# **BANDING PROJECT REPORT**

## No. 9

## Wianamatta Nature Reserve, New South Wales

## (Supplementary Data)

**Aim:** This is the sixth report in an *Australian Avian Communities Through Time* series (AACTT) documenting the avian faunas frequenting six sites across the north-western sector of the Cumberland Plain. The other sites on which reports have been published in this series are: Agnes Banks Nature Reserve (Farrell *et al.* 2012); Nurragingy Reserve (Farrell *et al.* 2015); Prospect Nature Reserve (Mowat *et al.* 2017); Scheyville National Park (Farrell *et al.* 2018) and Windsor Downs Nature Reserve (Farrell *et al.* 2020). As was the case at Windsor Downs Nature Reserve, the Wianamatta Nature Reserve (WNR) was impacted by wildfire during our study. This provided us with a second opportunity to explore some of the responses of birds to fire in a fragment of natural vegetation on the Cumberland Plain.

**Location:** 33° 41.6' S; 150° 43.1' E. Elevation 41 m asl. The reserve is approximately 6 kms north of the Penrith CBD.

**Description**: Wianamatta Nature Reserve (Fig.1) is bounded by The Northern Road to the east, Cranebrook Road to the northwest, Vincent Road to the south and semi-rural properties to the north-east and west. It covers an area of 181 ha. Small-acreage properties surround the reserve, except for the housing estate of Cranebrook to the south. The headwater of Rickaby's Creek commences in a swampy area near the southern boundary, forms a narrow channel and then exits the reserve at the northern-most boundary. Water flow only occurs during rain periods, but deeper pools may remain for several months. A small ephemeral creek emanating from a culvert under The Northern Road follows the north-eastern boundary. Some larger ponds within this water course hold water throughout the year. The main entrance to the reserve, off Cranebrook Road, is paved to the central area, whilst other unpaved tracks transect the reserve. The underlying geology comprises predominantly Wianamatta Shales with some overlying Tertiary alluvium.

Previously cleared areas and sections of remaining forest can be clearly delineated on the satellite image (Fig. 1). Tree species include: Thin-leaved Stringybark *Eucalyptus eugenioides*, Broad-leaved Ironbark *E. fibrosa*, Woollybutt *E. longifolia*, Grey Box *E. moluccana* and Parramatta Red Gum *E. parramattensis subsp. parramattensis* (BioNet Atlas of NSW Wildlife Gate). The reserve encompasses several endangered ecological communities,



**Figure 1.** Satellite image showing Wianamatta Nature Reserve with the locations of the Banding Station and access gates marked. The area encompassed by the yellow line indicates the area burnt during the November 2016 wildfire. Observational transect and survey plots are marked in blue.



Figure 2. Rainfall recorded at Penrith from June 2014 to June 2017.

which include predominantly Shale Gravel Transition Forest with smaller sections of the Castlereagh Swamp Woodland Community and Cooks River/Castlereagh Ironbark Forest (Biodiversity Conservation Act 2016; OEH 2014). Several endangered (E) and vulnerable (V) plant species are present in the reserve – Sydney Bush-pea *Pultenaea parviflora* (E), *Micromyrtus minutiflora* (E), Nodding Geebung *Persoonia nutans* (E), Bynoe's Wattle *Acacia bynoeana* (E) and Juniper-leaved Grevillea *Grevillea juniperina* subsp. *juniperina* (V).

When this study began, it was noted that a fire had occurred sometime previously, as evidenced by the blackened trunks of some trees. Towards the end of our 3-year study a wildfire in November 2016 burnt approximately half of the reserve (Fig. 1), having a major impact on the avifauna.

Long-term rainfall records for nearby Penrith (Penrith ID067113 Bureau of Meteorology) indicate an increase in rainfall from Spring (167.9 mm) through into Summer (267.7 mm) and then a decline in Autumn (161 mm), with Winter (106.4) mm) being the driest season (Fig. 2).

**Status history:** The Reserve was previously the 'Cranebrook Receiving Station,' which was operated by Airservices Australia as an international radio station. It was sold in 2004 and subsequently acquired by New South Wales National Parks in 2009 as part of the Wianamatta Regional Park. In 2011, it was re-designated as a nature reserve to protect its endangered flora and fauna, aboriginal heritage sites and historical significance; the remains of the old receiving station can still be seen in the centre of the original complex (Office of Environment and Heritage 2014).

**Previous published records:** Apart from a short list of birds in Wnorowski and Wnorowski (2017), there are no published bird lists specific to this site.

**Duration of Project:** Banding occurred between June 2014 and August 2017. Banding was not conducted in the following months due to inclement or extreme hot weather: July and September 2014; May and September 2015; May, June September and November 2016; March 2017.

## **METHODS**

Banding was conducted monthly (total visits = 30) when the weather was favourable. Designated net lanes were established at the commencement of this study (Fig. 3a) but these were changed after the fire (Fig. 3b), with some extra lanes being established in the unburnt area and some lanes in the burnt area not being used due to the lack of vegetation to provide background camouflage. Not all lanes were used on every banding trip due to the number of banders/trainees in attendance. The number of nets per visit averaged 15.4 (range 9-22), with an average of 252.7 m of netting being employed (range 138-354 m). Nets were generally opened 30 min after dawn and closed at approximately 1130 hrs (average duration 4.9 hrs; range 2-6 hrs) (Table 1). Incidental observations (heard or seen - including species flying over the reserve) of all species present on each visit were recorded. One team member (DM) usually camped out at the site on the night prior to a banding visit and so could record the nocturnal species present.

Capture rates (i.e. no. of individuals captured per 100 m of erected net per hour) were calculated for all species. Metal bands (supplied by the Australian Bird and Bat Banding Scheme) were attached to all birds captured. Any bird caught after its banding was classed as a 'retrap' irrespective of how often it was captured or the length of time between banding and recapture. The percentage recapture for each species was calculated as the number of re-trapped individuals as a percentage of the total number of individuals of that species banded both pre- and postfire.

To enable investigation of the use of burnt areas by birds while the vegetation regenerated during the post-fire period, all net lanes used were given a code in November 2016. This code was recorded for every bird banded, and designated where the bird was trapped i.e. in the burnt area, on the edge between the unburnt and burnt area or the unburnt area.

An 'observational' transect (Fig. 1) starting at the main gate on Cranebrook Road and finishing at the gate on The Northern Road (~1.5 km) was used to sample a range of habitats within



**Figure 3.** Location of net lanes (a) before the November 2016 wildfire – (Basemap: Google Earth (b) post-fire – (Basemap: orthomosaic of drone images captured during flights on 5th February 2017, produced by MF). The red line indicated the northern boundary of the fire. The Banding Station was relocated after the fire.

the reserve – forest, grassland, swamp and low shrubland. The same two observers walked along this transect and then back again (between 0800–1000 hrs taking approximately 1.5 hrs) in most months from July 2014 to October 2016, recording all bird species seen or heard. After the fire in November 2016, the same procedure was followed except that sightings of birds in the burnt and unburnt areas were recorded separately.

Two survey plots (200 m x 50 m) (Fig. 1) were also established, one within the burnt area and the other in an

Table 1

Banding effort from June 2014 to August 2017.

Banding Date	Hours nets open	Total length (m)	Number of nets
1.6.14	5	222	13
3.8.14	5.5	216	13
4.10.14	5.5	228	14
2.11.14	5.5	228	14
21.12.15	6	210	13
4.1.15	4.75	222	14
1.2.15	5	138	9
1.3.15	4.75	240	15
19.4.15	5	210	13
7.6.15	5	222	14
5.7.15	5	150	9
2.8.15	5	192	12
4.10.15	5	288	19
1.11.15	5	300	19
6.12.15	5	294	19
24.1.16	2	210	13
7.2.16	5.5	318	20
6.3.16	5	354	22
3.4.16	5.25	246	15
3.7.16	5	279	18
7.8.16	4.5	222	14
2.10.16	4.5	348	20
4.12.16	6	306	18
8.1.17	5	324	19
5.2.17	4	258	15
2.4.17	3	240	14
7.5.17	5	264	15
4.6.17	5	264	15
2.7.17	4.75	318	18
6.8.17	5	270	15
Average	4.9	252.7	15.4

unburnt area (Survey Plots 1 and 2, respectively). A 20-minute survey was carried out between 0900 hrs and 1000 hrs during seven banding visits between January 2017 and October 2017. Observers walked slowly along the central transect line counting and recording all birds sighted or heard within 25 m on either side (Figs 4a, b and 5).

### **RESULTS**

The number of bird species recorded (sighted, banded and heard) at WNR during this study was 106 (Tables 2, 3 and Appendix); of these, members of 39 different woodland species were banded.

The following waterbird species were recorded in the small swampy area in the south of the reserve and in several ephemeral creeks: Purple Swamphen *Porphyrio porphyrio*; Australian White Ibis *Threskiornis molucca*; Straw-necked Ibis *Threskiornis spinicollis*; White-faced Heron *Egretta novaehollandiae*; White-necked Heron *Ardea pacifica*; Australian Wood Duck *Chenonetta jubata* and Pacific Black Duck *Anas superciliosa*. The Golden-headed Cisticola *Cisticola exilis* and Plum-headed Finch *Neochmia modesta* were also



Figure 4. Photographs looking along centre line of survey plot 1 (a) one month and (b) two months after the fire showing regeneration of shrubs, ground cover and trees.



Figure 5. A view along the centre line of survey plot 2.

recorded near the swamp. Six species of diurnal raptors were sighted flying over the reserve: Brown Goshawk Accipiter fasciatus, Wedge-tailed Eagle Aquila audax, Whistling Kite Haliastur sphenurus, Black-shouldered Kite Elanus axillaris, Australian Hobby Falco longipennis and Peregrine Falcon Falco peregrinus. Nocturnal species included the Southern Boobook Ninox novaeseelandiae, Australian Owlet-nightjar Aegotheles cristatus and Tawny Frogmouth Podargus strigoides. Only one introduced species was captured (Common Blackbird Turdus merula), although four others were sighted, namely the Nutmeg Mannikin Lonchura punctulata, Spotted Dove Streptopelia chinensis, Red-whiskered Bulbul Pycnonotus jocosus and Common Myna Sturnus tristis (Tables 2, 3 and Appendix).

Summer migrant species included the Fan-tailed Cuckoo Cacomantis flabelliformis, Shining Bronze-cuckoo Chalcites lucidus, Horsfield's Bronze-cuckoo C. basalis, Eastern Koel Eudynamys orientalis, Pallid Cuckoo Cacomantis pallidus, Channel-billed Cuckoo Scythrops novaehollandiae, Dollarbird Eurystomus orientalis, Sacred Kingfisher Todiramphus sanctus, Olive-backed Oriole Oriolus sagittatus and White-throated Gerygone albogularis. Although Silvereyes Zosterops lateralis were captured in all months of the year,

there was an increase in capture rates during November 2014 and 2015 and April 2017 due to migrating flocks visiting the reserve. Similarly, the Yellow-faced Honeyeater *Lichenostomus chrysops*, although present year-round, showed peaks in capture rates in Spring in both 2014 and 2015 as migrating flocks passed through the reserve (Tables 2, 3 and Appendix).

The arrival and departure times of the Rufous Whistler *Pachycephala rufiventris* and Golden Whistler *Pachycephala pectoralis* at this site concur with those from our other sites across the Cumberland Plain. Rufous Whistlers arrived during spring and their general departure in early autumn coincided with the arrival of the Golden Whistlers (both subspecies *youngi* and *pectoralis* have been recorded at the site) which arrived in late summer/early autumn and departed in spring. There was some overlap during spring and again in autumn when both species were observed simultaneously at the site (Table 3).

The Rose Robin *Petroica rosea* was the only winter migrant recorded. The Pink Robin *P. rodinogaster* was a winter visitor to the site, but with minimal data available it would be premature to designate this species as a migrant (Table 3).

Honeyeaters of several species were the most frequently encountered birds at the site. Fourteen different species were recorded (with twelve being captured), namely the White-naped Honeyeater *Melithreptus lunatus*; Brown-headed Honeyeater *M. brevirostris*; Scarlet Honeyeater *Myzomela sanguinolenta*; Fuscous Honeyeater *Lichenostomus fuscus*; Yellow-faced Honeyeater; White-eared Honeyeater *Lichenostomus leucotis*; White-plumed Honeyeater *L. penicillatus*; New Holland Honeyeater *Phylidonyris novaehollandiae*; White-cheeked Honeyeater *P. niger*; Noisy Miner *Manorina melanocephala*; Lewin's Honeyeater *Meliphaga lewinii*; Noisy Friarbird *Philemon corniculatus* and Red Wattlebird *Anthochaera carunculata* (the last three were not captured) (Tables 2, 3 and Appendix).

Overall capture rates (Fig. 6) increased during Spring in 2014. There was a similar increase in the Spring of 2015 and during the 2015/16 Summer. These increases reflect the influx of both adult and juvenile honeyeaters into the Reserve in response to the flowering of most of the *Eucalyptus* species and particularly the

Table 2



Species recorded pre-fire but not post-fire Species recorded post-fire but not pre-fire Species (in species number order) banded at Wianamatta Nature Reserve during 2014-17 (•=seen or heard; 0.23= capture rate).

Table 3

* % Retrapped							20									50		15.8 1				5.6				13.0 1					16.7 1				3.7	7.7		_	5
Total banded post-fire				-		0	9	~	-	-				4	-	0	-	19	0		0	18				33		4	0		9	-		-	27	39			170
L1.80.80	•			•			•	0.07		•			•			0.15		0.30			•	•				0.74		0.15	•		0.67	•			•	0.67	•		2.74
L1.70.20	• •	•		0.07			0.07	0.13		•		•	• {	0.07		0.07		0.46	•							0.13		•	0.13		0.07			0.07	0.20	1.06	•		2.52
71.30.40				•		•	0.15	0.15		•		•	•	•				0.15	0.15		•					0.08		•	•		0.08				1.36	0.45	•		2.58
L1.20.70	•	•		•		0.15	0.08	0.08		•			• ;	0.15	•	0.15		0.45			•	•				0.45		•	•				•		0.15	0.45	•		2.12
71.4.17	•			•			•	0.56		•								0.14	•			1.39				0.83					0.28				0.14	0.14	•		3.47
71.20.20				•			0.19		0.10	•	•	•	0.29	•		•		0.78		•	•	•						•					•		0.29	0.10	•		1.75
71.10.80	•			•			0.25		•	0.06	•	•	•	1	0.06		0.12	0.43	•	•	•	0.06				0.25		•			•	0.06	•		0.19	0.19	•		1.67
91.21.40	•			•			0.22		0.11	0.05	•		•	0.05		0.11		0.71		•	0.11	0.49		•	•	0.54		0.16			0.33		•		٠	0.22	•	•	3.10
91.11.40						ſæ,		Н		Ж		щ																											
% Retrappe				12.5	100		53.6	23.8	33.3	57.1	1	56	14.3	i	50	40		45.7	75			11.3				27.1		5.7	33.3		23.7	14.3	11.1		9.8	22.2			
Total bande	~ -	- ~	) 4	~	-	~	28	21	12	~ `	- 1	52	4	ς	4	S		94	4	-	9	76	0	S	ŝ	140	4	105	21	-	270	63	6		41	117	ŝ		1128
91.01.20	•	0.06		0.06			0.32	0.25	0.13	0.13		0.25	0.06	•		0.06		0.70	0.06		0.06	0.32			•	0.45		0.64			1.08	0.25			0.06	•	•		4.97
91.80.70	•			•		•	•	0.20		•	•	•	0.10		0.10			0.80			•	0.40		0.10		1.30		0.40	0.10		1.10	•	•			0.20	•		4.80
91.70.60			0.07	•		•	0.14	•	•	•	•	•	• {	0.07	•			0.72	0.14		•	•		•	•	0.36		•	0.43		0.50	0.07	•		0.14	0.36	0.07	0.07	3.15
91.40.60				•			0.08	•	•	•	•	0.39	0.15		•	0.06		0.46	•		0.23	•		•	•	•		0.54	0.08		0.15		•		•	0.62	•		2.71
91.60.90	• 0	0.00		•			0.06	0.06	•	•	•	0.11						0.23	•	•	•	0.11		•		0.11		0.06	•		0.56	•	•		0.51	0.73	•		2.66
91.20.70	0.06		0.06	•			0.17		•	0.11	•		•		0.06			0.40	0.06		•	0.74		0.11	0.06	0.34	0.11	0.63	0.17		2.69	•			0.46	0.46	•		6.69
54.01.16	•			0.24			0.24		•	0.24	•	•	•	•				0.24	0.48	•		•		•	•	2.62		0.71	•		3.57	0.48	•		0.24	0.71	•	•	9.76
6.12.15			0.07	0.27			0.14		0.20	•		•	•	1	0.07			0.61	0.07		•	0.61			•	1.36		0.07			3.20	0.68	•		0.07	0.27	•		7.69
21.11.10	•	•	•	•			0.07		0.13	•	•	• 3	0.13					0.67				0.13		•	0.13	0.33		0.13	0.20		1.73	0.20	•		0.07	0.33	•		4.27
\$1.01.40		0.14	0.07	•		•	0.21	0.28	0.35	0.07		• 3	0.07					1.32	•		•	1.39		•	•	1.18		0.63	0.21		2.36	0.69	•		0.42	0.21	•		9.58
21.80.20				•	0.10		0.42	0.21		•	•	0.63	•			0.21		1.04	•		0.10	0.94		•		0.94		2.71	0.10		1.56	0.83	•			•	•		9.79
\$1.70.80				•			0.40	•		•	•	0.13	•	0.13	•			0.27				0.40				0.13		•	0.13		1.20	•					•		2.80
\$1.90.70				•	0.0	0.18	0.45	0.36		•	•	0.45	60.0	0	0.0			1.26				0.0		٠		0.63		0.09	0.18		1.35	0.18	•		•	0.45	•		5.95
\$1.40.01				•			0.10	0.38		•		0.10	•			0.19		2.38			•	0.10				0.48		0.19	0.10			•			0.38	1.05	•		5.43
21.60.10	•			•			•	•		0.18	•	•						0.53		•		0.0				0.35		•		•	0.61	•	•		0.35	1.58	•		3.68
21.20.10	• •	•	•	•			0.58	0.14	•	•	•	•	•					•		•	٠	0.43		٠	•	1.16		0.43	•		1.30	0.14	•		0.29	0.29	•		4.78
\$1.10.40	0.0			0.28			0.19		•	0.0	•		•					0.47		0.0	٠	0.28		٠	•	0.66		0.09			1.61	0.76	0.47		•	0.28	•		5.41
21.12.15	•			•			•		0.08	0.08	•	0	0.08					0.08	•	•		0.56			•	1.59		0.08			1.11	0.08	0.16		0.08	0.48	0.08		4.52
41.11.20	•			•			0.08	0.08	0.16	•	•	0.64	•			0.08		0.40	•	•	0.08	0.72		•		1.52		•	0.16		1.99	1.04	0.16		0.24	0.48	0.08		7.89
41.01.40	•		•	•			0.24	0.16	0.08	0.16	0.08	0.16	•	0.08	0.08	•		0.96	0.08	•	•	1.36	0.08	0.16	•	1.12		1.44	0.24	0.08	2.55	0.72	•		•	0.80	•		10.61
41.80.60	•			•	0.08	•	0.08	0.08		•	•	0.25	0.34	•		0.08		0.84		•	٠	0.59	0.08	0.08		0.84	0.08	0.84	0.25		1.09	0.25			0.17	•	•		6.06
41.00.10	•			•			0.18	0.0		•	•	0.81	0.27	•	0.18			1.53			•					1.17		0.0	0.0		0.81		0.0			3.51			8.83
	Geopelia striata	Chalcites hasalis	Chalcites lucidus	Rhipidura albiscapa	Petroica rodinogaster	Petroica rosea	Eopsaltria australis	Pachycephala pectoralis	Pachycephala rufiventris	Colluricincla harmonica	Smicrornis brevirostris	Acanthiza lineata	Acanthiza nana	Acanthiza pusilla	Acanthiza reguloides	Sericornis frontalis	Hylacola pyrrhopygia	Malurus cyaneus	Malurus lamberti	Dicaeum hirundinaceum	Pardalotus punctatus	Zosterops lateralis	Melithreptus lunatus	Melithreptus brevirostris	Myzomela sanguinolenta	Acanthorhynchus tenuirostris	Lichenostomus fuscus	Lichenostomus chrysops	Lichenostomus leucotis	Lichenostomus penicillatus	Phylidonyris novaehollandiae	Phylidonyris niger	Manorina melanocephala	Stagonopleura bella	Taeniopygia bichenovii	Neochmia temporalis	Cracticus torquatus	Turdus merula	
Species	Peaceful Dove	I all-allo Cavavo Horefield's Bronze-cuckoo	Shining Bronze-cuckoo	Grey Fantail	Pink Robin	Rose Robin	Eastern Yellow Robin	Golden Whistler	Rufous Whistler	Grey Shrike-thrush	Weebill	Striated Thornbill	Yellow Thornbill	Brown Thornbil	Buff-rumped Thornbill	White-browed Scrubwren	Chestnut-rumped Healthwren	Superb Fairy-wren	Variegated Fairy-wren	Mistletoebird	Spotted Pardalote	Silvereye	White-naped Honeyeater	Brown-headed Honeyeater	Scarlet Honeyeater	Eastern Spinebill	Fuscous Honeyeater	Yellow-faced Honeyeater	White-eared Honeyeater	White-plumed Honeyeater	New Holland Honeyeater	White-cheeked Honeyeater	Noisy Miner	Beautiful Firetail	Double-barred Finch	Red-browed Finch	Grey Butcherbird	Common Blackbird	Totals

Species recorded pre-fire but not post-fire. Species recorded post-fire but not pre-fire. Juniper-leafed Grevillea (Robinson 1991) (Table 3). This seasonal increase in capture rates did not occur in late 2016 (Fig. 6), which was probably at least partly due to very dry conditions (Fig. 2) which then culminated in a wildfire in November. Perhaps not surprisingly, the relatively low rates recorded for 2016 continued post-fire and throughout 2017 (Fig. 6).

The Varied Sittella *Daphoenositta chrysoptera* was the only threatened species (*NSW Biodiversity Conservation Act 2016*) recorded in the nature reserve. Sightings were documented in 27% of our visits and generally occurred from Spring to Autumn, with a flock of 10 sighted within Survey plot 2 in 2017.

Some rare sightings for the Cumberland Plain were recorded:

- Red-capped Robin *Petroica goodenovii*: this species was sighted on two occasions post-fire, foraging within the burnt section. It is now only consistently sighted at Windsor Downs and Castlereagh Nature Reserves (Saunders 2018).
- Plum-headed Finch: a single individual was sighted foraging in the swamp area, but this was probably an aviary escapee.
- Pink Robin: this species has only been sighted three times in the Sydney region prior to an individual being captured at Shaw's Creek, Hawkesbury Heights in 1984 and another at Nurragingy Reserve in 2013 (Farrell *et al.* 2016). One female captured during this study in 2014 was then retrapped twice in 2015 (Table 3). The species' recorded northern-most breeding limit is the Brindabella Range west of Canberra, so it is unlikely that this female travelled south and back again. In Canberra, this species is deemed a latitudinal winter migrant. The most likely scenario is that this female had moved from the forested valleys in the Blue Mountains to the west of the study area onto the Cumberland Plain during winter (Farrell and Hardy 2016).
- Beautiful Firetail *Stagonopleura bella*: a single individual was captured in July 2017. This species primarily frequents heathland and is found in the Heathcote and Royal National Parks to the south-east of Sydney (Patrick 2016), as well as in the Blue Mountains National Park to the west (Smith *et al.* 2019), so its occurrence at WNR is well away from its normal habitat.
- Chestnut-rumped Heathwren *Hylacola pyrrhopygia*: this species is generally found in "heathlands and scrub covering rocky ridges" (Hoskin 1991 p.142), so this individual's capture at WNR is a considerable distance away from its normal habitat, although very small numbers of this species have been recorded at both Agnus Banks and Windsor Downs Nature Reserves.

The Beautiful Firetail and Chestnut-rumped Heathwren were the only two species that were not recorded pre-fire, but both were trapped on only one occasion post-fire.

Saunders (2018) records several species as being in decline across the Cumberland Plain. Those found at WNR include:

 Peaceful Dove *Geopelia striata* – was captured or observed on more than half of our visits both pre- and post-fire. Saunders (2018) states that the Bar-shouldered Dove *G. humeralis* is increasing in numbers and may be competing with the Peaceful Dove given their similar food sources. Both species are present at Wianamatta, with Bar-shouldered Doves being sighted/heard during  $\sim 25\%$  of our visits (none were captured)

- Buff-rumped Thornbill *Acanthiza reguloides* was recorded on a third of our visits, predominantly because of its capture in our mist nets
- Double-barred Finch *Taeniopygia bichenovii* our wider study at six sites across the Cumberland Plain has documented the decline and disappearance of this species at Scheyville National Park (Farrell *et al.* 2018), Nurragingy Reserve (Farrell *et al.* 2015), Agnes Banks Nature Reserve (Farrell *et al.* 2012), and Prospect Nature Reserve (Mowat *et al.* 2017). This species was recorded frequently and in reasonable numbers throughout this study and banded both pre- and post-fire.

The Bell Miner *Manorina melanophrys* became the dominant species at our sites in Nurragingy Reserve and Scheyville National Park, but they have not been observed or heard at WNR. Their aggressive relative, the Noisy Miner *M. melanocephala*, was captured and banded at the beginning of our study. These birds were observed mainly in roadside vegetation on the edges of the Reserve and were rarely recorded in the central area of the Reserve.

#### Changes in avian assemblages

#### Banding data (Table 3).

Of the 39 species banded at the reserve, only five were not encountered post-fire. They were the Horsfield's and Shining Bronze-cuckoos, White-naped and Fuscous Honeyeaters and the Pink Robin.

Overall average capture rate, as defined above, was 6.00 (range 2.66 - 10.61) pre-fire, whilst post-fire it was 2.49 (range 1.67 - 3.47) (Fig. 6). There were higher capture rates over the spring and summer in 2014–15 and 2015–16 than in 2016–17 as a result of the fire. Very low rainfall during 2016–17 may have also been a contributing factor.

The capture rates of the six most common resident species caught were calculated for each banding day: these species were the Eastern Yellow Robin *Eopsaltria australis*, Superb Fairy-wren *Malurus cyaneus*, Eastern Spinebill *Acanthorhynchus tenuirostris*, New Holland Honeyeater, Double-barred Finch and Red-browed Finch *Neochmia temporalis* (Figs 7–12). The Eastern Yellow Robin's average daily capture rate was similar pre-fire (0.19) and post-fire (0.12), but the Superb Fairy-wren's capture rate declined by nearly 50% (0.72 to 0.43). The two granivores (Double-barred and Red-browed Finches) were little affected, with averages capture rates going from 0.17 to 0.29 and 0.58 to 0.4, respectively. The two honeyeaters were the species most affected by the fire; the Eastern Spinebill's average daily capture rate declined from 0.85 pre-fire to 0.38 post-fire, whilst the New Holland Honeyeater's rate declined from 1.46 to 0.18.

When the recorded capture sites for these six species were tabulated (Table 4), it showed that the Eastern Yellow Robin and Superb Fairy-wren were predominantly captured in the unburnt area (57% and 59.5 % of captures, respectively), but did venture



Figure 6. Overall capture rates (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.

into the burnt area to forage (28% and 27.7%, respectively). The Superb Fairy-wrens were sighted foraging during the plot surveys in the burnt area, whilst Eastern Yellow Robins were sighted feeding on insects which lacked camouflage in areas denuded of leaf litter (JF pers. obs.). Approximately two-thirds of the Eastern Spinebill and New Holland Honeyeater captures were within the unburnt area (65.8% and 68.4%, respectively). These birds rarely ventured into the burnt area (13.2% and 5.3%) of captures, respectively). In comparison, Double-barred and Red-browed Finches were trapped more often in the burnt area (50% and 43.5%, respectively) when they were feeding on grass seeds. The grasses were among the first plants to regenerate. White-browed Scrubwrens Sericornis frontalis, Silvereyes and Golden Whistlers all preferred the thicker vegetation in the unburnt area (Table 4). The number of individuals captured of other species was too low to make a valid assessment of their preferences.

### Retraps (Table 3).

No birds banded at WNR have been recovered away from the site.

The highest percentages of retrapped individuals were recorded for resident species, even though they may have only been present in relatively small numbers: Variegated Fairy-wren Malurus lamberti (75%), Grey Shrike-thrush Colluricincla harmonica (57.1%), Striated Thornbill Acanthiza lineata (56%), Eastern Yellow Robin (53.6%), Buff-rumped Thornbill (50%) and Superb Fairy-wren (45.7%). The resident honeyeater species had retrap percentages much lower than the species listed above: Eastern Spinebill (27.1%), New Holland Honeyeater (23.7%), White-cheeked Honeyeater (14.3%) and White-eared Honeyeater (33.3%). This reflects the many juvenile birds banded during the breeding season which then dispersed. As larger percentages of the Silvereye and Yellow-faced Honeyeater populations are Autumn/Winter migrants at this site, the recorded low recapture rates for these species (11.3% and 5.7%, respectively) are to be expected. The Red-browed Finch, even though it was the third most numerous species in the reserve, had a recapture rate of just 22.2%. Low retrap rates have also been documented at other sites across the Cumberland Plain for this species and have been

#### Table 4

Species banded at Wianamatta Nature Reserve showing the percentage of each captured within the burnt area, in the unburnt area and on the edge between burnt and unburnt areas.

Species	Burnt	Edge	Unburnt	n
Superb Fairy-wren	27.7	12.8	59.5	47
Red-browed Finch	43.5	23.9	32.6	46
Eastern Spinebill	13.2	21	65.8	38
Double-barred Finch	50	20	30	30
Silvereye		10	90	20
New Holland Honeyeater	5.3	26.3	68.4	19
Eastern Yellow Robin	28.6	14.3	57.1	19
Golden Whistler		11.1	88.9	9
White-browed Scrubwren		12.5	87.5	8
Yellow-faced Honeyeater	40	20	40	5
Rufous Wistler	33.3	33.3	33.3	3
Yellow Thornbill	33.3		66.6	3
Brown Thornbill			100	3
Variegated Fairy-wren		100		2
White-eared Honeyeater	50	50		2
Grey Shrike-thrush		100		2
Buff-rumped Thornbill	100			1
Grey Fantail	100			1
Rose Robin		100		1
White-cheeked Honeyeater			100	1
Beautiful Firetail		100		1

attributed to the birds moving in and out of the monitoring sites and the fact that they rarely live more than four years in the wild (Farrell 2012).

Fifty-eight individuals of 14 species that were banded prefire were retrapped post-fire (Table 3). They included members of four honeyeater species (Eastern Spinebill and Yellow-faced, White-eared and New Holland Honeyeaters), six insectivorous species (Eastern Yellow Robin, Golden Whistler, Rufous Whistler, Yellow Thornbill *Acanthiza nana*, White-browed Scrubwren and Superb Fairy-wren) and two granivorous species (Red-browed and Double-barred Finches).



Figure 7. Overall capture rates of Eastern Yellow Robins (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.



Month - Year

Figure 8. Overall capture rates of Superb Fairy-wrens (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.



Figure 9. Overall capture rates of Eastern Spinebills (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.



Figure 10. Overall capture rates of New Holland Honeyeaters (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.



Month - Year

Figure 11. Overall capture rates of Double-barred Finches (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.



Figure 12. Overall capture rates of Red-browed Finches (birds caught per hour per 100m of net erected) from June 2014 to August 2017. \* months where banding didn't occur. Red line indictaes time of wildfire.

#### Table 5

Checklist of all species recorded and counts in the two survey plots from January to October 2017.

		Survey Plot 1 (Burnt)								Survey Plot 2 (Unburnt)								
	Species	08.01.17	05.02.17	02.04.17	04.06.17	02.07.17	06.08.17	01.10.17	08.01.17	05.02.17	02.04.17	04.06.17	02.07.17	06.08.17	01.10.17			
Peaceful Dove	Geopelia striata												1					
Bar-shouldered Dove	Geopelia humeralis												1					
Rainbow Lorikeet	Trichoglossus haematodus												1	1				
Laughing Kookaburra	Dacelo novaeguineae									2								
Horsfield's Bronze-cuckoo	Chalcites basalis														1			
Welcome Swallow	Hirundo neoxena											1						
Grey Fantail	Rhipidura albiscapa		1						1			2		1	2			
Eastern Yellow Robin	Eopsaltria australis								1	2	1		1		1			
Golden Whistler	Pachycephala pectoralis					1						1			1			
Rufous Whistler	Pachycephala rufiventris														5			
Grey Shrike-thrush	Colluricincla harmonica	1							2		1	3	1	1	1			
Magpie-lark	Grallina cyanoleuca											2						
Black-faced Cuckoo-Shrike	Coracina novaehollandiae		2												1			
Weebill	Smicrornis brevirostris		2															
Yellow Thornbill	Acanthiza nana	1							7									
Brown Thornbill	Acanthiza pusilla											1						
White-browed Scrubwren	Sericornis frontalis									1					2			
Superb Fairy-wren	Malurus cyaneus		2	2	2		1	10	10	4	1	5	4	8	10			
Varied Sittella	Daphoenositta chrysoptera									10								
Mistletoebird	Dicaeum hirundinaceum		1															
Spotted Pardalote	Pardalotus punctatus									3								
Brown-headed Honeyeater	Melithreptus brevirostris														1			
Eastern Spinebill	Acanthorhynchus tenuirostris						3		3		2	2		2	1			
Yellow-faced Honeyeater	Lichenostomus chrysops									3		3		3	2			
White-eared Honeyeater	Lichenostomus leucotis						2					1						
New Holland Honeyeater	Phylidonyris novaehollandiae								2		3	3	1	3	17			
White-cheeked Honeyeater	Honeyeater Phylidonyris niger								2									
Double-barred Finch	Taeniopygia bichenovii									1								
Red-browed Finch	Neochmia temporalis						10				1				2			
Grey Butcherbird	Cracticus torquatus						1				1							
Australian Magpie	Cracticus tibicen						1						2					
Little Wattlebird	Anthochaera chrysoptera														1			
Australian Raven	Corvus coronoides												1		1			

#### Observational transect (Table 2).

Pre-fire observations made over 2.5 years yielded 54 species, with an average of 13 species per visit (range 5-23), whilst one year of post-fire observations (burnt plus unburnt areas) yielded 37 species. In the year after the fire, the average number of species observed per visit for the unburnt area was 5.9 (range 3-13) and that for the burnt area 6.5 (range 3-8); however, these figures do not indicate abundance. Twenty-two species sighted pre-fire were not recorded post-fire. As the fire burnt the swamp area and areas beside Rickaby's Creek, birds associated with these habitats were directly affected and most had not returned one year post-fire (e.g. Straw-necked Ibis, White-faced Heron). The four introduced species sighted pre-fire were not recorded post-fire. As most of the 22 species not recorded post-fire were sighted only occasionally pre-fire, they may conceivably return as the habitats recover. Only five species (Crested Pigeon Ocyphaps lophotes, Black-shouldered Kite, Peregrine Falcon, White-throated Treecreeper Cormobates leucophaea and Brown-headed Honeyeater) were not recorded pre-fire but were sighted post-fire, although only on a single occasion each.

#### Survey plots (Figures 4–5 and Table 5).

Of the 33 species recorded in both survey plots, only 13 were observed within the burnt area. The burnt plot had a mean of 2.4 species per visit, whilst the unburnt plot's average was 9.4. As the burnt plot regenerated, more species and individuals were sighted, although most of these birds were either flying through or over the plot. Superb Fairywrens were the most prevalent here, as they foraged among the burnt stalks and within the sprouting regrowth. Small flocks of Red-browed Finches were observed, mainly feeding among the regenerating grasses. Weebills *Smicrornis brevirostris* and Yellow Thornbills were observed foraging among the epicormic shoots sprouting from some of the taller trees.

As expected, the unburnt plot where the plants escaped damage exhibited a greater variety of insectivores and honeyeaters, with the Superb Fairy-wren and New Holland Honeyeater being the most numerous species.

## DISCUSSION

Observations from the survey plots and the observational transect gave contrasting results regarding the number of species sighted within the unburnt versus burnt areas. On average, more species were sighted in the unburnt than the burnt survey plot, whilst the observation transect results showed the opposite trend. However, this was a consequence of our sampling technique. Survey data were collected from same-sized burnt and unburnt plots, whereas the burnt area traversed during the observational transect formed ~75% of the total distance covered. Added to this was the ease of sighting birds that consistently utilised the burnt area (e.g. Double-barred Finch, Superb Fairy-wren and Australian Raven *Corvus coronoides*).

Overall, of the 106 species observed (sighted/heard/ trapped) from June 2014 to October 2016, 38 had not returned 8 months after the November 2016 fire. However, many of these species were only observed on one or few occasions pre-fire, so their return over a greater observation period postfire is likely. The species most affected by the fire were the honeyeaters, for which capture rates and sightings declined appreciably post-fire. This was due to large areas containing their main food source, *Grevillea juniperina*, being burnt. The insectivorous species could utilise the burnt areas where a more open landscape gave them ready access to their principal food source, whilst the granivores could exploit the grasses that regenerated.

A similar scenario occurred at Windsor Downs Nature Reserve where two insectivorous species, the Superb Fairywren and Eastern Yellow Robin, could exploit a small area of the reserve that was burnt for hazard reduction (Farrell *et al.* 2020). The bird community, in this instance, quickly reestablished itself over several succeeding months.

At WNR, the Superb Fairy-wren and Red-browed Finch, in particular, could exploit the regeneration of vegetation, although it may take some time for the honeyeaters to return to the numbers recorded pre-fire.

Saunders (2018), utilizing the Cumberland Bird Observers Club Inc. bird database records from 1970 to 2018, lists 20 species that have declined in numbers on the Cumberland Plain, whilst Barrett (2007), when comparing atlas data (Atlas 1, 1977–1981, Blakers *et al.* 1984; Atlas 2, 1998–2001, Barrett *et al.* 2003) for NSW, documents a decline in 80 species, which is a greater percentage than that recorded for the whole of Australia. This emphasises the importance of areas such as WNR, in addition to the other five sites in our overall study across the fragmented, remnant, natural habitat of the north-western sector of the Cumberland Plain.

#### CONCLUSION

Urbanisation, resulting in loss of natural vegetation across the north-western sector of the Cumberland Plain, has increased over the past decade, with many new housing estates being developed between Penrith, Blacktown and Richmond. In some instances, efforts have been made to preserve small remnant woodland patches within some of these developments (e.g. Jordon Springs, which is situated on an old Australian Defence Industry Site), but these need to be larger as many are too small to harbour a full complement of woodland bird species. These smaller areas are often overwhelmed by aggressive bird species, such as Bell Miners, Noisy Miners and Common Mynas, and are more likely to be impacted by predators (e.g. domestic/feral cats *Felis catus*). As few relatively large areas of suitable bird habitat remain on this section of the Cumberland Plain, it is essential to preserve what remains (e.g. the unused Airservices Australia site at Shanes Park adjacent to Wianamatta Regional Park (URS 2008)), so that future generations of inhabitants and visitors can still appreciate the rich diversity of birds that these woodlands contain.

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## **APPENDIX 1**

Incidental records (seen or heard but not trapped) of bird species at Wianamatta Nature Reserve from June 2014 - August 2017 (in species number order).

	.14	.14 .14	.14	.15	.15 .15	<u>دا.</u> 15	.15	.15	.16	.16	.16	.16	.16 16	.17	.17	.17	.17	.1/
Species	06	.10	.11	01	0.0	0.00	10	.12	10.1	03	0.07	.108	E		0.02	.05	90.1 06	208
	010	6	$\frac{02}{21}$	010	19	020	10	00	24		303	002	04	80	05	0120	98	100
Stubble Quail Coturnix pectoralis									•		•							
Bar-shouldered Dove Geopelia humeralis		٠	•		•				•			٠		٠			• •	)
Common Bronzewing Phaps chalcoptera											•	•	F					
Crested Pigeon Ocyphaps lophotes													Ι		٠			
Purple Swamphen Porphyrio porphyrio													R			٠	•	•
Australian Pelican Pelecanus conspicillatus						•							E					
Masked Lapwing Vanellus miles	•	٠	•	•		• •			•	•	• •			•		٠		
Australian White Ibis Threskiornis molucca	•																•	•
White-faced Heron Egretta novaehollandiae			•															
White-necked Heron Ardea pacifica			•	•					•								•	
Australian Wood Duck Chenonetta jubata	•				•	•					•	•						
Pacific Black Duck Anas superciliosa					٠	•		•	•						•			
Brown Goshawk Accipiter fasciatus	•						•			•				٠				
Whistling Kite Haliastur sphenurus				•														
Peregrine Falcon Falco peregrinus	•																	
Southern Boobook Ninox novaeseelandiae					•						•							
Rainbow Lorikeet Trichoglossus haematodus	• •	•	• •	• •	• • •		•	• •	• •	•	• •	• •		•	•	•	•	•
Little Lorikeet Glossopsitta pusilla					•			•				•			•		•	
Yellow-tailed Black Cockatoo Calyptorhynchus											-							
funereus			•	• •	•	• •		•	•	•	•	•		•	•			•
Sulphur-crested Cockatoo Cacatua galerita											•							
Little Corella Cacatua sanguinea			•		•	•		• •			•						•	•
Galah Eolophus roseicapillus				• •	•		•		• •		•			٠	•	•	•	•
Eastern Rosella Platycercus eximius					•	•					•	•						
Red-rumped Parrot Psephotus haematonotus									•	•								
Tawny Frogmouth Podargus strigoides					• •			•				•				٠	•	•
Australian Owlet-nightjar Aegotheles cristatus							•			•	•			٠	•			
Dollarbird Eurystomus orientalis								•										
Laughing Kookaburra Dacelo novaeguineae	• •	•	• •	•	•	• •	•	• •		•	•	•		•	•		•	•
Sacred Kingfisher Todiramphus sanctus			•					• •										
White-throated Needletail Hirundapus caudacutus				•											•			
Pallid Cuckoo Cacomantis pallidus					•		•							٠				
Eastern Koel Eudynamys orientalis				•				٠										
Channel-billed Cuckoo Scythrops novaehollandiae	1							•	•			•						
Welcome Swallow Hirundo neoxena	• •					• •	•			•	•			•		٠	•	•
Rufous Fantail Rhipidura rufifrons											•							
Leaden Flycatcher Myiagra rubecula				•														
Restless Flycatcher Myiagra inquieta																٠		
Magpie-lark Grallina cyanoleuca	•	٠	• •	•	• •	•			•		• •	• •		•	•	٠	• •	•
Crested Shrike-tit Falcunculus frontatus								•				•						
Black-faced Cuckoo-Shrike Coracina		•		• •	• •				•	•	•			•				
novaehollandiae			•	•••	•••			•	• •		•	•				•		
White-bellied Cuckoo-shrike Coracina papuensis									•	•								
White-throated Gerygone Gerygone albogularis			• •		•		•	• •	• •									
Golden-headed Cisticola Cisticola exilis							•		•									
Varied Sittella Daphoenositta chrysoptera	•				•		•	•	• •						•			•
Lewin's Honeyeater Meliphaga lewinii								•										
Red Wattlebird Anthochaera carunculata	•	•	•		• •	• • •	•	٠			•	• •			•			•
Noisy Friarbird Philemon corniculatus			•	•	•			• •	•		•	•						
Olive-backed Oriole Oriolus sagittatus				•														
Satin Bowerbird Ptilonorhynchus violaceus					(	•												
White-winged Chough Corcorax melanorhamphos								٠							•			•
Pied Currawong Strepera graculina	• •	•	•	•		• •	•	• •			•	• •						•
Australian Magpie Cracticus tibicen	•	•		• •	•	•	•	•	• •		• •	•			•	•	• •	•
Australian Raven Corvus coronoides	• •	•	• •	• •	• • •	• • •	•	• •	•	•	• •	• •		•	•		• •	•
Spotted Dove Streptopelia chinensis				•				• •						٠				•
Red-whiskered Bulbul Pycnonotus jocosus			٠														•	
Common Myna Sturnus tristis							٠	•		•		•		٠				•
													_		_			

Species recorded pre-fire but not post-fire. Species recorded post-fire but not pre-fire.