3 RESULTS AND DISCUSSION

3.1 OVERVIEW

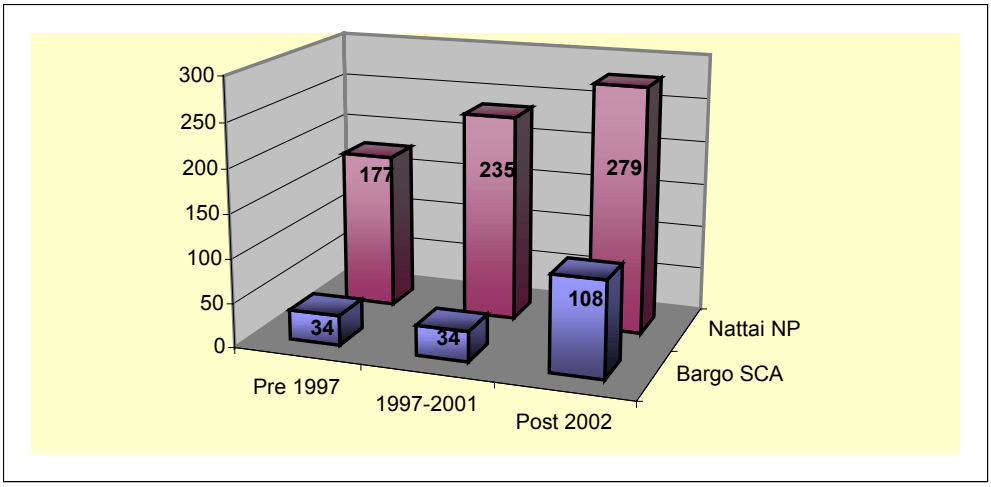
Over 195 systematic fauna survey sites have been completed within the Nattai and Bargo Reserves over several years since 1997. These surveys cover the range of habitats and landscapes present and have been completed during both summer and winter months. While a survey of a reserve system of this size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

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

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

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

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



3.2 DIURNAL BIRDS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.3 NOCTURNAL BIRDS

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

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

3.4 ARBOREAL MAMMALS

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

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

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

Plate 5: Greater Glider ©Narawan Williams

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

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

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

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

3.5 BATS

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

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

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

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

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

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

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

3.6 Other Native Mammals

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.7 REPTILES

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

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

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

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

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

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

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

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

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

3.8 FROGS

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

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

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

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

3.9 INTRODUCED SPECIES

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

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

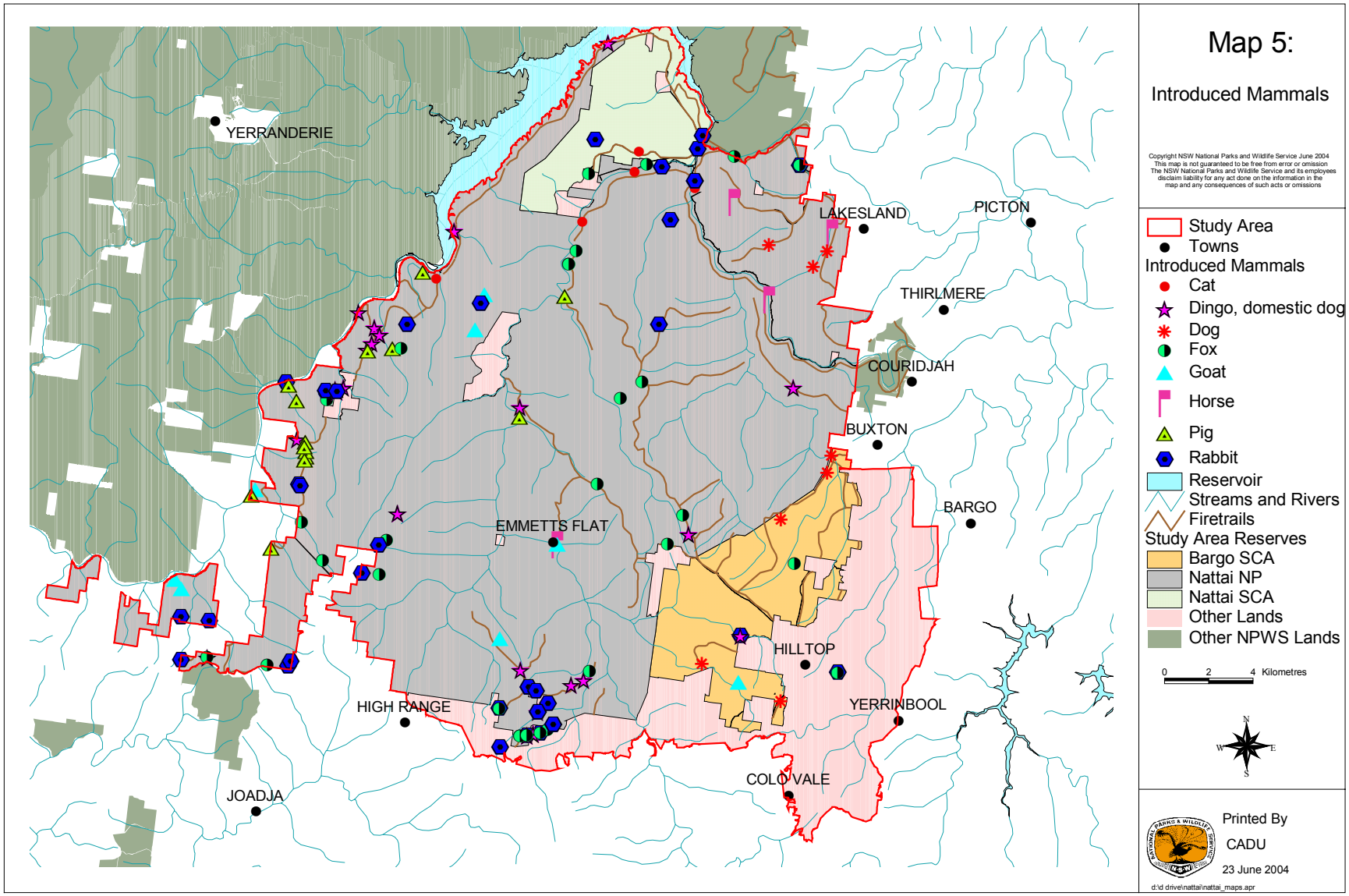
Pigs have most commonly been recorded in the Burragorang and Nattai Valleys foraging in the open country and wallowing in the soaks and easily dug soils of the deep alluviums of stream banks and terraces. They were not recorded on the sandstone plateau during these fauna surveys.

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

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

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

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


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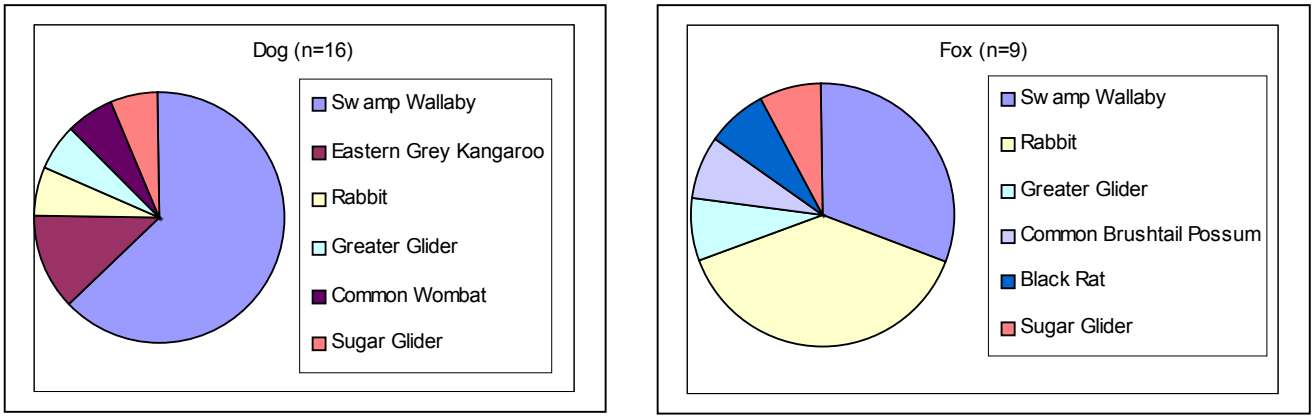
3.10 Feral Predator Scat Analysis

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

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

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



3.11 Landscape Patterns in Fauna Distribution

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

The Sandstone Plateau

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

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

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

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

The Burragorang Valley

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

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

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