Kerle Environmental
Ecologist Dr Anne Kerle M. Env. Law, MEIANZ
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MOUNT CANOBOLAS FAUNA SURVEY

24TH – 29th MARCH 2019

t. 02 63376648 m. 0428846509 e. annekerle@bigpond.com
5 Fitzroy Street, Peel (via Bathurst) NSW 2795

Introduction

Mount Canobolas State Conservation Area

The Mount Canobolas State Conservation Area (SCA) Draft Plan of Management begins with the following vision for this reserve:

> *Mount Canobolas State Conservation Area is a sentinel in the landscape. It is a park valued, understood and protected by the community for its uniqueness, biodiversity, visitor experiences, and for the spiritual and cultural connections between people and this special place, now and into the future* (OEH 2018).

This iconic place is an extinct volcano rising to an altitude of 1397m asl and more than 500m above the surrounding central tablelands landscape. It has great significance for the local Wiradjuri custodians. The ecological values of this place are shaped by its high altitude, volcanic origins, isolation from similar geological formations and the extensive clearing of the surrounding landscape leaving it as a relatively isolated remnant of native vegetation. The presence of sub-alpine communities is particularly noteworthy (OEH 2018). The SCA incorporates an area of 1672 ha.

The vegetation communities of the Mt Canobolas SCA have been broadly described and mapped with the following communities defined:

1. *Eucalyptus macrorhyncha – E. dives*: shrubby open forest and woodland (26% of the SCA)
    a. *E. macrorhyncha* dominant in more exposed sites
    b. *E. dives* dominant in less exposed sites
2. *E. pauciflora – E. dalrympleana:* Grassy woodlands and tall open forests (51% of the SCA)
    a. *E. pauciflora – E. canobolensis* grassy woodlands
    b. *E. dalrympleana – E. viminalis* tall open forests
3. Outcrop low open woodland (*E. canobolensis – E. petroc?*) and / or shrubs
4. *E. pauciflora – E. canobolensis* Grasslands and grassy open woodland
5. Waterfall low open woodlands – *E. gonyocalyx* (Federal Falls)
6. Ferns Creekline – the “Walls” nature track

The distribution of these communities across the SCA has been broadly mapped (Figure 1).

Some 800 biological entities have been recorded from Mount Canobolas. Of these, three threatened ecological communities and 12 threatened species listed under the *Biodiversity Conservation Act 2016* are known to occur on Mount Canobolas. These are:

Communities:

Mount Canobolas Xanthoparmelia Lichen Community.

Tableland Basalt Forest in the Sydney Basin and the South Eastern Highlands Bioregion Endangered Ecological Community.

Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions Endangered Ecological Community.

Species:

Plants

Prostanthers gilesii (CE)
Eucalyptus canobolensis (V)

Mammals

Petaurus australis (V)
Petauroides volans (Cth V)
Miniopterus schreibersii (V)
Saccolaimus flaviventris (V)

Birds

Artamus cyanopterus (Dusky Woodswallow)
Daphoenositta chrysoptera (Varied Sitella)
Hieraaetus morphinoides (Little Eagle)
Neophema pulchella (Turquoise Parrot)
Petrioca boodang (Scarlet Robin)
Petrioca phoenicea (Flame Robin)

In February 2018 the Mt Canobolas SCA was extensively burnt by wildfire. The intensity of the burn was variable, ranging from extreme intensity to remnant unburnt patches. As a consequence, each of the vegetation communities was subjected to a range of intensities of fire. Five levels of intensity have been defined and mapped (Figure 2). Fire history of this SCA also includes previous wildfire and the implementation of hazard reduction burns by the National Parks and Wildlife Service (S. Woodhall *pers. comm*. March 2019).

While the vegetation has been mapped there has been no previous systematic survey of the faunal biodiversity of the Mt Canobolas SCA. Incidental records have been accumulated in databases such as the Atlas of Living Australia, Birdlife Australia Bird Atlas and Bionet (NSW OEH). Consequently, the Draft Plan of Management has listed the following Action as Priority 1 (within 3 years) in the scheme of operations:

3. Conduct and support surveys for native animals in the Park.

1i) Knowledge of the park's native animals, particularly threatened animals and other endemic and significant species is improved and supports park management. (OEH 2018).

The NSW NPWS initiated a fauna survey of Mount Canobolas in 2018 to begin in 2019. This survey was carried out by a research team supported by an essential team of volunteers. A concurrent floristic survey was also established.

Site Selection

A stratified sampling strategy based on vegetation type and fire intensity was used to select the biodiversity survey sites. Twenty-four sites were established for the botanical survey (Canobolas Post Fire CPF01- CPF24). For the fauna survey, a sub-set of twelve of these sites was selected. These were:

CPF01: *E. dalrympleana, E. dives* tall woodland over *Olearia;* unburnt

CPF03: rocky heath community, surrounded by *E. canobolensis;* Extreme/high fire intensity.

CPF04: *E. macrorhyncha – E. canobolensis* over *Acacia, Poa* and *Lomandra*; Extreme/high fire intensity.

CPF07: *E. canobolensis* over dead *Acacia melanoxylon* and disturbed groundcover of stinging nettle and *Echium vulgare.* Low fire intensity.

CPF08: *E. pauciflora & E. dalrympleana, A. melanoxylon, Poa sieberiana, Geranium solanderi* scattered *Pteridium esculentum.* Low fire intensity.

CPF09: *E. dalrympleana – E. macrorhyncha* with occasional *E. dives* over *Poa* and bracken. Tall forest. Low fire intensity.

CPF13: *E. canobolensis – E. dalrympleana* over bracken. Extreme/high fire intensity.

CPF14: Mature *E. dalrympleana* and young *E. pauciflora* over dense snow grass with *A. dealbata.* Unburnt.

CPF15: Very large *E. dalrympleana* and smaller *E. pauciflora* over shrubs / grass. *A. dealbata, A. melanoxylon, Rubus, Poa.* Unburnt.

CPF17: heathland of *Calytrix, mirbellum, Cassinia.* Unburnt.

CPF19: *E. canobolensis* over *A. dealbata,* grasses and herbs. Extreme/high fire intensity.

CPF23: *E. macrorhyncha & E. canobolensis (E. dives* downslope), *A. melanoxylon, Exocarpus cupressiformis,* groundcover *Poa sieberiana, Hibbertia obtusifolia.*

CPF24: *E. dives, E. dalrympleana, E. canobolensis* over *Cassinia, A. dealbata* and *Poa.*

The location of all the biodiversity sites is shown on Figures 1 & 2.

Figure 1: Distribution of vegetation communities across the Mt Canobolas State Conservation Area and the location of the 24 biodiversity survey sites.

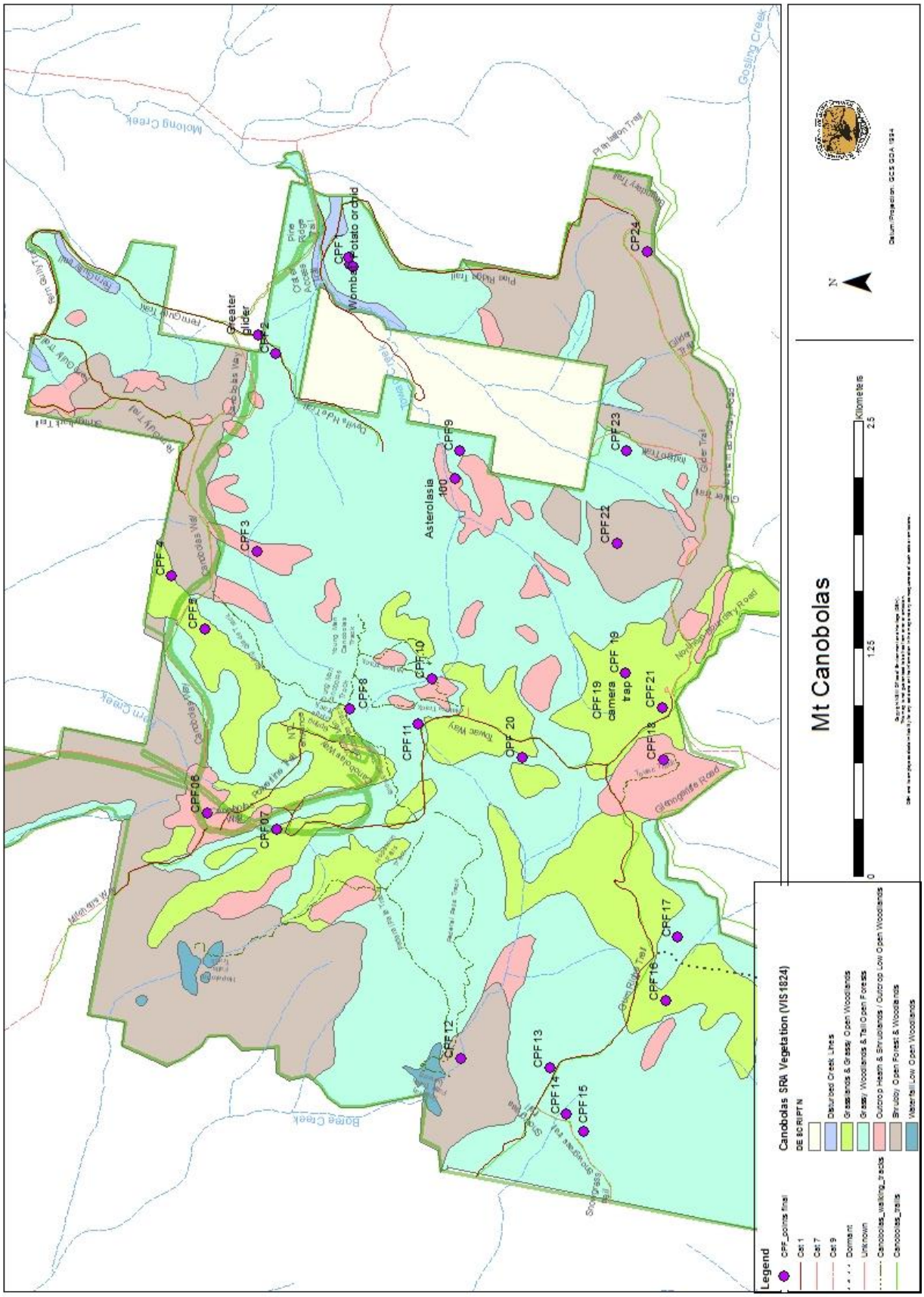
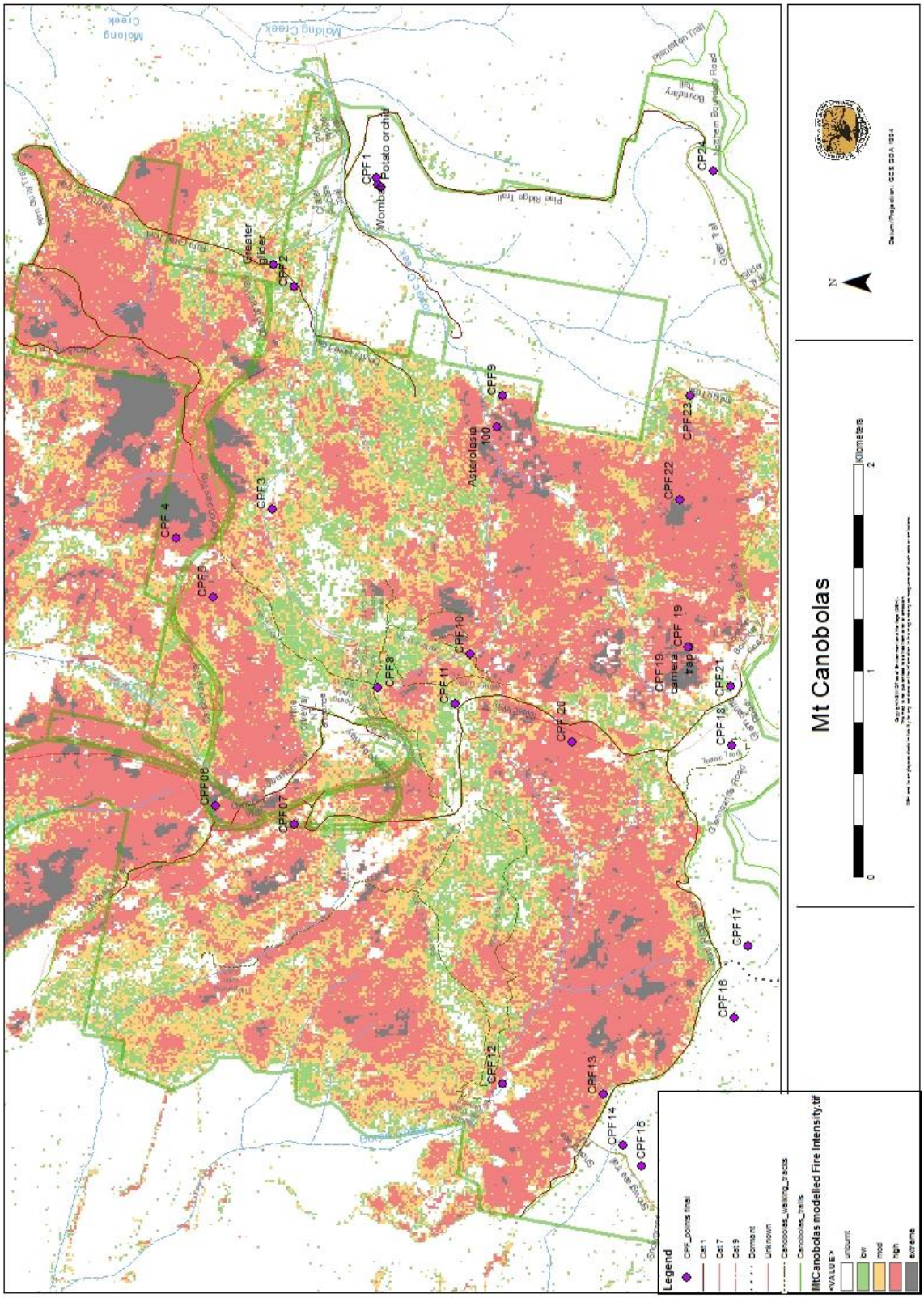


Figure 2: Extent and intensity of the wildfire within the Mt Canobolas State Conservation Area.



Fauna survey

The survey was conducted from Saturday 23rd March to Thursday 28th March 2019. Initially the weather was warm and humid but became cold and wet and the Mount was blanketed in fog. Temperatures at the Federal Falls Camping Ground during the survey varied from 5^0C minimum to 24^0C maximum.

Figure 3: Federal Falls Campground, 25th March 2019

Birds, mammals (including microbats), reptiles and frogs were the primary target of the fauna survey. Any notable observations of invertebrates were also recorded. A systematic survey approach was used to enable statistical analysis and comparison with additional surveys into the future.

Microbat diversity and abundance was surveyed using the ultrasonic “Anabat” bat detectors prior to the fauna survey. Eighteen of the 24 systematically selected sites were surveyed for microbats. The selected sites were: CPF1, CPF2, CPF3, CPF4, CPF5, CPF6, CPF7, CPF8, CPF9, CPF10, CPF11, CPF13, CPF15, CPF16, CPF17, CPF18, CPF23, CPF24. Two incidental sites were also surveyed making a total of 20 sites surveyed for microbat diversity and abundance.

This survey was carried out under NSW NPWS Scientific Licence SL100255 (valid 1/8/18 - 31/7/19) and Animal Research Authority (Animal Care and Ethics Committee of the Secretary NSW Department of Industry), valid 16/3/2019 – 16/3/2020. Both authorities are under the name of Dr J. Anne Kerle. Dr Mike Fleming, Dr Mike Augee and Ms Lesley Forward were added to the ACEC licence as associate investigators.

Methods

Two-hectare survey sites were established at each of the 12 selected biodiversity sites and incorporated the 20m x 20m floristic diversity plots. The method used is equivalent to the approach developed by the NPWS in which a 20m x 20m floristic plot is nested within the 50m x 20m vegetation plot (Figure 4), which is also contained within the 2ha (200m x 100m) fauna survey sites. When delineating each of the 2ha sites, the vegetation type and burn intensity was kept consistent as much as possible. A GPS was recorded for the four corners of all the 2ha sites for use when repeating the surveys in the future.

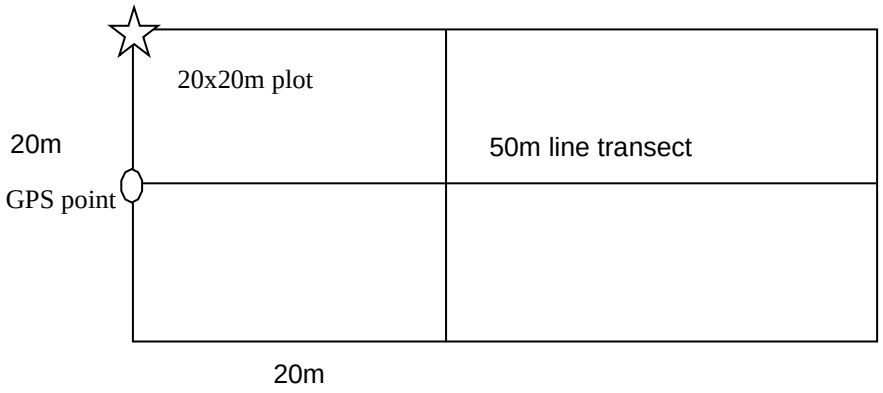


Figure 4: Standardised plot layout for biodiversity survey

The survey plots were designed to only incorporate one vegetation community and one burn intensity. For some, the plot was larger than the available vegetation community in that location so where possible traps were set within the specified community. Some of the site constraints were as follows:

- Neither of the rocky heath community sites (CPF03, CPF17) were large enough to incorporate a 2ha plot.
- Site CPF19 only contained a small area of the designated *E. pauciflora* / *E. canobolensis* grassy woodlands / tall open forest and was constrained by dense blackberry infestation and a cliff.
- While sites CPF14 and CPF15 are mapped as different vegetation communities they are in very close proximity and are structurally very similar and represent mature ('old growth'), unburnt habitat. These two sites have been combined for the fauna survey.

Survey personnel and volunteers were allocated to four groups, each with responsibility for three survey sites.

Survey methods were as follows:

Mammal trapping: Fifty Elliott traps (Type A) were allocated to each 2ha survey plot. Ideally the traps were to be placed on the ground about 10 paces apart and in 3 lines across the 2ha survey plot. As much as possible traps remained within the designated vegetation and burn type of the site. Given the rugged and frequently steep topography

of the Mount, this often dictated the placement of traps. Maps of the plots and configuration of traps are available in ARC GIS and Google Earth KLM formats.

Traps were baited with a peanut butter/rolled oats mixture, grass bedding placed inside the traps which were covered with a plastic bag as required by permit conditions.

Two species of *Antechinus* are listed in atlas records as occurring on Mount Canobolas. These are *Antechinus stuartii* (Brown Antechinus) and *A. agilis* (Agile Antechinus). As these two species are very similar in external morphology detailed measurements of all individuals trapped were taken in order to be confident of the identity of the species, if trapped (Dickman *et al*. 1998; Dickman 2008). Measurements taken were: Weight, head length, head/body length, tail length and pes length. All individuals were also sexed and marked with permanent pen prior to release.

Any introduced species trapped, such as *Mus musculus, Rattus rattus* or *R. norvegicus* were euthanised. This is as per permit requirements for trapping in the National Park estate in NSW, using methods proscribed by the NSW Department of Agriculture Director General's Animal Ethics Committee Licence.

Microbat survey: Ultrasonic recording of bats occurred in December 2018 at 20 of the floristic sites (Porteners 2019), around the time of the new moon. An Anabat detector was mounted on a tree facing towards a flyway at the centre of each floristic plot and all ultrasonic sounds were recorded for three nights.

The recordings were processed through Anascheme to separate recordings that only contained noise from those containing bat calls, with tentative identifications being provided for the calls. Sonograms of the calls were visually inspected to validate species identification.

Bird survey: All fauna survey sites were systematically surveyed for birds. This method provides a measure of species diversity and relative abundance within each habitat type:

Birds were surveyed by experienced observers within the 2ha plot. Surveys occurred within the first two hours after dawn and last two hours before dusk. Each of these surveys was comprised of three consecutive stages:

1. 20 minutes slow walking within the plot;
2. 20 minutes of observations from within the plot plus the area surrounding the 2ha plot;
3. 20 minutes of searching an extended area surrounding the 2ha plot but within the same habitat.

The total counts for each 20-minute period were recorded separately. Numbers of individuals and microhabitat use were recorded for each encounter. Environmental conditions (weather, wind, cloud cover, flowering of plants) were noted.

Spotlighting: Spotlighting was carried out on foot and/or from a slowly driven vehicle in the vicinity of each survey site. For safety, the spotlighting group did not walk within each site unless it was crossed by a path. Groups used 50- or 100-watt spotlights and used a red filter once an animal was located.

Reptiles and Amphibians: No systematic reptile survey was carried out during this survey. For future surveys the proposed method will be two 20-minute active searches within each survey plot on separate days between 10am and 3pm.

The rocky substrate prevents the use of pitfall trapping for reptiles.

Incidental / opportunistic observations: At all times survey participants were encouraged to record all species observed and note their location. This will be accumulated into a database which will contribute significantly to knowledge of species diversity within the SCA. The microbat survey team also recorded other vertebrate species as they travelled around the Mount Canobolas MCP biodiversity sites in December 2018. These observations have also been included in the database.

Results

Mammals

A total of fourteen mammal species were recorded during the survey through trapping, spotlighting and incidental observations. Five of these were introduced species.

The overall trapping success of was 2.2%, varying from 0% to 8% between the 12 sites, with only two small mammal species being caught (Table 1).

Table 1: Species and trapping results for the 12 trapping sites on Mount Canobolas, 23-28 March 2019.

Site	# Trap nights	Captures	% Trap success	Vegetation type	Fire intensity
CPF01	20	1 *Antechinus agilis*	5%	Tall ribbon gum peppermint shrubby woodland	Unburnt
CPF03	57	Nil	0	Rocky heath	Extreme / high
CPF04	150	Nil	0	Stringybark, Candlebark over shrubby woodland	Extreme / high
CPF07	100	10 *Mus musculus*	10.0%	Candlebark over wattle understory	Low
CPF08	150	Nil	0	Snow gum, Mountain gum shrubby woodland	Low
CPF09	100	Nil	0	Ribbon gum, stringybark tall grassy forest	Low
CPF13	100	4 *Antechinus agilis* (1 recapture)	4%	Candlebark, ribbon gum woodland	Extreme / high
CPF14/15	152	2 *Antechinus agilis*	1.3%	Ribbon gum, snow gum over snow grass or shrubs	Unburnt
CPF17	60	Nil	0	Rocky heath	Unburnt
CPF19	63	Nil	0	Candlebark over wattle and grasses	Extreme / high
CPF23	150	2 *Mus musculus*	1.3%	Stringybark, candlebark over shrubs and snow grass	Low
CPF24	150	10 *Antechinus agilis* (2 recaptures)	6.7%	Peppermint, ribbon gum, candlebark	Unburnt

				over shrubs and grass	
Total	**1252**	**10 *Mus musculus* 17 *A. agilis*** (including three recaptures)	**2.2%**		

Trapping success varied between the three burn intensities:

Unburnt sites: 4.5% trapping success - 11 *Antechinus agilis* individuals captured in 382 trap nights

Low intensity burn sites: 2% trapping success - 10 *Mus musculus* individuals captured in 500 trap nights.

Extreme / high burn sites: 1.1% trapping success – 3 *Antechinus agilis* individuals captured in 370 trap nights.

Of the six successful trapping sites, mature forest or woodland with a shrubby understorey appears to be the preferred habitat structure. This needs to be confirmed with a detailed assessment of the habitat at each site.

As previously noted, identification of the *Antechinus* species trapped required detailed information with both *A. stuartii* and *A. agilis* being recorded from the SCA in atlas databases. These two species are very similar in external characteristics and the measurements taken of the *Antechinus* sp. trapped during the survey to assist with identification are in Table 2. As an overall observation, the individuals captured on Mount Canobolas were externally very similar in colouration and general appearance to *A. stuartii* but significantly smaller, typical of *A. agilis*.

In addition, one trap death of an *Antechinus* occurred. This specimen has been lodged and registered in the mammal collection of the Australian Museum (College St Sydney). DNA analysis of this specimen (AM50091) and one from Mount Canobolas already held by the Museum (M37246) carried out by the Australian Museum DNA laboratory has identified both specimens as *Antechinus agilis* (Appendix 1).

Table 2: Measurements of the *Antechinus* sp. trapped during the survey

Date	Site	Trap Number	Sex	Weight (g)	Head body (mm)	Head length (mm)	Head width (mm)	Tail length (mm)	Pes length (mm)
25/3/19	CPF24	N19	M	29	95	35	15	80	-
25/3/19	CPF24	N8	F	22	80	30	15	70	-
25/3/19	CPF24	N15	F	23	93	29	15	75	-
25/3/19	CPF24	N16	M	33	98	31	17	85	-
27/3/19	CPF24	E11	F	21	88	30	17	70	17
27/3/19	CPF24	N11	F	21	90	30	19	71	18
27/3/19	CPF24	N25	F	26	93	32	18	81	19
27/3/19	CPF13	B1	F	16	80	32	16	67	17
27/3/19	CPF13	A9	M	26	105	31	15	87	15
27/3/19	CPF13	B12	M	28	95	32	17	78	16
28/3/19	CPF13	B1	F	20	83	32	15	80	17
27/3/19	CPF14/15	A13	F	21	90	30	16	67	16
28/3/19	CPF14/15	A24	F	17	85	29	15	80	16
27/3/19	CPF01	A8	M	27	-	37	17	78	18

Thirteen mammal species were recorded from spotlighting and incidental observations. These included three arboreal possums, four macropods, Wombat, Echidna and four feral mammal species (Table 3). Given the difficulty of safely spotlighting within sites many of the spotlighting records are from areas adjacent to the sites.

Table 3: Spotlighting and incidental mammal records for each fauna survey site and within the SCA. S: sign (diggings, scats, tracks); P: camera trap photo; I: incidental.

SPECIES	01	03	04	07	08	09	013	014/15	017	019	023	024	I
Common Ringtail Possum	3				1			2	1		4	1	12
Common Brushtail Possum													2
Greater Glider	1							1					2
Red necked Wallaby										2	1	1	2
Swamp Wallaby							2	1			3	1	
Eastern Grey Kangaroo							3				2		1
Wallaroo											1		
Wombat	P					S						S	
Echidna								S					

Feral Pig		S				S		S	S				
Rabbit							S	S	S				
Red Fox		S					S	S	S				
Deer sp									S				
Total species	**3**	**2**	**0**	**0**	**1**	**2**	**4**	**7**	**5**	**1**	**5**	**4**	**5**

For the total mammal species records for the Mount Canobolas SCA listed in databases see Appendix 2.

Birds

The systematic bird survey of 13 fauna survey sites (CPF 14 and CPF 15 surveyed separately) was carried out once during the period of the March 2019 fauna survey. The results of this survey are presented in Table 4. As for the mammal survey results, interpretation of the influence of the two key parameters of vegetation type and fire intensity on avian diversity and species abundance is not appropriate until the detailed habitat assessment at each site is carried out.

A total of 45 bird species were recorded during the survey, 39 during the systematic survey, three during spotlighting and three as incidental observations. Incidental observations were also recorded by the Microbat survey team in December 2018 with an additional two species being recorded (Table 5; M. Ellis *pers. comm*. 2019). The three nocturnal species observed were Powerful Owl, Southern Boobook and Tawny Frogmouth. The total species list for the survey period is provided in Table 6. Five species recorded are listed as Vulnerable under the *Biodiversity Conservation Act 2016*. These species are: Dusky Woodswallow, Scarlet Robin, Flame Robin, Varied Sitella and Little Eagle.

An initial comparison of the site-based bird records suggests that the mean species diversity (d) and abundance (a) at the sites with a low intensity burn (d 12.8 species, a 24.8) was marginally higher than for the unburnt sites (d 9.4 species, a 22.8). The sites that had an extreme or high intensity burn (d 8.3 species, a 21.8) had the lowest bird species diversity and abundance. This comparison is of limited value however given the variation in climatic conditions and timing of the survey and that this is currently a once off survey and vegetation characteristics have not been included.

For the total avian species records for the Mount Canobolas SCA listed in databases see Appendix 3.

Table 4: Species diversity and relative abundance results of systematic bird census, March 2019.

Bird Species by Site	CPF01	CPF03	CPF04	CPF07	CPF08	CPF09	CPF13	CPF14	CPF15	CPF17	CPF19	CPF23	CPF24	Grand Total
Australian King-Parrot						1								1
Australian Magpie		2		2		3							1	8
Australian Raven				1									3	4
Black-faced Cuckoo-shrike		2												2
Brown Thornbill				1						2		6	2	11
Crimson Rosella	3	3	1	12	4	8	2	4				5	3	45
Dusky Woodswallow				2										2
Eastern Rosella		4												4
Eastern Yellow Robin	3					1								4
Eurasian Blackbird					1									1
Galah	1					1					3	2		7
Grey Butcherbird						1								1
Grey Currawong				1		1					1	1		4
Grey Fantail	2	1	1	5	1	2		1	1	4		5	3	26
Grey Shrike-thrush	1				2	1			1			1	1	7
Initial Period														
Laughing Kookaburra												1	1	2
Nankeen Kestrel				2										2
Noisy Friarbird			1			1		4			8			14
Noisy Miner											1		2	3
Pied Currawong	1		2	3	1			1			1	2	1	12
Red Wattlebird		5	10	8	2	4	4	2			1			36
Red-browed Finch											2	2		4
Red-browed Treecreeper									1					1
Silvereye											8			8
Spotted Pardalote					3		2	2			3	1	2	13
Striated Pardalote				1	4	1		1						7

Striated Thornbill	1							4	4		2	3		14
Sulphur-crested Cockatoo	26						2	2	1			1		32
Superb Fairy-wren	1												1	2
Wedge-tailed Eagle											2			2
White-browed Scrubwren				2				2		1		2		7
White-browed Woodswallow												2		2
White-eared Honeyeater			1								1		2	4
White-naped Honeyeater	2				3					1				6
White-plumed Honeyeater								1						1
White-throated Treecreeper	2		2								1	2		7
Yellow Thornbill	1													1
Yellow-faced Honeyeater	1		1	9	1	4	1	2		6	6	8	4	43
Grand Total	45	17	19	49	22	29	11	26	8	14	40	44	26	350

Table 5: Species diversity and relative abundance results of non-systematic bird census December 2018 (Anabat team).

Common Name / Site	CPF 01	CPF 02	CPF 03	CPF 04	CPF 05	CPF 06	CPF 07	CPF 08	CPF 09	CPF 10	CPF 11	CPF 13	CPF 15	CPF 16	CPF 17	CPF 18	CPF 20	CPF 21	CPF 23	CPF 24	Grand Total
Australian King-Parrot		1			2		1		1		1		2						2	1	11
Australian Magpie			1	1	1							1									4
Australian Raven	1	3		1	1	1	2	1			1			1		1	1	1	1	1	17
Black-eared Cuckoo		1																			1
Black-faced Cuckoo-shrike					1																1
Brown Falcon									1	1											2
Brown Thornbill		1								1				1							3
Buff-rumped Thornbill		1																			1
Common Bronzewing													1						1		2
Crimson Rosella	7	6	1	6	7	1	6	6		10	5	6	5	10	2		4	1	2	4	89
Eastern Rosella	3	2	1	1	1		1					1		1			1				12
Eastern Spinebill		3																			3
Fan-tailed Cuckoo				1	1																2
Galah	1	9																			10
Grey Currawong		1		1			1														3
Grey Fantail	3	5			6			5	1	2	2	5	4	3	1	1	0	1	5	4	48
Grey Shrike-thrush	3	2						1	1	1		1		2	1	1				1	14
Laughing Kookaburra		2	1	1				1	1	1	1	1							1		10
Pied Currawong	1		1	4	3		2	1		1	2		3	2	1		2	2	1	2	28
Red Wattlebird		1		1	1		1					2		1			1		1		9
Restless Flycatcher																			1		1
Rufous Fantail								1					1								2
Rufous Whistler	2								1	1		1							1		6
Sacred Kingfisher					1				1	1		1							1		5
Satin Flycatcher									1												1

Silvereye																		2			2
Spotted Pardalote		1	1	1	2		1	2	2	2	2	1	1	1		1	1	1	1	1	22
Striated Pardalote				1		1	1	1		3	1	3	2	2	1		2	2		3	23
Striated Thornbill		1												3							4
Sulphur-crested Cockatoo	2	2	1	2	3	1	4	1		2	9	5	5	1		2	9	2	2	1	54
Superb Fairy-wren																1					1
Wedge-tailed Eagle														3							3
Weebill													1								1
White-browed Scrubwren		1						3		2	1			1	1	1					10
White-browed Treecreeper		1																			1
White-cheeked Honeyeater															1						1
White-eared Honeyeater						1									1						2
White-naped Honeyeater	4	1							2	2	2										11
White-throated Treecreeper	2							1		1										1	5
Yellow-faced Honeyeater	3	14	1	4	4	2	4	4	4	5	5	4	1	5	2	6	4	2	1	5	80
Yellow-tailed Black-Cockatoo		3																			3
Grand Total	32	64	8	25	35	7	24	29	16	36	32	32	26	37	11	20	26	14	22	25	521

Table 6: Total bird species list at May 2019, including spotlighting and incidental records for the survey period.

Common Name	Species name
Australian King-Parrot	*Alisterus scapularis*
Australian Magpie	*Cracticus tibicen*
Australian Raven	*Corvus coronoides*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Brown Thornbill	*Acanthiza pusilla*
Crimson Rosella	*Platycercus elegans*
Eastern Rosella	*Platycercus eximius*
Eastern Yellow Robin	*Eopsaltria australis*
Eurasian Blackbird	*Turdus merula*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Flame Robin	*Petroica phoenicea*
Galah	*Eolophus roseicapillus*
Grey Butcherbird	*Cracticus torquatus*
Grey Currawong	*Strepera versicolor*
Grey Fantail	*Rhipidura albiscapa*
Grey Shrike-thrush	*Colluricincla harmonica*
Laughing Kookaburra	*Dacelo novaeguineae*
Little Friarbird	*Philemon citreogularis*
Musk Lorikeet	*Glossopsitta concinna*
Noisy Friarbird	*Philemon corniculatus*
Noisy Miner	*Manorina melanocephala*
Pied Currawong	*Strepera graculina*
Powerful Owl	*Ninox strenua*
Red Wattlebird	*Anthochaera carunculata*
Red-browed Finch	*Neochmia temporalis*
Red-browed Treecreeper	*Climacteris erythrops*
Scarlet Robin	*Petroica boodang*
Silvereye	*Zosterops lateralis*
Southern Boobook	*Ninox novaeseelandiae*
Spotted Pardalote	*Pardalotus punctatus*
Striated Pardalote	*Pardalotus striatus*
Striated Thornbill	*Acanthiza lineata*
Sulphur-crested Cockatoo	*Cacatua galerita*
Superb Fairy-wren	*Malurus cyaneus*
Tawny Frogmouth	*Podargus strigoides*
Wedge-tailed Eagle	*Aquila audax*
White-browed Scrubwren	*Sericornis frontalis*
White-browed Woodswallow	*Artamus superciliosus*
White-eared Honeyeater	*Nesoptilotis leucotis*
White-naped Honeyeater	*Melithreptus lunatus*
White-plumed Honeyeater	*Ptilotula penicillatus*
White-throated Treecreeper	*Cormobates leucophaea*
Yellow Thornbill	*Acanthiza nana*
Yellow-faced Honeyeater	*Caligavis chrysops*
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*

Microbats

Microbat diversity and abundance has been provided in a separate report (Ellis *et al.* 2019). Although identification of microbat species from acoustic call recognition can be problematic the results from this survey indicate that there were at least 12 species utilising Mount Canobolas during the survey period (2-4 December 2018). These species are listed on Table 7. The distribution of microbat activity across the survey sites was variable as was the species diversity and abundance (Table 8). Species richness varied from three species at Site CPF18 to 11 species at Site CPF16. Neither of these sites were burnt by the February 2018 fire.

Table 7: Microbat species and call frequency results of the acoustic call analysis for Mount Canobolas, December 2018

Species	# Calls
Chalinolobus gouldii	38
Chalinolobus morio	108
Falsistrellus tasmaniensis	133
Falsistrellus tasmaniensis/Scotorepens orion	21
Miniopterus schreibersii oceanensis	64
Mormopterus planiceps	7
Mormopterus ridei	1
Nyctophilus spp.	110
Tadarida australis	209
Vespadelus darlingtonia	213
Vespadelus regulus	1352
Vespadelus vulturnus	6
Species richness	**12**

Table 8: Microbat species richness and call frequency for 20 survey sites on Mount Canobolas, December 2018.

Site	Species richness	Microbat activity	Fire intensity
CPF 01	10	71	Unburnt
CPF 02	10	109	Low
CPF 03	8	77	Extreme/High
CPF 04	6	41	Extreme/High
CPF 05	5	34	Extreme/High
CPF 06	5	10	Extreme/High
CPF 07	8	55	Low
CPF 08	5	17	Low

CPF 09	6	212	Low
CPF 10	10	103	Extreme/High
CPF 11	4	11	Low
CPF 13	6	76	Extreme/High
CPF 15	5	53	Unburnt
CPF 16	11	330	Unburnt
CPF 17	9	183	Unburnt
CPF 18	3	17	Unburnt
CPF 20	5	38	Extreme/High
CPF 21	6	90	Low
CPF 23	4	32	Low
CPF 24	8	706	Unburnt
Total	12	2265	

Reptiles and Amphibians

No systematic survey of reptiles or amphibians was carried out during the March 2019 survey. Four species were observed and three identified from the following photographs (Figures 5, 6 & 7):

Figure 5:

Copper-tailed Skink

Ctenotus taeniolatus

Figure 6:

Grass Sun-skink

Lamphrolis guichenotti

Figure 7:

Yellow-bellied Water-skink

Eulamprus heatwolei

Liopholis whitii White's Skink. North Boundary Rd. 55 685172E 6303502N Two individuals in hole in road embankment

An additional four species were observed during the Microbat survey in December 2019: Red-throated Skink (*Acritoscincus platynota*), Robust Ctenotus (*Ctenotus robustus*), Jacky Lizard (*Amphibolurus muricatus*) and Mountain Dragon (*Rankinia diemensis*) (M Ellis *pers. comm.* 2019).

Table 9: Amphibian and reptile species recorded from Mount Canobolas. Records from December 2018 (ME) and March 2019 surveys are indicated.

Scientific Name	Common Name	Status	Atlas Records	Dec 2018 (ME)	March 2019
Crinia parinsignifera	Eastern Sign-bearing Froglet	P	1		
Crinia signifera	Common Eastern Froglet	P	6		
Uperoleia laevigata	Smooth Toadlet	P	5		
Litoria verreauxii	Verreaux's Frog	P	3		
Acritoscincus platynota	Red-throated Skink	P	3	Y	
Ctenotus robustus	Robust Ctenotus	P	1	Y	
Ctenotus taeniolatus	Copper-tailed Skink	P	10		Y
Egernia striolata	Tree Skink	P	1		
Eulamprus heatwolei	Yellow-bellied Water-skink	P	3	Y	Y
Eulamprus quoyii	Eastern Water-skink	P	3		
Hemiergis decresiensis	Three-toed Earless Skink	P	1		
Lampropholis delicata	Dark-flecked Garden Sunskink	P	1		
Lampropholis guichenoti	Pale-flecked Garden Sunskink	P	1	Y	Y
Liopholis whitii	White's Skink	P	12	Y	Y

Menetia greyii	Common Dwarf Skink	P	4		
Saproscincus mustelinus	Weasel Skink	P	3		
Amphibolurus muricatus	Jacky Lizard	P	4	Y	
Rankinia diemensis	Mountain Dragon	P	3	Y	

Amphibian and reptile species from all Atlas records are listed in Appendix 4.

Invertebrates

The invertebrate fauna of the Mount Canobolas complex was not the focus of this survey but the NPWS staff informedparticipants that an unidentified fluorescent planarian has been observed on the Mount. Two individuals of the Planarian were found on the last morning of the survey in widely separated locations: one at Site 1 and the other at in the side of the track below Site 15 (AMG: 55 682275E 6307438N). The individual from Site 15 (Figure 8) has been sent to a Planarian expert in Queensland for identification and description.

Figure 8:

Mount Canobolas Planarian

Discussion

The fauna survey conducted within the Mount Canobolas State Conservation Area (SCA) for NPWS in March 2019 has successfully established a repeatable systematic survey methodology which can provide a foundation for further biodiversity assessments and inform management of the reserve. The results can be compared through time and in relation to measured habitat parameters. In total 14 mammal, 12 microbat and 45 bird species were recorded within the 12 two ha survey sites during the March 2019 survey. While there were four reptile species recorded none were within survey sites.

Prior to this survey some smaller fauna surveys had been conducted by Dr Cilla Kinross and students from Charles Sturt University and the survey results submitted to Bionet. Otherwise, records from this SCA have generally comprised opportunistic observation with little habitat information included with the record.

To date the necessary habitat assessment of each of the 2ha survey sites has not been carried out. This assessment will be carried out within the standardised 50x20m subplot (Figure 4) and will include structural attributes including litter, rock and log cover, vertical vegetation structure, canopy height, tree size, density and condition, log volume, native species regeneration and dominant plant species. The nested 20x20m plot (Figure 4) is the location of the detailed floristic survey also being conducted during this biodiversity survey of Mount Canobolas (Porteners 2019).

Not all species of fauna using the survey sites or the SCA more broadly, will be recorded during the systematic 2 ha site surveys. This will be affected by weather conditions, seasonal conditions and the limited survey time. Migratory, uncommon, cryptic species and others are recorded as opportunistic/incidental sightings and included in the database for the conservation area. Including species recorded during both systematic surveys and opportunistic observations 128 vertebrate species (24 mammal, 12 microbat, 84 bird, 18 reptile and 5 amphibian), have been listed in the Bionet database for the Mount Canobolas SCA. This includes introduced species.

The Mount Canobolas SCA is the highest point of the Mount Canobolas Volcanic Complex with volcanic geological formations extending to both the north and south. The volcanic Black Rock Range south of Mount Canobolas is lower in altitude than Mount Canobolas, at 540-800m asl, and has no sub-alpine vegetation community. It is an area of 1030ha remnant native vegetation and connected with Mount Canobolas by remnant native vegetation and pine forest (Figure 9). A vertebrate survey of Black Rock Range conducted in November 2005 recorded a significant vertebrate diversity and represents a useful, nearby, comparison with the vertebrate diversity of the Mount Canobolas SCA.

The Black Rock Range survey area incorporated the Range itself and immediate farming surrounds to the east. A total of 145 species was recorded including 8 amphibian, 20 reptile, 90 bird, 12 mammal and 10 introduced species (D. Goldney *pers. comm.* 2006). Microbats

were not surveyed. An initial comparison of the species composition demonstrates the effect of timing and differences in habitat on survey results. Compared with the current vertebrate diversity for the Canobolas SCA, many of the bird species were migratory, reptile activity was significantly higher and most of the amphibian species were recorded from the Panuara Rivulet which runs along the eastern edge of the Range in the farming land.

Figure 9: Mount Canobolas volcanic complex with Black Rock Range to the south and the Cadia Valley Operations mine to the south east, fringed on its east by remnant native vegetation.

Some differences are apparent in the mammal diversity between these two areas: two dasyurid species, *Antechinus flavipes* (Yellow-footed Antechinus) and *Sminthopsis murina* (Common Dunnart) were present on Black Rock Range but not yet recorded for Mount Canobolas; arboreal diversity differs with *Petauroides volans* (Greater Glider), *Acrobates* sp. (Feathertail Glider) and *Petaurus australis* (Yellow-bellied Glider) recorded for Mount Canobolas but not on the range to the south; but *Petaurus. norfolkensis* (Squirrel Glider) has been recorded from Black Rock Range in subsequent field assessments in 2013 and 2015 (Kerle *et al.* 2013, Hermensen *et al.* 2016). It is also notable that both Mount Canobolas and

Black Rock Range support significant populations of the Common Ringtail Possum, a species that has largely disappeared from inland NSW (Kerle 2004).

The Feathertail Glider (*Acrobates pygmaeus*) listed in the Bionet records for Mount Canobolas is another species that has been subject of taxonomic revision. The genus has been split into two distinct species Broad-toed Feathertail Glider (*Acrobates frontalis*) and Narrow-toed Feathertail Glider (*A. pygmaeus*) (van Dyck *et al*. 2013). The distribution of these two species appears to overlap when the published distribution maps are compared (p354 van Dyck *et al*. 2013). More information is needed to clarify the distribution of these two species, habitat preferences and potential overlap in distribution. Fortunately, the specific identification of one of the three historical records of Feathertail Glider can be determined as the specimen is held in the Australian Museum (specimen M5935 4/6/1935) and this needs to be followed up. These records of Feathertail Gliders another that might represent a western limit of distribution for a species on Mount Canobolas.

Both *Antechinus agilis* (Agile Antechinus) and *A. stuartii* (Brown Antechinus) are listed in Bionet as having been recorded from the Mount Canobolas SCA. The Agile Antechinus was first described in 1998 (Dickman *et al.* 1998) and the distribution of these two species may be overlapping so the specific identification of the records listed in Bionet needs to be questioned. The DNA analysis of the Mount Canobolas specimens, and some specimens already held in the Australian Museum as Agile Antechinus (Appendix 1), has clearly shown that this species is present within the SCA. The measurements of all the Antechinus trapped during the survey also show that not only were they similar in size to each other but much smaller than the equivalent Brown Antechinus measurements provided in Dickman *et al*. (1998). This supports the decision that all Antechinus trapped in March 2019 are the same species, Agile Antechinus. Notably, this probably makes the SCA the most northerly location for the species and a western outlier in NSW relative to their main distribution (M. Eldridge *pers. comm*. 2019, Dickman 2008). While the Brown Antechinus was recorded from Black Rock Range the specific identity of these records needs to be questioned.

A more detailed comparison of avian species distribution and diversity between Mount Canobolas and Black Rock Range will be valuable after surveys have been conducted in the SCA in Spring/Summer. At that time migrant species should have returned, weather generally warmer and nesting in full swing.

Again, due to the timing of the March 2019 survey, reptile and amphibian distribution and diversity on Mount Canobolas was not adequately surveyed. There is interest from professional experts in the Mount Canobolas area due to its similarity in volcanic origin and altitude to Mount Kaputar where new reptile species have been described (R. Sadlier *pers. comm*. 2019) and because the taxonomy and distribution of frogs in NSW is still not well understood (J. Rowley *pers. comm*. 2019).

Species of interest include the Highland Copperhead (*Aspidytes ramsii*) and could be the subject of a genetic study to clarify relationships of this high elevation population to other

populations of this species. Collection of roadkill specimens, if observed, in the SCA would add to existing samples and assist this analysis of the level of isolation of the Mount Canobolas Highland Copperhead. The record of *Eulamprus* (water skink group) species is interesting as it would represent populations at the extreme western edge of their distribution (R. Sadlier *pers. comm.* 2019).

Despite the impact of cold weather and timing of the late March 2019 survey, the results have already provided significant additions to the knowledge of faunal diversity in the Mount Canobolas SCA. It will be very important to continue surveys, however, not only to increase the knowledge of faunal diversity, habitat preference and abundance but also to understand the ecological relationships of the species with habitat types, management strategies and recreational requirements of this conservation area. The impact of fire – both management burns and wildfire – on the biodiversity of the Mount Canobolas SCA is an important objective of this study which has yet to be assessed and requires much more data.

References

Dickman, C. R., Parnaby, H. E., Crowther, M. S. & King, D. H. (1998) *Antechinus agilis* (Marsupialia: Dasuridae), a new species from the *A. stuartii* complex in south-eastern Australia. *Aust. J. Zool*. 46: 1-26

Dickman, C. R. Agile Antechinus *Antechinus agilis* (2008). pp 83-4 in The Mammals of Australia, Third Edition. Ed S. Van Dyck & R. Strahan, Reed New Holland, Sydney

Ellis, M. E. (2019) Microbat survey results (Dec 2018) from Mount Canobolas. Report to NPWS

Kerle, Anne (2004) A cautionary tale: decline of the common brushtail possum (*Trichosurus vulpecula*) and common ringtail possum (*Pseudocheirus peregrinus*) in the woodlands of the western slopes and plains of New South Wales. Pp. 71-84, in The Biology of Australian Possums and Gliders (R.L. Goldingay & S.M. Jackson, eds.). Surrey Beatty & Sons, Sydney.

Kerle, J. A., Kimmorley, C. & Old, J. M. (2013) An inland population of the common ringtail possum (*Pseudocheirus peregrines*) at Black Rock Ridge, New South Wales: a preliminary ecological assessment. *Australian Mammalogy* 35: 236-40

Hermensen, E., Kerle, A. and Old, J. (2016) Diet of an inland population of the common ringtail possum (*Pseudocheirus peregrinus*) *Australian Mammalogy* 38: 130-134

Portners, M. (2019) Floristic survey of 24 selected survey sites on Mount Canobolas. Report to NPWS

Van Dyck, S., Gynther, I & Baker, A. Eds (2013) Field Companion to the *Mammals of Australia.* New Holland Publishers.

Appendix 1: DNA classification results for *Antechinus* specimen collected from Mount Canobolas, March 2019.

Australian Centre for Wildlife Genomics
Australian Museum Research Institute, Australian Museum
1William Street
Sydney, NSW 2010
E: Wildlife.Forensics@austmus.gov.au

AUSTRALIAN MUSEUM

Australian Centre for Wildlife Genomics
Results Report

Dear Dr Kerle,

One whole Antechinus sp. was received by the Australian Centre for Wildlife Genomics at the Australian Museum on the 16th of April 2019 for the purpose of species identification. Please find the results for the analyses carried out on this sample below Following that you will find a brief summary of the work carried out and the methods used.

Please feel free to contact us if you wish to discuss these results further. We also encourage any feedback that may help us improve our services

Yours sincerely,
The Australian Centre for Wildlife Genomics.

NATA

Accredited for compliance with (ISO/IEC 17025) interpreted for research using CITAC Guide CG2 "Quality Assurance for Research and Non Routine Analysis" (1998). Facility Number: 18884.

Case No: WGM166 Date: 23/07/2019 Service: Species Identification Species: Antechinus sp.
Client contact: Dr Anne Kerle, Kerle Environmental
Report prepared by: Dr Greta Frankham Report checked by: Dr Mark Eldridge
Laboratory work conducted by: Dr Greta Frankham

DNA EXTRACTION:

A tissue sub-sample was taken from the Antechinus sp. sample provided and DNA was successfully extracted using our standard laboratory protocols.

PCR AMPLIFICATION:

Based on the information you provided regarding suspected species, two mitochondrial (mtDNA) gene regions were sequenced and compared to published data to confirm species identification. The source of scientific literature used in this case was:

> Control Region: Fumagalli L, Pope LC, Taberlet P, Moritz C. Versatile primers for the amplification of the mitochondrial DNA control region in marsupials. 1997, Mol Ecol. 1997;6: 1199–1201.

SEQUENCE ANALYSIS:

DNA sequences amplified from the unknown Antechinus were compared to those generated from vouchered reference material from the Australian Museum mammal collection as well as sequences from previously published work available on GenBank. Another unidentified Antechinus sp collected from Mt Canobolas in 2002 was also included in this analyses.

Based on the sample provided, the tests that were used and reference data available, in my opinion, the sequence identity of the unknown to the known reference sequences is sufficient for a species match. The results table 1, below, indicates which species the mtDNA of the unknown sample is consistent with and figure 1, shows the results of the phylogenetic analysis upon which the species determination was made.

The source of literature for the analysis of these samples was:

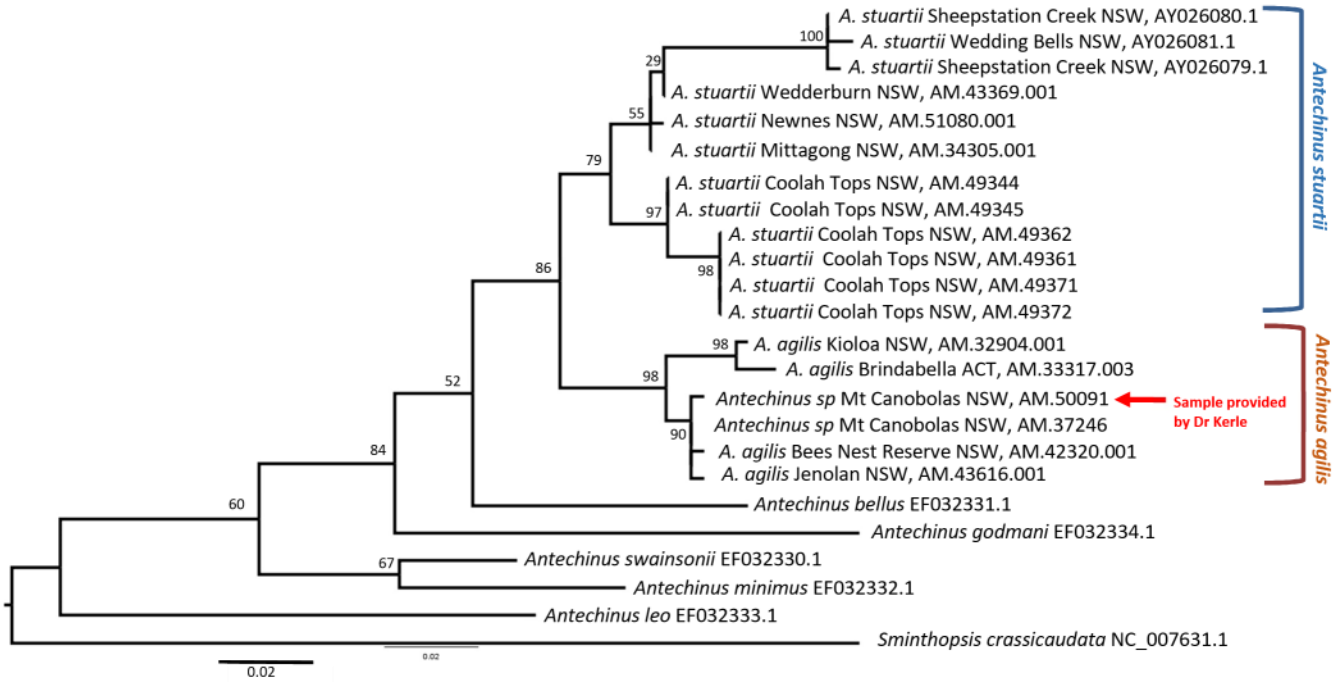
> Previously published material: Crowther, M. S., J. Sumner, and C. R. Dickman. Speciation of Antechinus stuartii and A. subtropicus (Marsupialia: Dasyuridae) in eastern Australia: molecular and morphological evidence. 2003, Australian Journal of Zoology 51, no. 5: 443-462
>
> MEGA 6: Tamura K, Stecher G, Peterson D, Filipski A, and Kumar S 2013, Molecular Biology and Evolution 30:2725-2729

RESULTS:

Table 1. Results of Species Identification using DNA analysis.

AM Sample ID	Client Sample ID	Species
AM.50091	*Antechinus sp.*	*Antechinus agilis*

Figure 1. Results of phylogenetic analysis (Maximum likelihood) for species identification



WORK FLOW SUMMARY:

Determination of species identity based on mitochondrial DNA sequencing.

1. Your sample arrives and details are logged.

2. Sample is photographed in situ.

3. The sample is securely stored at either ambient, -20 or -80 degrees Celsius until it can be processed and after handling.

4. Total genomic DNA is extracted from two separate sources from your sample. The primary source is taken from blood or tissue (if available).

5. Polymerase Chain Reaction (PCR) is used to amplify several target genes that have been chosen as good identifiers for the taxa in question. We have generalised amplification conditions and reagents optimized for birds, fish, mammals, amphibians and reptiles.

6. The short PCR products amplified from these targets are purified and sequenced. Sequencing is sub-contracted to the Australian Genome Research Facility, which is a NATA accredited sequencing facility.

7. DNA analysis is used to compare your unknown sequence with data from large international public databases (Genbank and/or BOLD) as well as from vouchered reference material held by the Australian Museum.

All procedures are carried out using Standard Operation Procedures developed as part of our ISO/IEC 17025 accreditation (NATA facility number 18884).

The Australian Centre for Wildlife Genomics has access to thousands of specimens in Australia's oldest zoological reference collection (the Australian Museum) as well as museum taxonomists, ensuring accurate and trustworthy results.

Disclaimer: This report is not to be used for court purposes. A court statement can be prepared upon request.

Appendix 2: List of all mammal species recorded from the Mount Canobolas State Conservation Area from Bionet [*Exotic species].

Family	Species Code	Scientific Name	Common Name	NSW status	Comm. status
Tachyglossidae	1003	*Tachyglossus aculeatus*	Short-beaked Echidna	P	
Dasyuridae	1668	*Antechinus agilis*	Agile Antechinus	P	
Dasyuridae	1674	*Antechinus stuartii*	Brown Antechinus	P	
Vombatidae	1165	*Vombatus ursinus*	Common Wombat	P	
Petauridae	1136	*Petaurus australis*	Yellow-bellied Glider	V,P	
Petauridae	1138	*Petaurus breviceps*	Sugar Glider	P	
Pseudocheiridae	1133	*Petauroides Volans*	Greater Glider	P	V
Pseudocheiridae	1129	*Pseudocheirus peregrinus*	Common Ringtail Possum	P	
Acrobatidae	1147	*Acrobates pygmaeus*	Feathertail Glider	P	
Phalangeridae	1113	*Trichosurus vulpecula*	Common Brushtail Possum	P	
Macropodidae	1265	*Macropus giganteus*	Eastern Grey Kangaroo	P	
Macropodidae	1266	*Macropus robustus*	Common Wallaroo	P	
Macropodidae	1261	*Macropus rufogriseus*	Red-necked Wallaby	P	
Macropodidae	1242	*Wallabia bicolor*	Swamp Wallaby	P	
Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P	
Molossidae	1324	*Austronomus australis*	White-striped Freetail-bat	P	
Molossidae	1938	*Mormopterus ridei*	Eastern Free-tailed Bat	P	
Vespertilionidae	1349	*Chalinolobus gouldii*	Gould's Wattled Bat	P	
Vespertilionidae	1351	*Chalinolobus morio*	Chocolate Wattled Bat	P	
Vespertilionidae	1834	*Miniopterus schreibersii Oceanensis*	Eastern Bentwing-bat	V,P	
Vespertilionidae	1335	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	P	
Vespertilionidae	T092	*Nyctophilus sp.*	long-eared bat	P	
Vespertilionidae	1365	*Scotorepens orion*	Eastern Broad-nosed Bat	P	
Vespertilionidae	1022	*Vespadelus darlingtonia*	Large Forest Bat	P	
Vespertilionidae	1378	*Vespadelus regulus*	Southern Forest Bat	P	
Vespertilionidae	1379	*Vespadelus vulturnus*	Little Forest Bat	P	
Muridae	1412	*Mus musculus*	House Mouse*		
Muridae	1395	*Rattus fuscipes*	Bush Rat	P	
Muridae	1408	*Rattus rattus*	Black Rat*		
Canidae	1905	*Canis lupus familiaris*	Dog*		
Canidae	1532	*Vulpes vulpes*	Fox*		
Leporidae	1510	*Oryctolagus cuniculus*	Rabbit*		
Equidae	1512	*Equus caballus*	Horse*		
Suidae	1514	*Sus scrofa*	Pig*		
Bovidae	1521	*Capra hircus*	Goat*		
Cervidae	1526	*Cervus elaphus*	Red Deer*		

Appendix 3: List of all bird species recorded from the Mount Canobolas State Conservation Area from Bionet. [*Exotic species]

Family	Species Code	Scientific Name	Common Name	NSW status
Anatidae	0208	*Anas superciliosa*	Pacific Black Duck	P
Podargidae	0313	*Podargus strigoides*	Tawny Frogmouth	P
Ardeidae	0188	*Egretta novaehollandiae*	White-faced Heron	P
Accipitridae	0222	*Accipiter cirrocephalus*	Collared Sparrowhawk	P
Accipitridae	0221	*Accipiter fasciatus*	Brown Goshawk	P
Accipitridae	0224	*Aquila audax*	Wedge-tailed Eagle	P
Accipitridae	0225	*Hieraaetus morphnoides*	Little Eagle	V,P
Falconidae	0239	*Falco berigora*	Brown Falcon	P
Falconidae	0240	*Falco cenchroides*	Nankeen Kestrel	P
Falconidae	0237	*Falco peregrinus*	Peregrine Falcon	P
Cacatuidae	0267	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	P
Cacatuidae	0273	*Eolophus roseicapillus*	Galah	P
Psittacidae	0281	*Alisterus scapularis*	Australian King-Parrot	P
Psittacidae	0258	*Glossopsitta concinna*	Musk Lorikeet	P
Psittacidae	0282	*Platycercus elegans*	Crimson Rosella	P
Psittacidae	0288	*Platycercus eximius*	Eastern Rosella	P
Cuculidae	0338	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P
Cuculidae	0342	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	P
Strigidae	9922	*Ninox novaeseelandiae*	Southern Boobook	P
Strigidae	0248	*Ninox strenua*	Powerful Owl	V,P,3
Alcedinidae	0322	*Dacelo novaeguineae*	Laughing Kookaburra	P
Alcedinidae	0326	*Todiramphus sanctus*	Sacred Kingfisher	P
Climacteridae	0561	*Climacteris affinis*	White-browed Treecreeper	P
Climacteridae	0560	*Climacteris erythrops*	Red-browed Treecreeper	P
Climacteridae	0558	*Cormobates leucophaea*	White-throated Treecreeper	P
Maluridae	0529	*Malurus cyaneus*	Superb Fairy-wren	P
Acanthizidae	0486	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P
Acanthizidae	0470	*Acanthiza lineata*	Striated Thornbill	P
Acanthizidae	0471	*Acanthiza nana*	Yellow Thornbill	P
Acanthizidae	0475	*Acanthiza pusilla*	Brown Thornbill	P
Acanthizidae	0484	*Acanthiza reguloides*	Buff-rumped Thornbill	P
Acanthizidae	0463	*Gerygone fusca*	Western Gerygone	P
Acanthizidae	0453	*Gerygone olivacea*	White-throated Gerygone	P
Acanthizidae	0465	*Smicrornis brevirostris*	Weebill	P
Acanthizidae	0488	*Sericornis frontalis*	White-browed Scrubwren	P
Pardalotidae	0565	*Pardalotus punctatus*	Spotted Pardalote	P
Pardalotidae	0976	*Pardalotus striatus*	Striated Pardalote	P
Meliphagidae	0640	*Acanthagenys rufogularis*	Spiny-cheeked Honeyeater	P
Meliphagidae	0591	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P

Meliphagidae	0632	*Phylidonyris nigra*	White-cheeked Honeyeater	P
Meliphagidae	0638	*Anthochaera carunculata*	Red Wattlebird	P
Meliphagidae	0614	*Caligavis chrysops*	Yellow-faced Honeyeater	P
Meliphagidae	0641	*Entomyzon cyanotis*	Blue-faced Honeyeater	P
Meliphagidae	0634	*Manorina melanocephala*	Noisy Miner	P
Meliphagidae	0578	*Melithreptus lunatus*	White-naped Honeyeater	P
Meliphagidae	0617	*Nesoptilotis leucotis*	White-eared Honeyeater	P
Meliphagidae	0646	*Philemon citreogularis*	Little Friarbird	P
Meliphagidae	0645	*Philemon corniculatus*	Noisy Friarbird	P
Meliphagidae	0625	*Ptilotula penicillatus*	White-plumed Honeyeater	P
Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P
Campephagidae	0424	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P
Pachycephalidae	0408	*Colluricincla harmonica*	Grey Shrike-thrush	P
Pachycephalidae	0416	*Falcunculus frontatus frontatus*	Eastern Shrike-tit	P
Pachycephalidae	0398	*Pachycephala pectoralis*	Golden Whistler	P
Pachycephalidae	0401	*Pachycephala rufiventris*	Rufous Whistler	P
Oriolidae	0671	*Oriolus sagittatus*	Olive-backed Oriole	P
Artamidae	*8519*	*Artamus cyanopterus Cyanopterus*	Dusky Woodswallow	V,P
Artamidae	0545	*Artamus superciliosus*	White-browed Woodswallow	P
Artamidae	0700	*Cracticus nigrogularis*	Pied Butcherbird	P
Artamidae	0705	*Cracticus tibicen*	Australian Magpie	P
Artamidae	0702	*Cracticus torquatus*	Grey Butcherbird	P
Artamidae	0694	*Strepera graculina*	Pied Currawong	P
Artamidae	0697	*Strepera versicolor*	Grey Currawong	P
Rhipiduridae	0361	*Rhipidura albiscapa*	Grey Fantail	P
Rhipiduridae	8447	*Rhipidura albiscapa alisteri*		P
Rhipiduridae	0362	*Rhipidura rufifrons*	Rufous Fantail	P
Corvidae	0930	*Corvus coronoides*	Australian Raven	P
Monarchidae	0415	*Grallina cyanoleuca*	Magpie-lark	P
Monarchidae	0366	*Myiagra cyanoleuca*	Satin Flycatcher	P
Monarchidae	9955	*Myiagra inquieta*	Restless Flycatcher	P
Monarchidae	0365	*Myiagra rubecula*	Leaden Flycatcher	P
Corcoracidae	0693	*Corcorax melanorhamphos*	White-winged Chough	P
Petroicidae	0392	*Eopsaltria australis*	Eastern Yellow Robin	P
Petroicidae	0380	*Petroica boodang*	Scarlet Robin	V,P
Petroicidae	0381	*Petroica goodenovii*	Red-capped Robin	P
Petroicidae	0382	*Petroica phoenicea*	Flame Robin	V,P
Petroicidae	0384	*Petroica rosea*	Rose Robin	P
Timaliidae	0574	*Zosterops lateralis*	Silvereye	P
Hirundinidae	0359	*Petrochelidon nigricans*	Tree Martin	P
Turdidae	0991	*Turdus merula*	Eurasian Blackbird*	

Sturnidae	0999	*Sturnus vulgaris*	Common Starling*	
Estrildidae	0662	*Neochmia temporalis*	Red-browed Finch	P
Motacillidae	0647	*Anthus novaeseelandiae*	Australian Pipit	P

Appendix 4: List of all reptile and amphibian species recorded from the Mount Canobolas State Conservation Area from Bionet

Family	Species Code	Scientific Name	Common Name	NSW status
Myobatrachidae	3131	*Crinia parinsignifera*	Eastern Sign-bearing Froglet	P
Myobatrachidae	3134	*Crinia signifera*	Common Eastern Froglet	P
Myobatrachidae	3058	*Limnodynastes dumerilii*	Eastern Banjo Frog	P
Myobatrachidae	3158	*Uperoleia laevigata*	Smooth Toadlet	P
Hylidae	3215	*Litoria verreauxii*	Verreaux's Frog	P
Scincidae	2464	*Acritoscincus platynotan*	Red-throated Skink	P
Scincidae	2375	*Ctenotus robustus*	Robust Ctenotus	P
Scincidae	2386	*Ctenotus taeniolatus*	Copper-tailed Skink	P
Scincidae	2408	*Egernia cunninghami*	Cunningham's Skink	P
Scincidae	2429	*Egernia striolata*	Tree Skink	P
Scincidae	2214	*Eulamprus heatwolei*	Yellow-bellied Water-skink	P
Scincidae	2557	*Eulamprus quoyii*	Eastern Water-skink	P
Scincidae	2441	*Hemiergis decresiensis*	Three-toed Earless Skink	P
Scincidae	2450	*Lampropholis delicata*	Dark-flecked Garden Sunskink	P
Scincidae	2451	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	P
Scincidae	2430	*Liopholis whitii*	White's Skink	P
Scincidae	2519	*Menetia greyii*	Common Dwarf Skink	P
Scincidae	2452	*Saproscincus mustelinus*	Weasel Skink	P
Scincidae	2580	*Tiliqua scincoides*	Eastern Blue-tongue	P
Agamidae	2194	*Amphibolurus muricatus*	Jacky Lizard	P
Agamidae	2182	*Rankinia diemensis*	Mountain Dragon	P
Varanidae	2271	*Varanus gouldii*	Gould's Goanna	P
Elapidae	2665	*Austrelaps ramsyi*	Highland Copperhead	P