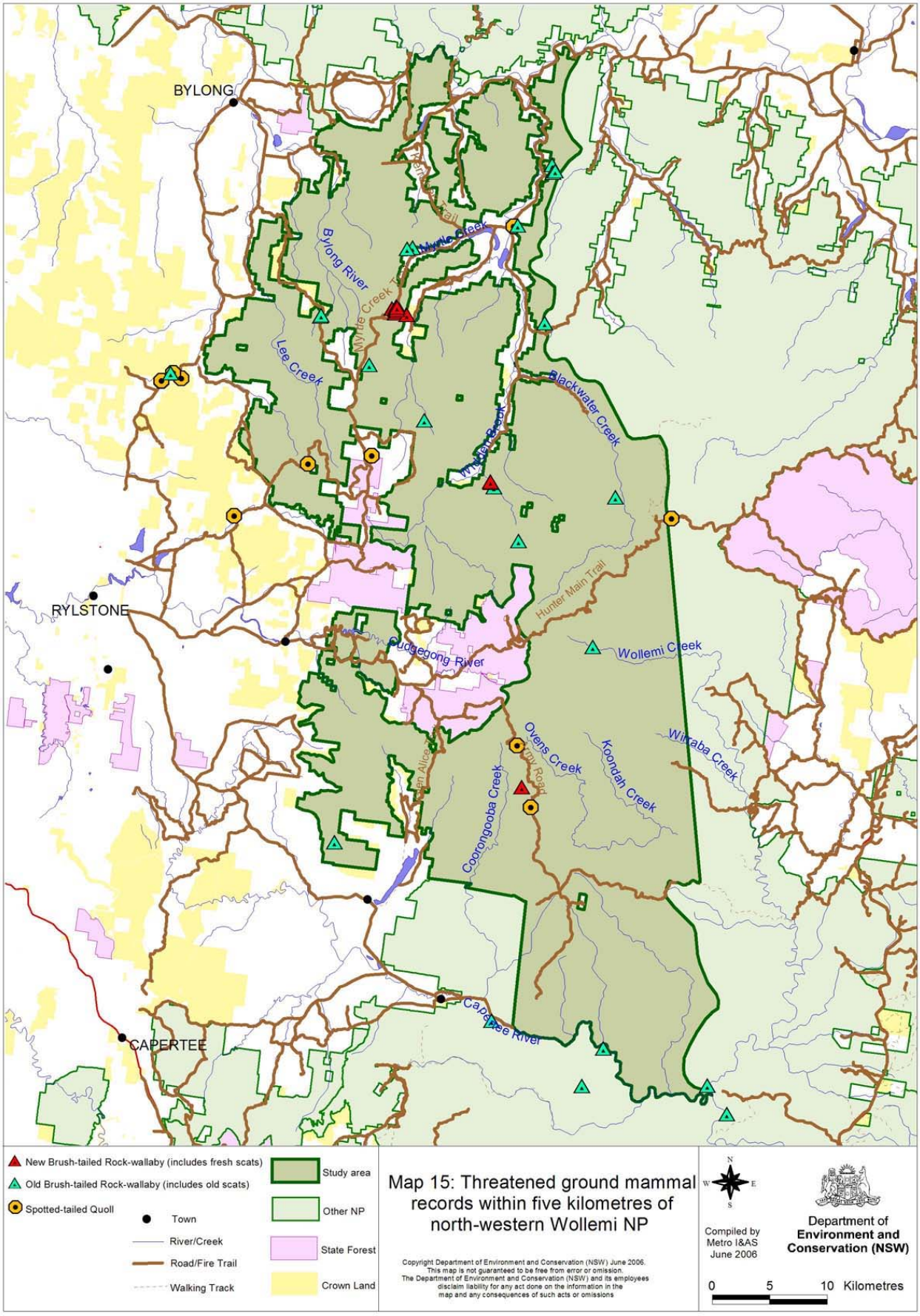
occurs not far to the south-east, in Watagans National Park. However, to the north the Wollemi-Yengo population(s) is the last known significant population within the central ESU. Another healthy population of the species does not occur until the Apsley and Macleay River gorges over 160 kilometres to the north (Wong 1994), where the animals are of a different ESU.

The primary threat to the persistence of Brush-tailed Rock-wallabies in north-western Wollemi National Park is likely to be predation by Foxes and Wild Dogs. Competition with Feral Goats poses a threat in the Bylong River, and could become highly significant if the species spreads to, or increases in numbers in, the Widden Valley. The proximity of the Myrtle Creek colony to agricultural land makes it susceptibility to disease transmission from feral carnivores. The small size and apparently scattered nature of the colonies also makes them susceptible to fire.

The long-term survival of the wallabies within northern Wollemi National Park will require park managers to gain an understanding of the most significant threats to remaining colonies as soon as possible. This should be followed by a threat abatement program(s) and associated monitoring of the known Brush-tailed Rock-wallaby colonies. If, as suspected, Foxes pose a threat to the Myrtle Creek colony, the site should be included in the Fox TAP and its associated outcomes and recommendations. At least until further information is gained, high intensity wildfire should be excluded from the rocky refugia of known colonies. At a minimum, an annual survey should be undertaken of the Myrtle Creek colony to determine whether the colony size remains stable, increases or decreases in response to management actions and threat abatement programs. An assessment of the colony's health and size using DNA analysis of fresh scats could also be considered. See Section 4.6.1 of this report for further detail of recommended monitoring and further survey.



Map 14: Threatened arboreal mammal records within five kilometres of north-western Wollemi National Park



Map 15: Threatened ground mammal records within five kilometres of north-western Wollemi National Park

GREY-HEADED FLYING-FOX

Species Profile

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. It feeds 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. The species can travel up to twenty kilometres to a food source, and is an important pollinator and disperser of native plants. The Grey-headed Flying-fox is endemic to eastern Australia, between Melbourne, Victoria and Bundaberg, Queensland (NPWS 2001g). The species range has contracted, previously occurring as far north as Rockhampton (NPWS 2001g). It primarily occurs along the eastern coastal plain, east slopes and tablelands, although regular movements occur over the Great Dividing Range to the western slopes in northern NSW (NPWS 2001g). A number of studies have noted the annual southerly movement of animals in spring and summer and their return to north-east NSW and south-east Queensland in winter (NPWS 2001g).

Plate 45: Grey-headed Fliying-fox
© N. Williams

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 or close to residential developments; electrocution on power lines, particularly in urban areas; and accumulation of pollutants and pesticides (NPWS 2001g, Duncan *et al.* 1999).

Local and Regional Conservation Status

The Grey-headed Flying-fox is listed as Vulnerable under the NSW TSC Act (1995) and is also listed as Vulnerable under the Commonwealth EPBC Act (1999). The species is regularly recorded in all three coastal bioregions (DEC 2006b). Eby *et al.* (1999) estimated there to be approximately sixteen camps within the Sydney Basin Bioregion. Current locality data suggests the species to be primarily distributed across the coastal and hinterland environments of the Sydney Basin, although this may reflect reporting bias in the data. The species has been recorded foraging in numerous conservation reserves, including Royal, Lane Cove, Dharug, Blue Mountains, Wyrrabalong, Yengo and Werakata National Parks (DEC 2006b), as well as southern and eastern Wollemi National Park. However, a greater number of records occur off reserve, including within parks and gardens in metropolitan areas between Sydney and Newcastle. The majority of known camps are not within national parks.

The Grey-headed Flying-fox was recorded for the first time within north-western Wollemi National Park during DEC surveys in November 2005 (Map 16). Only one individual was encountered, flying high over the canopy south of Koondah Creek. Four animals were recorded approximately four kilometres east of the study area in 1998 during CRA surveys near Wollemi Creek (Map 16). Further east, the bat has been recorded more frequently, including in eastern Wollemi and northern Yengo National Parks (DEC 2006b). These results indicate that the Grey-headed Flying-fox roams widely over at least the southern half of the study area, but suggest they are only infrequent visitors. North-western Wollemi National Park would form a component of the foraging habitats on which Grey-headed Flying-foxes in the Hunter Valley depend. Such as was observed in north-eastern Wollemi National Park in 2005 (DEC 2005a), large numbers are likely to congregate in the study area only when an abundance of eucalypts are in heavy flower, or when food resources are limited elsewhere. There is no indication of a Grey-headed Flying-fox camp in the study area.

Wollemi National Park contributes significantly to the system of reserves (also including Yengo and Werakata National Parks) that provide a natural foraging area for Grey-headed Flying-foxes in the Hunter Valley in spring and summer, and therefore holds conservation significance to the species. The area may also play an important role during southward/northward population movements.

YELLOW-BELLIED SHEATHTAIL-BAT

Species Profile

Plate 46: Yellow-bellied Sheathtail-bat © J. Little/DEC

The Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) is readily distinguished from other insectivorous bat species in south-eastern Australia by its large size, characteristic tail and distinct coloration, with bright white or yellow fur on the belly and contrasting rich, black, shiny fur on the back (Churchill 1998). Males possess a prominent throat pouch, which is represented by an undeveloped skin fold in the female (Richards 1995). Endemic to Australia, it is the only species of Sheathtail-bat to extend so far into temperate, cool areas (Churchill 1998). It is widely distributed across northern and eastern Australia, but is uncommonly captured in harp traps due to its rapid, high-flying behaviour. However it is fairly easily identified by its ultrasonic call, which is audible to humans (Pennay *et al.* 2004). It forages for airborne insects (mainly beetles and moths) above the tree canopy, although in more open habitats also feeds closer to the ground (Churchill 1998, Shelley 2004). It usually roosts in tree hollows (Churchill 1998). It is thought to undertake a winter migration from the south to warmer areas, with reports from southern Australia existing only between January and June (Richards 1995, Shelley 2004). Habitat preferences of this species are fairly broad, with roost sites located in cleared grazing areas, open woodland, and unmodified forests (Shelley 2004).

Threats

The ecology of the Yellow-bellied Sheathtail-bat remains poorly understood, making the elucidation of threats difficult. The most pertinent threat is likely to be the clearing of forest and woodland for settlements and agriculture, resulting in the loss of hollow-bearing trees for roost sites and reduction of foraging habitat (DEC 2005f, Shelley 2004). Foraging activities are also likely to be impacted by the use of pesticides that cause a reduction in the availability of food and possibly a build up of toxins within the bats' tissues (DEC 2005f).

Local and Regional Conservation Status

The Yellow-bellied Sheathtail-bat is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in NSW come from the Brigalow Belt South, Nandewar and Darling Riverine Plains as well as the NSW North Coast and Sydney Basin Bioregions (DEC 2006b). Within the Sydney Basin, most records are outside of reserves. However, it has been detected in the southern Blue Mountains and Ku-ring-gai National Parks and Manobalai Nature Reserve (DEC 2006b). There are a number of records in the coastal plain between Wollongong and Cessnock.

The Yellow-bellied Sheathtail-bat has only been recorded once within the study area, detected by ultrasonic call in January 2006. This individual was utilising alluvial Box – Red Gum – Rough-barked Apple woodland on a small tributary of Lee Creek (Map 16). The species is probably more widespread than records indicate. It is likely to utilise alluvial flats and lower talus slopes along the northern, north-western and south-western boundaries of the reserve.

Records of the Yellow-bellied Sheathtail-bat in the study area hold significance as very little is known about the species in the region. Within a 40 kilometre radius of the study area boundary, the species has been detected at just four other locations (Manobalai Nature Reserve, Turon River, Walerawang and Mount Arthur). The record collected in north-western Wollemi thus contributes important information about the species distribution, habitat preferences and status. Additionally, as few confirmed records for the species have been collected on reserves in the Sydney Basin, their protection within the National Park holds conservation importance.

Fertile low-elevation forests and woodlands of plains and valleys are the likely to be the preferred habitat of the Yellow-bellied Sheathtail-bat in the region. Within the study area and adjacent lands, these habitat types are located within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

EAST-COAST FREETAIL-BAT

Species Profile

Plate 47: East-coast Freetail-bat © N. Williams/DEC

The East-coast Freetail-bat (*Mormopterus norfolkensis*) is a member of a group of bats that remain in a state of taxonomic uncertainty (Churchill 1998). The species can be distinguished from other members of the group 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. This is a poorly known species, but it appears to be restricted to the east of the Great Dividing Range between approximately Brisbane (Queensland) and Picton (New South Wales) (Duncan *et al.* 1999, Parnaby 1992a). The species appears to favour dry eucalypt forest and woodland, though it has also been captured in rainforest and wet sclerophyll forest (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 have serious impacts (Duncan *et al.* 1999). These threats are of heightened significance because the species' entire known distribution lies within an area of concentrated human population density and increasing urban development. The East-coast Freetail-bat is listed as threatened by the Key Threatening Process removal of dead wood and trees (NSW Scientific Committee 2003c) and it has been suggested that pesticide use may also be a problem (NPWS 2002c).

Local and Regional Conservation Status

The East-coast Freetail-bat is listed as Vulnerable under the NSW TSC Act (1995). Most records for the species in NSW occur within the NSW North Coast, South East Corner and Sydney Basin Bioregions. Within these bioregions it appears to prefer the coastal plains and larger incised valleys of the Dividing Range, with relatively large numbers of records from the Cumberland Plain, Central Coast and Hunter Valley (DEC 2006b). The majority of records for the species within the Sydney Basin Bioregion occur outside of reserves. However, it has been detected within Nattai, Blue Mountains, Dharug, Wollemi, Yengo and Marramarra National Parks and Western Sydney Regional Park (DEC 2006b).

The East-coast Freetail-bat has only been recorded on the immediate perimeter of north-western Wollemi National Park, on the southern edge of the Glen Alice Valley (Map 16). At this location it was detected by its ultrasonic call, flying over a farm dam. The species has also been detected on Wollemi Creek and the Capertee River, to the east and west of the study area, again by it's distinctive ultrasonic call (Map 16). It is significant that the bat has not been captured in harp traps within the area, as this highlights the species habit of flying high and ranging widely through more open habitats where it is difficult to capture. Current records are therefore likely to be an underestimate of the status and distribution of the bat in the region. However, as this species primarily occurs east of the Great Dividing Range, it is considered unlikely to be present in the drier western-influenced environments in the north and north-west of the study area. Interestingly, all of the records obtained to date have been in the vicinity of permanent water, which suggests the species may be dependent on water availability and more moist environments near this western limit of its range. A better understanding of habitat requirements is required to make an accurate assessment of the species distribution and abundance within the study area. Recent surveys of the species across the southern Sydney region have suggested an association with more fertile country (DEC 2006a), a pattern which may be replicated in this region.

LARGE-EARED PIED BAT

Species Profile

Plate 48: Large-eared Pied Bat © N. Williams/DEC

The Large-eared Pied Bat (*Chalinolobus dwyeri*) is readily distinguished from other members of its genus by the combination of large ears and overall black colour, with bands of white fur along the undersides of the body, that typically 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). 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 & Dwyer 1995). It occurs in a wide range of habitats, including wet and dry eucalypt forest, rainforest, 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 and overhangs (Churchill 1998) as well as abandoned Fairy Martin (*Petrochelidon ariel*) nests (Schulz 1998). It seems to prefer the 'twilight' areas of caves, and may be dependent on sandstone outcrops (Duncan *et al.* 1999, Hoye & Dwyer 1995).

Threats

Threats to this species are poorly understood but thought to include: clearing, isolation and alteration of forest and woodland foraging habitat near cliffs, caves and old mines; damage to roosting and maternity sites from mining operations and recreational caving activities; and use of pesticides (DEC 2005j). Predation by feral animals is also thought to be a threat (Duncan *et al.* 1999), as is disturbance of roost sites by Feral Goats (M. Schulz pers. comm.).

Local and Regional Conservation Status

The Large-eared Pied Bat is listed as Vulnerable under the NSW TSC Act (1995) and also as Vulnerable under the Commonwealth EPBC Act (1999). The Sydney Basin is extremely important to the species, holding a large proportion of overall records. Only scattered records occur to the north, south and west of the Bioregion (DEC 2006b). There is a concentration of records across the Blue Mountains plateau, particularly within Nattai and Blue Mountains National Parks, as well as in the upper Hunter Valley in Yengo, Wollemi and Goulburn River National Parks (DEC 2006b). However these concentrations are likely to reflect the locations of recent DEC survey effort. Records are scattered throughout the Bioregion, including southern Wollemi, Kanangra-Boyd, Royal, Gardens of Stone and Morton National Parks (DEC 2006b). However, despite this wide distribution the species is infrequently detected, suggesting that it only occurs at low abundance.

The Large-eared Pied Bat is widespread within north-western Wollemi National Park, as was found to be the case in the north-eastern section (DEC 2005a). A total of 35 individuals have been captured at 26 harp locations, and it has been recorded from a further 13 locations by its ultrasonic call (Map 16). These sites are located in a wide range of environments, including Box – Red Gum – Rough-barked Apple woodland in the northern alluvial valleys and lower slopes, dry rainforest along Myrtle Creek, Scribbly Gum woodland north of Tayan Peak, Stringybark – Peppermint woodland on sandstone ridges and rainforest on basalt-influenced soils. No roost sites have been located within the study area, but are sure to occur in deep sandstone overhangs and holes in cliff faces, including along sandstone gully lines and the northern and western escarpments. Maternity roost requirements for the species are poorly understood, but are located within deeper cave systems, which are comparatively rare. It is however likely that a maternity roost site(s) occurs within the reserve.

The recent systematic surveys in north-west and north-east Wollemi, northern Yengo and Goulburn River National Parks have shown the upper Hunter Valley and Goulburn Valley region to be a stronghold for the species. The records continue to provide evidence that the bat is more common in sandstone reserves in the Sydney Basin Bioregion than previously thought, and is likely to be relatively well protected. The primary threat at this stage is likely to be predation by feral animals, wildfires that scorch roost and maternity caves, and disturbance of roost sites by Feral Goats.

EASTERN FALSE PIPISTRELLE

Species Profile

The Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) is a relatively large (up to 70 millimetres) bat that is similar to the Greater Broad-nosed Bat (*Scoteanax rueppellii*). It is distinguished by the possession of two pairs of upper incisors, a gap between the incisors and the canines, and larger ears (Parnaby 1992a; Churchill 1998). Its ultrasonic call pattern can be easily confused with various species of *Scotorepens* and the Greater Broad-nosed Bat, though good quality calls can be distinguished (Reinhold *et al.* 2001). It is patchily distributed throughout its range in south-eastern Australia, between south-east Queensland and western Victoria, and Tasmania. It appears to prefer wet forested habitats, particularly riparian or high rainfall areas, with large trees (taller than 20 metres) (Menkhorst and Lumsden 1995). It may be more common at high elevations in northern parts of its range (Phillips 1995), though it has been recorded between sea level and 1500 metres in Victoria (Menkhorst & Lumsden 1995) and Tasmania (M. Schulz pers. comm.). It usually roosts in hollows in *Eucalyptus*, though it has been recorded in caves (Churchill 1998). It may hibernate over winter and has been known to travel at least twelve kilometres from its roost site (Churchill 1998).

Plate 49: Eastern False Pipistrelle © L. Broome/DEC

Threats

Threats to the species are poorly known, but appear to comprise: disturbance to winter roosting and breeding sites, including loss of hollow-bearing trees; loss of trees for foraging; and application of pesticides in or adjacent to foraging areas (DEC 2005k). Urban expansion in areas such as the Cumberland Plain continues to threaten the species (DEC 2006a). The Eastern False Pipistrelle is listed as impacted by the Key Threatening Process removal of dead wood and trees (NSW Scientific Committee 2003c).

Local and Regional Conservation Status

The Eastern False Pipistrelle is listed as Vulnerable under the NSW TSC Act (1995). The species is known from the Sydney Basin Bioregion and the South Eastern Highlands Bioregion (DEC 2006b). The species has been relatively well reported from a number of reserves in the Sydney Basin, including, in addition to Wollemi, Nattai, Blue Mountains, Kanangra-Boyd and Gardens of Stone National Parks (DEC 2006b).

A total of nine Eastern False Pipistrelle have been captured at seven locations in north-western Wollemi National Park, additional to the seven times it has been positively detected by its ultrasonic call (Map 16). Unless a long sequence is recorded, the ultrasonic call of this species is easily confused with those of the Eastern Broad-nosed Bat (*Scotorepens orion*) and Greater Broad-nosed Bat (*Scoteanax ruepellii*) (Pennay *et al.* 2004). This has led to the 'possible' identification of Eastern False Pipistrelle at a number of further locations (due to low reliability these have not been included on Map 16). Though the species has been detected once at moderately low elevation in the Lee Creek catchment, the distribution of records suggest it occurs much more frequently at higher elevations, mostly above 600 metres above sea level, which is consistent with previous research on the species. At these higher elevations the bat has most frequently been detected within tall wet sclerophyll forests along sandstone gully lines or enriched ridges. Similar to the south of Sydney (DEC 2006a), it has only rarely been located in sandstone dry sclerophyll woodland.

The northern Wollemi region is important to the conservation of the Eastern False Pipistrelle as it lies towards the western edge of the species' known range. As with many other bat species, a better understanding of habitat requirements and further harp trapping surveys are required in order to accurately assess its distribution and conservation status in the study area and the surrounding region.

EASTERN BENTWING-BAT

Species Profile

The Common Bentwing-bat (*Miniopterus schreibersii*) is the most widely distributed bat in the world, occurring through Europe, Africa and Australasia (Churchill 1998). However, recent research suggests there to be three taxa in Australia (Duncan *et al.* 1999). The subspecies *oceanensis* occurs in eastern Australia and extends from central Victoria to Cape York Peninsula, Queensland (Duncan *et al.* 1999). This subspecies is commonly called the Eastern Bentwing-bat. This species is distinguished from most other bats by the long last bone in the third wing digit and from the Little Bentwing-bat (*M. australis*) by the longer forearm (greater than 44 mm) (Parnaby 1992a). The ultrasonic call can be distinctive, although it is often inseparable from *Vespadelus darlingtoni* and *V. regulus* (Reinhold *et al.* 2001). The species 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 bat that usually feeds above the canopy or in canopy gaps (Churchill 1998) and has been known to travel up to 65 kilometres in a night (Dwyer 1966). Though individuals often use numerous roosts, they congregate en masse at a small number of sites to breed and hibernate (Churchill 1998).

Plate 50: Eastern Bentwing-bat © S. Eberhard

Threats

Damage and disturbance to hibernating and maternity roosting sites is the greatest known threat to this species. Because only relatively few nursery caves are used, significant population changes can occur if these sites are damaged (Dwyer 1995) or inappropriately gated (e.g. Hoye 2001). Disturbance of hibernating colonies can lead to starvation due to loss of energy reserves (Gilmore and Parnaby 1994). Alteration of drainage patterns in or near roost sites may also be a threat, by leading to changes in roost site microclimate (N. Williams pers. comm.). Disturbance of smaller diurnal roosts by recreational caving and tourism may also be significant. Other potential threats include modification to feeding habitat by agriculture and urban development (Gilmore and Parnaby 1994), application of pesticides in or adjacent to foraging areas (DEC 2005l) and predation by Feral Cats and (less often) Foxes (Dwyer 1995).

Local and Regional Conservation Status

The Eastern Bentwing-bat is listed as Vulnerable under the NSW TSC Act (1995). The species is widely distributed in the eastern third of NSW, with the number of records decreasing with distance from the coast (DEC 2006b). Records are widespread within the Sydney Basin Bioregion, but strong clusters are present in the Lower Hunter and Central Coast, Cumberland Plain, Woronora Plateau and across the southern Blue Mountains. Individuals have been recorded flying through a diverse range of habitat in a number of reserves including Royal, Nattai, Kanangra-Boyd, Blue Mountains and Wollemi National Parks (DEC 2005a). However, roost sites for the species, particularly maternity roosts, are much less frequently recorded and poorly reserved.

Though the Eastern Bentwing-bat is widespread in north-western Wollemi National Park, only five individuals have been captured at four harp trap locations. This stands in stark contrast to the density of records in north-eastern Wollemi, where almost 100 individuals have been captured at six locations (DEC 2005a). The majority of records in north-western Wollemi derive from ultrasonic call identification, by which the species was detected at 17 locations (Map 17). Though the species may be more widespread within the study area than records indicate, it is clearly less common here than in other parts of the region. This is likely to be due to a lower abundance of deep caves suitable for roosting. One possible roost site was located along Myrtle Creek, but as no bats were present at the time this could not be confirmed. No maternity roost sites have been located in the study area. However, one of the bats captured in December 2005 was pregnant, indicating that breeding does occur somewhere in the region (most likely in the Baerami Valley oil shale mines). As urban and industrial expansion continues to place pressure on off-reserve roost sites, any roost sites that are located in reserves will take on increasing conservation importance. If any roosts, particularly maternity or hibernation sites, are confirmed they should be managed to minimise disruption from visitation and fire. Gating of any occupied roost sites should be avoided, or if necessary designed/modified in consultation with an expert on the species in order to minimise impacts.

LARGE-FOOTED MYOTIS

Species Profile

Plate 51: Large-footed Myotis © R. Williams

The Large-footed Myotis (*Myotis adversus*) is another bat species for which the taxonomy has recently been reviewed. Australian Myotis are now considered to belong to two species. The Southern Myotis (*M. macropus*) is found in the coastal region and along the Murray River between South Australia and south-east Queensland. The Northern Myotis (*M. moluccarum*) occurs in Queensland and across the Top End (Duncan *et al.* 1999, Churchill 1998). Even though Myotis can be recorded from up to 20 metres using Anabat, it can be difficult to distinguish from *Nyctophilus* species (Reinhold *et al.* 2001). In the hand 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 roosts in caves, tree hollows and man-made structures such as bridges, road culverts and mines (Churchill 1998).

Threats

The primary threats to the Large-footed Myotis are thought to be: changes in water quality due to sedimentation (from vegetation clearing and logging), eutrophication (sewage and fertiliser run-off), pollution and altered flow regimes (Duncan *et al.* 1999); loss or disturbance of roosting sites by activities such as recreational caving or roadworks (Duncan *et al.* 1999, Gilmore and Parnaby 1994); and clearing or application of pesticides adjacent to foraging areas (DEC 2005m). Land subsidence due to longwall mining may also impact on habitat for this species (NSW Scientific Committee 2005a).

Local and Regional Conservation Status

The Large-footed Myotis is listed as Vulnerable on the NSW TSC Act (1995). Throughout its range, it is primarily a coastal species. In the Sydney Basin Bioregion it is strongly associated with the coastal plains and hinterland environments of the Central Coast, Cumberland Plain and Illawarra. Records are highly scattered in the South Eastern Highlands Bioregion, though this may reflect the difficulty in capturing this species. Representation in DEC reserves is relatively poor, however records occur in Nattai, Royal and Popran National Parks (DEC 2006b).

The Large-footed Myotis has not been recorded within the study area, but was observed foraging over a large pool in the Capertee River, just over two kilometres east of the area boundary, during DEC surveys in November 2005. This sighting was confirmed by identification of the species' ultrasonic call from above another large pool, 500 metres further east (Map 17). The species is likely to utilise other large pools along the Capertee River within the study area, as well as other permanent waterbodies such as the Cudgegong River and potential Blackwater or Wollemi Creeks.

Elsewhere in the region, the Large-footed Myotis has been recorded on the Hunter Valley floor, but remains an infrequently encountered species. The preservation of habitat within north-western Wollemi National Park, though only small in extent, may thus have importance for the regional conservation of the species. The value of reserve to this species will only come to light when a greater understanding of the species ecology and habitat preferences in the region is gained through further survey and research.

GREATER LONG-EARED BAT (SOUTH-EASTERN FORM)

Species Profile

Plate 52: Greater Long-eared Bat © N. Williams/DEC

Immediately recognised as a long-eared bat by its prominent ears, the Greater Long-eared Bat (*Nyctophilus timoriensis*) has fairly uniformly dark grey-brown fur and is distinguished by its thickset body, a low ridge above a broad snout and a inter-canine width greater than 5.6 mm (Parnaby 1995, Churchill 1998). This species utilises tree hollows, crevices and loose bark as roost sites. It is known to be an agile yet slow-flying bat, making use of the understorey and ground to capture non-flying prey (Churchill 1998, DEC 2005g). Ultrasound recordings are of little use in identifying this species, as its call characteristics and frequencies overlap almost completely with other *Nyctophilus* species using Anabat call analysis (Pennay *et al.* 2004). Recent taxonomic revision has shown the mainland form of the Greater Long-eared Bat to be comprised of three distinct species with allopatric (non-overlapping) distributions, in addition to a Tasmanian subspecies (Parnaby 1995, Duncan *et al.*1999). The nominate south-eastern form occurs across much of inland southern Australia, from south central Queensland, central western NSW, north-western Victoria to south eastern South Australia. It is generally associated with dry woodlands, and semi-arid mallee and savannah (Churchill 1998).

Threats

The main threat facing this species is extensive loss of habitat through clearing (Duncan *et al.*1999). In uncleared areas the species is threatened by loss of hollow-bearing trees due to timber harvesting and grazing (Duncan *et al.*1999). An altered fire regime is also likely to impact on the species, with a long absence of fire causing a lack of hollow regeneration, while fires of too high intensity can destroy hollow-bearing trees altogether and remove the shrub layer which is commonly used for foraging. Application of pesticides near foraging areas is also likely to impact, through reduction of invertebrate populations and accumulation of toxins within the bats' tissues (DEC 2005g).

Local and Regional Conservation Status

The Greater Long-eared Bat (south-eastern form) is listed as Vulnerable under the NSW TSC Act (1995) and Vulnerable under the Commonwealth EPBC Act (1999). Records for the species are sparsely distributed across the western three quarters of the state, with concentrations in the Brigalow Belt South and Murray Darling Depression Bioregions (DEC 2006b). The species only occurs in the far north-west of the Sydney Basin Bioregion, where western influenced environments occur in the Goulburn and Hunter River Valleys (DEC 2005a). Representation in reserves in the Bioregion is poor, with key areas being Goulburn River National Park, Manobalai Nature Reserve and north-eastern Wollemi National Park.

The Greater Long-eared Bat was detected for the first and only time in the study area when captured in a harp trap on the Kerrabee Trail, west of Myrtle Creek, in September 2005 (Map 17). Like all Long-eared Bats, however, the abundance and distribution of records of the Greater Long-eared Bat is likely to be an underestimation of true status, because it cannot be readily distinguished using ultrasonic call analysis. Elsewhere within a five kilometre radius of the study area, the species has been detected in north-eastern Wollemi (on Ruebens Creek) and Goulburn River (on the Merriwa River) National Parks (Map 17). Further afield, recent surveys indicated the species to be quite common in alluvial Red Gum – Ironbark – Rough-barked Apple woodlands in the crown lands south of Manobalai Nature Reserve (DEC 2005b). Based on these records, the Greater Long-eared Bat is expected to be present at further locations in the far north of the study area, particularly along alluvial creeklines such as the lower reaches of Blackwater Creek. These habitats are largely encompassed within the 'Upper Goulburn Valley and Escarpment' and the 'Sydney Basin Western Escarpment' Mitchell Landscapes which remain subject to several threatening processes and are a high management priority (see Section 4.1.1).

The presence of Greater Long-eared Bat within northern Wollemi National Park has high conservation significance as the species reaches the eastern limit of its range in this area and is very scarce and poorly conserved within the Sydney Basin Bioregion. Further harp trapping is required to ascertain the conservation status of the species within the region. The habitat preferences of this species in the Hunter and Goulburn River Valleys differ markedly from those in south-west NSW, Victoria and South

Australia where it occurs in mallee woodland (M. Schulz pers. comm.). Habitat is comparable to the Pilliga, where it occurs in Box – Ironbark woodland. The collection of records of the species in the Hunter region over the last five years has contributed important information regarding the ecology of the species at the eastern limit of its range. The alluvial woodland habitats on both sides of the perimeter of northern Wollemi National Park are key to the regional survival of the Greater Long-eared Bat and hence should take high priority in park management planning. Land holders should be encouraged to maintain the structural integrity of woodland habitats near the boundary of the park, retain dead timber and hollow-bearing trees and avoid over-use of pesticides near the woodland-agriculture interface.

GREATER BROAD-NOSED BAT

Species Profile

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is a large microchiropteran bat usually found in gullies draining east from the Great Dividing Range between south east New South Wales and north-eastern Queensland. The species can be confused with the Eastern False Pipistrelle from which it can be distinguished by its single pair of upper incisors and its smaller ears (Parnaby 1992a). The ultrasonic call overlaps in frequency and may be confused with Eastern False Pipistrelle, Eastern Broad-nosed Bat and Inland Broad-nosed Bat, though they can be distinguished if a good call sequence is recorded (Pennay *et al.* 1994). The Greater Broad-nosed Bat utilises creeks and clearings for hunting (Churchill 1998, Hoye and Richards 1995). In southern New South Wales the species appears to be restricted to lower altitude forests (McKean 1966), while in the centre of its range it occurs at a wide range of altitudes from near sea level to upland areas (Calaby 1966 in Duncan *et al.*1999). It usually roosts in tree hollows, in cracks and fissures in trunks or under exfoliating bark, and in old buildings (Churchill 1998).

Plate 53: Greater Broad-nosed Bat © N. Williams/DEC

Threats

The threats to this species are poorly known, but thought to include: disturbance to roosting and breeding sites; clearing and fragmentation of foraging habitat; and application of pesticides and herbicides in foraging areas or near waterways (DEC 2005n). Logging may remove suitable hollows and alter the availability of prey (Duncan *et al.* 1999), while urban expansion continues to pose a threat to the species in the Sydney Basin (DEC 2006a).

Local and Regional Conservation Status

The Greater Broad-nosed Bat is listed as Vulnerable under 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 (DEC 2006b). 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 to a lesser extent the Cumberland Plain and the southern Blue Mountains. The species is reasonably well reported from DEC reserves within the Sydney Basin, including Nattai, Kanangra-Boyd, Blue Mountains and Wollemi National Parks (DEC 2006b).

The Greater Broad-nosed Bat has been detected at three harp trap locations (resulting in the capture of nine individuals) (Map 17). As mentioned above, unless a long sequence is recorded, the ultrasonic call of this species is easily confused with those of the Eastern Broad-nosed Bat and Eastern False Pipistrelle (Pennay *et al.* 2004). This has led to the 'possible' identification of Greater Broad-nosed Bat at a number of further locations (however due to low reliability these have not been included on Map 17).

The habitat at the harp trap locations includes sheltered dry sclerophyll forest, exposed rocky woodland and riparian Box – Rough-barked Apple woodland with River Oak. The Greater Broad-nosed Bat has also been recorded on the Capertee River and Wollemi Creek, to the west and east of the study area (Map 17). Given its propensity to occupy a wide range of habitat types, the Greater Broad-nosed Bat is considered likely to be widespread across the study area, though probably only at low density. The species is thought to be sparse across its range (Parnaby 1992b). This suggestion is supported by the results of the recent surveys and by data obtained in the neighbouring north-eastern Wollemi National Park (DEC 2005a).

North-western Wollemi National Park is located towards the western limit of the known distribution of the Greater Broad-nosed Bat. The records collected during the current surveys (and those in north-eastern Wollemi) contribute important information about the distribution and ecological tolerances of this poorly understood species. Continued scientific survey and research of the species is crucial to guiding its conservation management. The protection of the Greater Broad-nosed Bat within the study area has high significance and is important to the ongoing conservation of the species at the edges of its range.

EASTERN CAVE BAT

Species Profile

Plate 54: Eastern Cave Bat © N. Williams/DEC

The Eastern Cave Bat (*Vespadelus troughtoni*) is a small mustard yellow-brown bat with dark wings. It has a patchy distribution through much of eastern Australia and remains one of the least known and understood members of its genus. It is very similar in size to the Large Forest Bat (*V. darlingtoni*), the most reliable distinguishing feature between the two species being the shape and size of the penis (Parnaby 1992a). The species is very difficult to distinguish from ultrasonic call recordings, as the frequency and call pattern overlaps with that of the Little Forest Bat (*Vespadelus vulturnus*) (Pennay *et al.* 2004). The Eastern Cave Bat displays a predominantly tropical distribution that ranges down the east coast from Cape York in Queensland to Kempsey in NSW, with smaller numbers recorded south to at least the Sydney Basin (Law *et al.* 2005). The western limit appears to be the Warrumbungle Range, with a single record from southern NSW, east of the ACT (DEC 2005h). Although little is known about the biology and ecology of this species, general habitat preferences seem to range from dry open forest and woodland in the west and inland through to moister wet eucalypt forest and rainforest along the coast (Churchill 1998, DEC 2005h). A cave-dwelling species, it roosts in small groups in reasonably well lit areas near the entrances of sandstone overhangs, mine tunnels, boulder piles and occasionally buildings (Churchill 1998). It has also been discovered roosting in disused Fairy Martin (*Hirundo ariel*) mud nests (Schulz 1998).

Threats

Threats to the species are poorly understood as little is known about its habitat preferences, diet and breeding requirements. As for other cave-dwelling bats destruction or disturbance of roosting and maternity sites, and the surrounding forest and woodland, is likely to be the main threat (DEC 2005h). This type of disturbance results from clearing and isolation of habitat as a result of increasing development, both residential and agricultural, as well as altered fire regimes and consequential habitat modification and from practices such as timber harvesting and grazing (DEC 2005h). Direct damage or disturbance to roosting sites can result from mining operations or recreational activities such as caving (DEC 2005h). Application of pesticides near foraging areas is also likely to impact, through reduction of invertebrate populations and accumulation of toxins within the bats' tissues (DEC 2005h). Predation by Feral Cats and Foxes also poses a threat to the species (DEC 2005h).

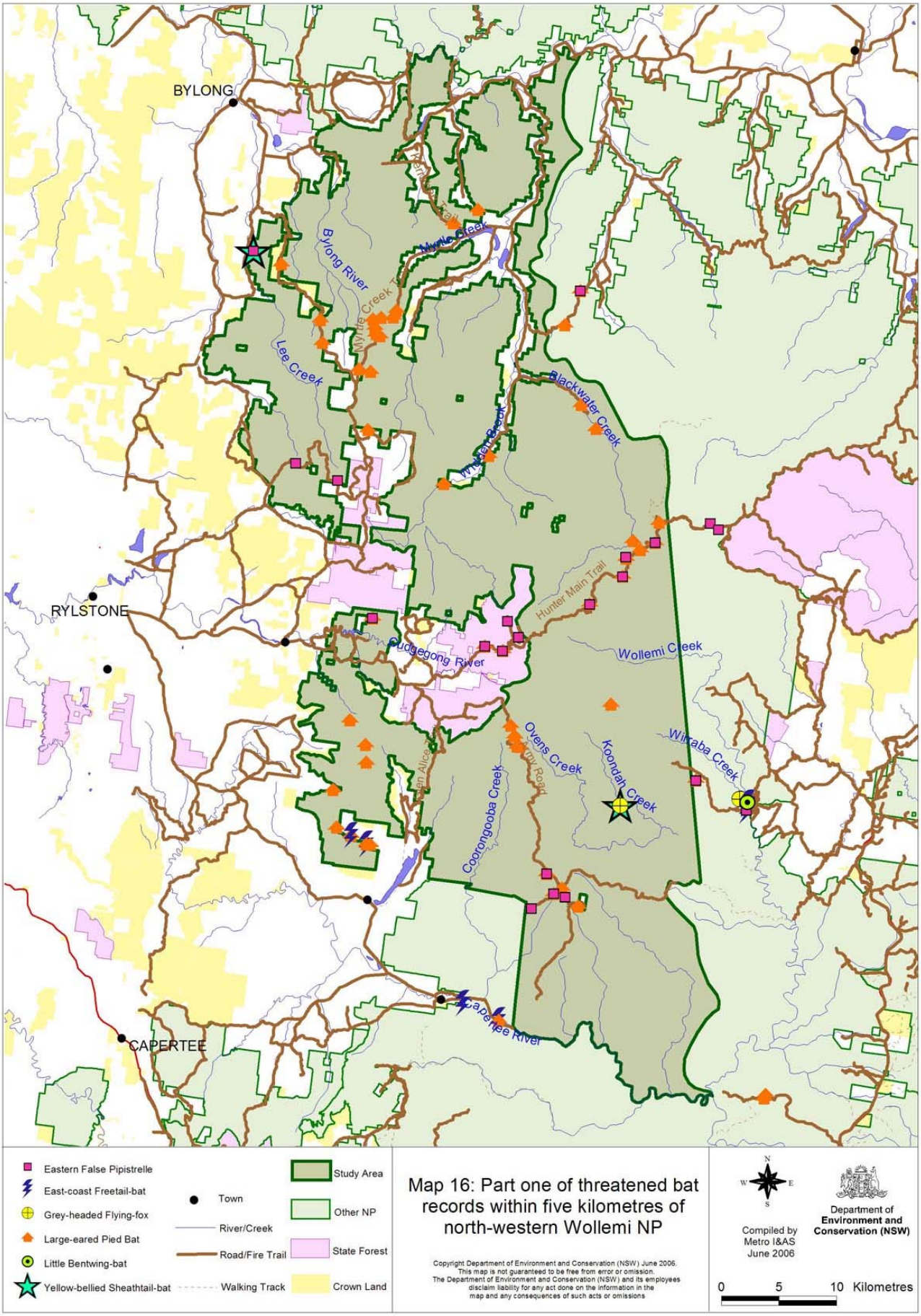
Local and Regional Conservation Status

The Eastern Cave Bat is listed as Vulnerable under the NSW TSC Act (1995). This poorly understood species has only been recorded 34 times on the Atlas of NSW Wildlife between 1980 and the current surveys. The majority of records occur in the North Coast and Sydney Basin Bioregions, with a few records in the Brigalow Belt South Bioregion and one record south of Ulladulla on the NSW South Coast (DEC 2006b). The species is reported in low numbers from DEC reserves including, in addition to Wollemi, Yengo, Goulbourn River and Warrumbungle National Parks and Arakoola and Manobalai Nature Reserves (DEC 2006b). Extensive DEC surveys in various reserves and Sydney Catchment Authority Special Areas in the central area of the Sydney Basin Bioregion have failed to locate this species in that area (DEC 2006a), although targeted searches of overhangs and caves was not undertaken.

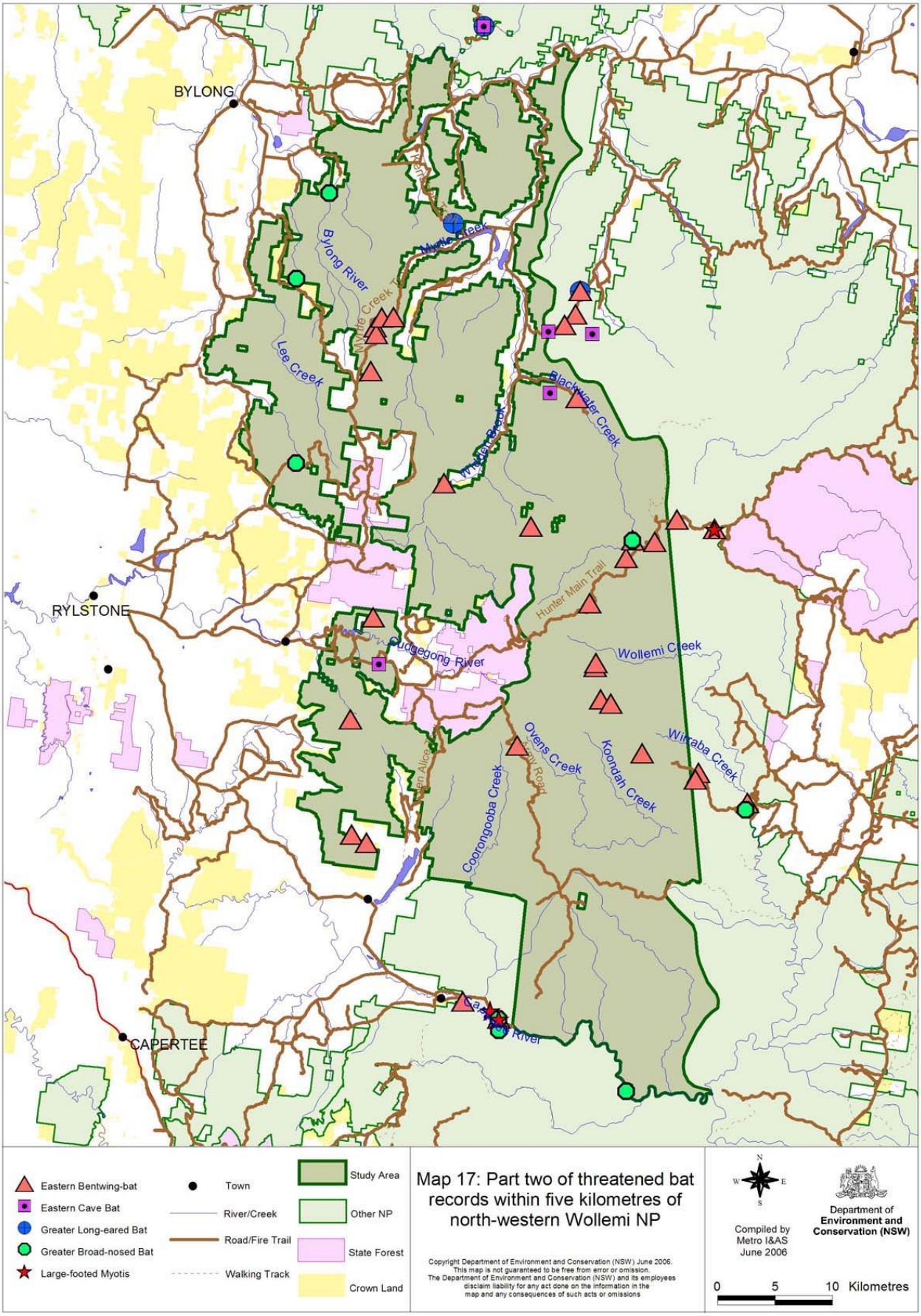
The Eastern Cave Bat had been confirmed from just three locations in the study area, including two bats captured in a harp trap on the ridgeline east of Widden Brook, two adult males found roosting in an overhang south of Dunns Swamp, and three individuals located in an overhang at the base of the escarpment south of Blackwater Creek (Map 17). Due to the difficulty in identifying the Eastern Cave Bat using Anabat call analysis, the species abundance and distribution in the study area is likely to be underestimated in relation to bats that can be detected by this method. The northern escarpment is likely to provide extensive roosting opportunities for this species, with potential foraging habitat also widespread. To date there is no evidence of maternity roosts within the study area.

Recent DEC surveys of reserves in the upper Hunter and Goulburn River Valleys have found the Eastern Cave Bat to be widespread in north-eastern Wollemi (where one roost was located and

several individuals captured), northern Yengo (where two roost sites (one with five bats and one with 20 bats) were located) and Goulburn River National Parks, as well as Manobalai Nature Reserve and Crown Lands (where a maternity roost was located). The region thus appears to be a stronghold for the Eastern Cave Bat in the Sydney area and is likely to play a pivotal role in its conservation within the Sydney Basin. As with many of the bats, further research into the ecology of the species in the southern part of its range is required to obtain a better understanding of distribution and habitat requirements, in order to accurately assess conservation status in the study area and the surrounding region. It is possible that the Eastern Cave Bat is more widespread than previously thought, but due to difficulties in identification has been overlooked or mis-identified in other locations. Given the paucity of information on the Eastern Cave Bat, these records make an exciting contribution to the overall understanding of the species' ecology and distribution.



Map 16: Part one of threatened bat records within five kilometres of north-western Wollemi National Park



Map 17: Part two of threatened bat records within five kilometres of north-western Wollemi National Park