Avifaunal communities of the River to River Corridors Project study area: April 2011 survey report

for

The River to River Corridors Project

InSight Ecology

June 2011

Avifaunal communities of the River to River Corridors Project study area: April 2011 survey report

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for

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June 2011

This is Report 4 in a series for the River to River Corridors Project - a joint initiative of the City of Ryde, Hunters Hill Council, Sydney Metropolitan Catchment Management Authority, local flora and fauna conservation organisations, Bushcare groups, and local residents, with funding from the NSW Environmental Trust.

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Photographs: Front cover (from top, then left to right down panel) –Lane Cove River from footbridge at end of Magdala Road; eucalypt gully forest in Lane Cove National Park (NP) between Lane Cove River and Delhi Road; recent riparian revegetation at Riverglade Reserve, Hunters Hill; Powerful Owl *Ninox strenua*; older eucalypt forest in Lane Cove NP near site shown in second photograph above; Gladesville bridge over Parramatta River, from Betts Park at Huntleys Point. All of these photographs were taken by InSight Ecology. Other photographs in this document without credits were taken by InSight Ecology.

Acknowledgements

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This study is part of the River to River Corridors Project which is funded by the NSW Environmental Trust, City of Ryde, Sydney Metropolitan Catchment Management Authority, and Hunters Hill Council. The project is managed by Sam Cappelli (Manager, Environment at City of Ryde) and his team. A Community Reference Group has also been established.

This report and the survey upon which it is based benefited from discussions with and information from a range of people and organisations in the Ryde-Hunters Hill district. They include Gith Strid-Nwulaekwe (City of Ryde) and Kristin Gabriel (City of Sydney and formerly City of Ryde), Jacqui Vollmer (Hunters Hill Council), Adam Smith and Fiona Morrison (City of Ryde), Bev Debrincat and Kurtis Lindsay (Habitat Network and Ryde Hunters Hill Small Bird Project), Cathy Merchant (Ryde-Hunters Hill Flora and Fauna Preservation Society), and Andrew Duffy (Office of Environment and Heritage [OEH] at Lane Cove National Park). Historical bird data was referred to in NSW Atlas of Wildlife (OEH), Australian Museum Fauna Database, Bird Atlasses I and II (Birds Australia), and in discussions with experienced local amateur ornithologists.

Permission to access publicly and privately owned land in the study area was obtained from Office of Environment and Heritage in NSW Department of Premier and Cabinet, City of Ryde, Hunters Hill Council, Holy Cross College Ryde, and Catholic Theological Union (for access to Villa Maria property, Hunters Hill). Rachel Danos and Michael McCormack of Holy Cross College Ryde were particularly supportive of the survey and overall project.

The support and enthusiasm of these organisations, groups and individuals is gratefully acknowledged.

Executive summary

Urban landscapes are complex interacting systems driven by constant change and re-adjustment. The urbanisation of Sydney has removed, fragmented and substantially modified habitat for native plants and animals. In inner zones such as Ryde-Hunters Hill these effects have been largely historical with the last phase of large-scale clearing of native vegetation occurring over 60 years ago. In outer areas, however, habitat continues to be lost or degraded as Sydney sprawls west, north-west and south-west.

As a consequence, episodes of local extinctions of biota have occurred and are still happening. Species unable to move through parts of their former ranges now surrounded by a hostile matrix of sealed surfaces and unsuitable habitat have become isolated within increasingly small and pressured bushland remnants. For birds, these have been species dependent on ground and shrub cover and food and breeding resources provided by a diversity of quality habitats. In Ryde-Hunters Hill district, the extinction of bush birds such as Spotted Quail-thrush, Eastern Bristlebird, Speckled Warbler, Superb Lyrebird, Rockwarbler and White-fronted Chat – the latter a saltmarsh specialist now confined to just two small populations in Sydney – are cases in point. Other bushland bird species appear to be currently in population decline, placing them at risk of local extinction over time.

A total of 1,755 individual birds from 28 families, 51 species and 14 foraging guilds were recorded during the survey in the River to River Corridors Project study area. Bushland remnants accounted for 78.4% (40) of all bird species recorded in the survey - only two (Common Myna and Red-whiskered Bulbul) of these species were introduced from overseas. Twelve foraging guilds occurred in bushland remnants and included native insectivores, nectarivores/insectivores, nectarivores, granivores, carnivores, omnivores, frugivores, and a frugivore/insectivore.

Bird communities of the study area are a mix of remnant indigenous forest species and ubiquitous native and introduced urban birds. Lane Cove River valley and its tributaries - Buffalo Creek, Kitty's Creek, and to a lesser extent, Tarban Creek - exert a strong influence over the structure and composition of these communities. Remnant sandstone and shale forest habitats along these zones still support small breeding populations of indigenous birds that have disappeared from much of urban Sydney, e.g. Eastern Yellow Robin, Golden Whistler, White-throated Treecreeper, Eastern Whipbird and Striated Thornbill. Importantly, these habitats also function as corridors for the movement of migratory and nomadic birds such as flycatchers, gerygones, cuckoos and honeyeaters.

In contrast, urban neighbourhood, open parkland and revegetated parkland habitats were characterised by more individual birds but fewer species than found in bushland remnants. Urban neighbourhood sites supported 630 birds from 21 different species including 4 introduced taxa across 11 guilds. Ground granivores (e.g. Rock Dove, Spotted Dove, Crested Pigeon, Long-billed Corella), omnivores (e.g. Common Myna, Common Starling, Pied Currawong and Australian Raven), nectarivores/insectivores (Noisy Miner and Red Wattlebird) and frugivores (Australasian Figbird and Olive-backed Oriole) were the main urban neighbourhood guilds present. Open parkland sites comprised 462 birds from 26 species across 9 guilds which

were dominated by ground granivores, omnivores and ground insectivores. Revegetated parkland sites supported 266 birds from 23 species and 10 guilds, the main guilds being ground insectivores, omnivores, nectarivores/insectivores and ground granivores. Revegetated parkland and small forest remnants (Riverglade Reserve, Mallee and Tyagarah Reserves, Betts Park) supported small, isolated populations of Variegated Fairy-wren, White-browed Scrubwren, and Yellow Thornbill.

The indigenous urban-adaptees Rainbow Lorikeet (317 individuals) and Noisy Miner (249) were the most abundant birds recorded during the survey. Other abundant species included Welcome Swallow, the introduced Common Myna, Long-billed Corella, Pied Currawong, Crested Pigeon, Australian Magpie and Superb Fairy-wren. Open parkland and urban neighbourhood habitats accounted for more individuals of these species than other greenspace types. Superb Fairy-wrens were present in higher numbers in revegetated parkland than other greenspace types.

Several pronounced changes in the bird communities of the study area were detected in the autumn survey relative to the previous spring survey. These featured an 8.9% reduction in the total number of birds recorded in autumn compared with spring, substantially reduced numbers of birds in bushland remnants (37% less birds) and urban neighbourhood sites (22% less birds), marked influxes of mostly open country birds to urban neighbourhood (40% more birds) and revegetated parkland (20% more birds) sites, an apparent shift of omnivores, nectarivores/insectivores and ground granivores to open parkland and urban neighbourhood habitats, reduced species richness in bushland remnants (32% fewer species) and revegetated parkland (25% fewer species) sites, and reduced presence of some core forest bird guilds, especially shrub insectivores, nectarivores/insectivores, canopy insectivores and carnivores, from bushland remnant sites with apparent declines in food availability, emigration of warm season breeding migrants and natal dispersal. Other factors likely to be implicated in these interseasonal bird community changes are discussed in this report.

Managing Ryde-Hunter Hill's avifauna and their habitat requires knowledge of how birds utilise greenspace and interact with each other and their environment at different spatial and temporal scales. This study is supplying new ecological data to help understand and manage these interactions for long-term conservation outcomes. This includes baseline monitoring and evaluation of the performance of proposed new corridor plantings as bird habitat.

Contents

1. Introduction

1.1 Project background

The importance of retaining and integrating viable habitat for biodiversity with human living space has been recognised worldwide (Secretariat of the Convention on Biological Diversity 2006; UNEP Convention on Biological Diversity 2007; Natural Resource Management Ministerial Council 2010). Central to this is a need to understand how biota interacts and functions in complex urban ecosystems, a task that has not yet been accomplished (McDonald et al. 2008; Pickett et al. 2011). Knowledge of how animals utilise different types and configurations of greenspace is essential to guide ecologically sustainable urban planning and design (Commonwealth of Australia 2005; Pickett and Cadenasso 2006; Alberti 2010).

In Sydney, there has been substantial investment in the revegetation of riparian zones, residential streets, parks and housing estates, major transport arteries, and former industrial sites over the past 30-40 years (NSW Department of Planning 2005, 2010). However, there has been little attention paid to determining whether this work is facilitating or hindering the movement and conservation of native fauna and their habitat in these landscapes. For instance, Sydney's inner-west councils have rehabilitated and revegetated tracts of native vegetation along the Cooks River (Cooks River Foreshores Working Group 2006). Similar work has been undertaken by City of Ryde and Hunters Hill Council in the study area at Mallee Reserve and along Tarban Creek at Riverglade Reserve (Ryde Flora and Fauna Study 2006-2008; Hunters Hill Council 2009). While these efforts are addressing soil erosion, urban water quality management, and habitat protection and restoration objectives, their contribution to facilitating the movement and dispersal of native fauna has not been properly assessed.

Associated with this is a pressing need to establish functional wildlife corridors across suitable areas of suburban Sydney. These aim to allow area- and dispersal-limited species to move between isolated patches of habitat to forage and reproduce. This project studies local bird communities to inform the design and implementation of two key wildlife corridors in Ryde-Hunters Hill district over the period 2010-2013 and beyond.

1.2 Objectives

The River to River Corridors Project will:

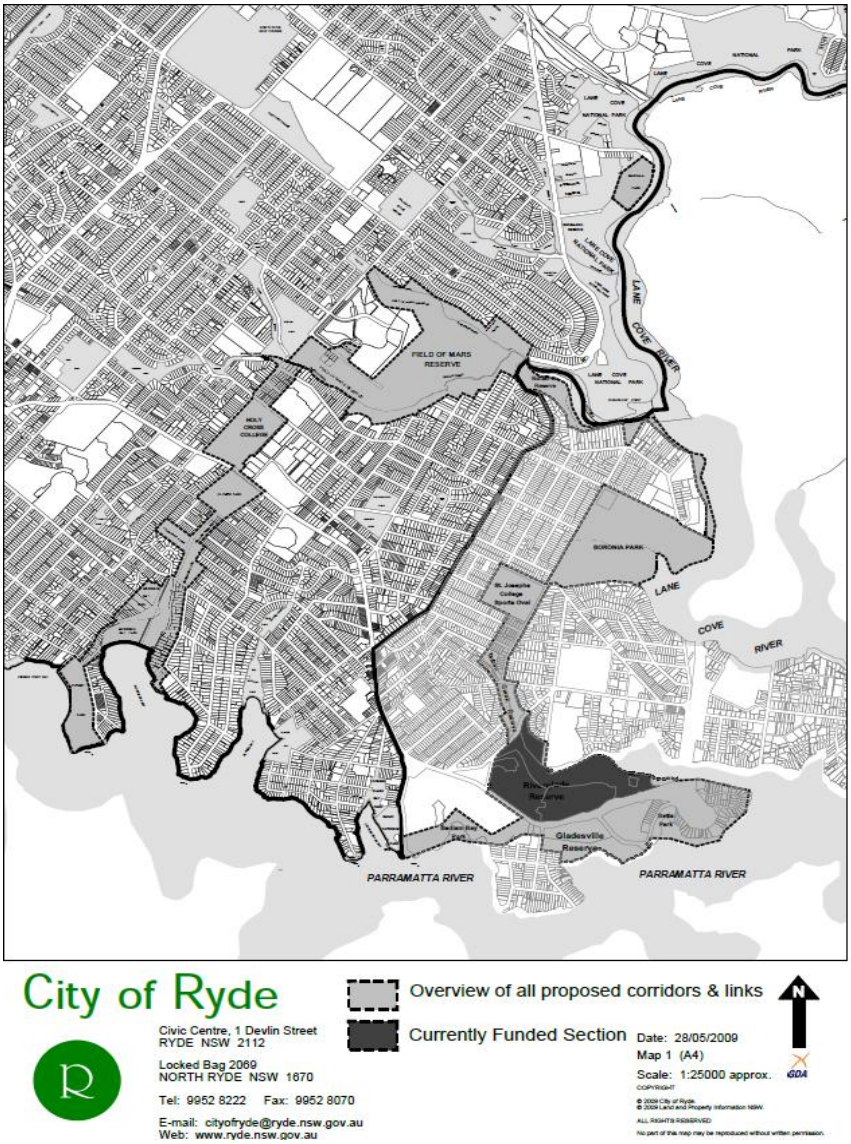
- Describe the composition, structure and habitat requirements of bird communities in different greenspace types in the study area (defined in Figure 1);
- Re-connect two corridors for bushland birds and other fauna based on data obtained from the baseline bird surveys and other studies, best-practice habitat rehabilitation techniques, and effective community participation;
- Enhance the connectivity and condition of existing urban bushland along both corridors;
- Promote community involvement in and ownership of the corridors, especially their monitoring and maintenance over time.

This document reports on the results of an avifaunal survey of the study area conducted in autumn (April) 2010. This is the second in a set of four replicated field investigations of the

avifauna of this area – the first being the spring (October) 2010 survey (InSight Ecology 2011a). Specifically, this report:

- Describes the relative abundance, species richness, composition, and habitat use of bird communities in 4 different types of greenspace sampled during the survey;
- Provides baseline data to help inform the selection and management of corridor planting sites and provide key reference points for later assessment of corridor performance over time;
- Enhances current knowledge of the biology and ecology of birds of bushland remnants and open urban landscapes in Sydney.

Figure 1: Location of the River to River Corridors Project study area (image: City of Ryde)



2. Methods

2.1 Literature review

A review of existing information on the avifauna and habitats of the study area was undertaken prior to the commencement of the first (October 2010) avifaunal field survey. This included unpublished reports of past fauna surveys (e.g. Ryde Flora and Fauna Study 2006-08), existing reserve management plans, and maps and reports of bush regeneration and habitat restoration projects conducted in the study area. Bird Atlases I and II (Birds Australia), Atlas of NSW Wildlife (OEH), and Australian Museum's Fauna Database were also reviewed for records of bird species in the study area.

2.2 Field survey

2.2.1 Selection of sites

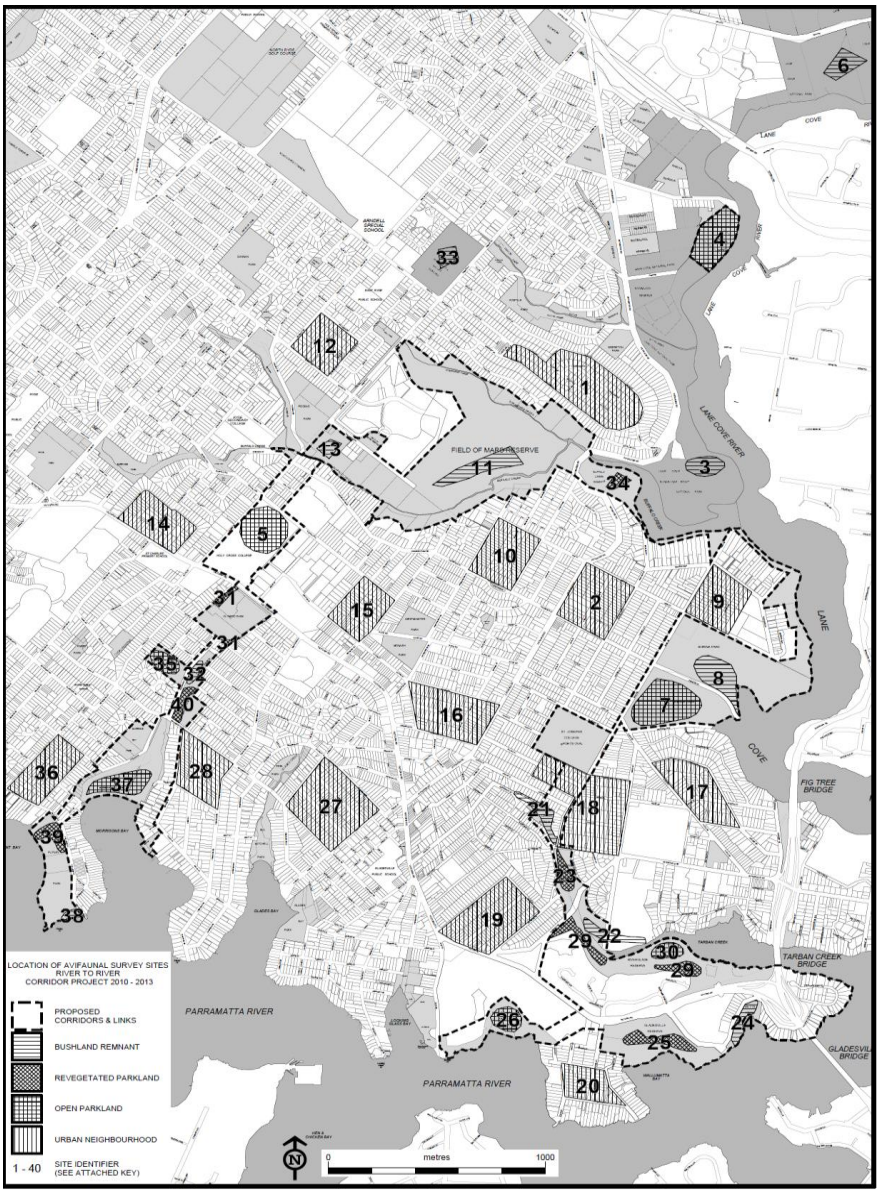
Inspections of the study area were undertaken in March 2008 and October 2010. A sampling design was developed based on the results of these visits, previous bird surveys of western Sydney greenspace undertaken by InSight Ecology, and discussions with City of Ryde and Hunters Hill Council staff.

A total of 4 greenspace types were surveyed in the study area. These included bushland remnant, revegetated parkland, open parkland, and urban neighbourhood. Bushland remnant sites comprised mainly remnant indigenous vegetation characteristic of Sydney's formerly extensive forest and woodland that existed prior to intensive urban development. The main bushland remnants occur in Lane Cove NP, Field of Mars Reserve (Wildlife Refuge), Wallumatta NR and Boronia Park Reserve. The latter reserve contains the endangered ecological community (EEC) of Sydney Turpentine Ironbark Forest (STIF), open forest on exposed sandstone slopes (Sydney peppermint, red bloodwood and smooth-barked apple) and sandstone gully forest (blackbutt, blueberry ash and black wattle). Wallumatta NR supports sandstone-shale transition eucalypt forest while Tarban Creek Reserve contains a small pocket of open eucalypt forest on sandstone. Small isolated remnants were also surveyed at Betts Park, Putney Point and Mallee and Tyagarah Reserves, the latter supporting a STIF EEC. Revegetated parkland sites consisted of mostly native tree, shrub and ground cover species planted in blocks or strips at Buffalo Creek, Tarban Creek, Riverglade and Gladesville Reserves and Putney, Olympic and Bremner Parks. These were typically bush regeneration or beautification projects undertaken by City of Ryde, Hunters Hill Council and volunteer Bushcare groups. Open parkland sites featured areas dominated by open grassed and paved surfaces with some narrow rows or isolated beds of planted indigenous and exotic vegetation. These typified open recreational space and included several parks with playgrounds, picnic areas, sporting ovals, car parks, and facilities. Urban neighbourhood sites were blocks of usually four residential streets featuring sealed surfaces (roads, streets and footpaths), mown verges of planted and mostly established native and exotic trees and shrubs, overhead powerlines, and houses with or without planted native and exotic shrubs, trees and garden beds in their yards.

A total of 40 sites were surveyed for birds in the study area (Figure 2). Of these, 11 were bushland remnant, 7 revegetated parkland, 7 open parkland, and 15 urban neighbourhood sites. These include:

1 Moncrieff Drive, East Ryde (urban neighbourhood = UN)
2 Blaxland Street, Boronia Park (UN)
3 Lane Cove National Park at Sugarloaf Point (bushland remnant = BR)
4 Magdala Park, East Ryde (open parkland = OP)
5 Holy Cross College, Ryde (OP with planted boundary)
6 Lane Cove National Park north (BR)
7 Boronia Park (OP)
8 Boronia Park (BR)
9 Park Road, Boronia Park (UN)
10 Westminster Road, Gladesville (UN)
11 Field of Mars Reserve (Wildlife Refuge) Site A (BR)
12 Badajoz Road, Ryde (UN)
13 Field of Mars Reserve (Wildlife Refuge) Site B (BR)
14 Beazley Street, Ryde (UN)
15 Monash Road, Gladesville (UN)
16 Eltham Street, Gladesville (UN)
17 Abigail Street, Hunters Hill (UN)
18 Mary Street, Hunters Hill (UN)
19 Hillcrest Avenue, Hunters Hill (UN)
20 Kelly Street, Henley (UN)
21 Tarban Creek Reserve, Gladesville (BR)
22 Tarban Creek north bank including Villa Maria property, Hunters Hill (BR)
23 Tarban Creek Reserve, Gladesville (revegetated parkland =RP)
24 Betts Park, Huntleys Point (BR)
25 Gladesville Reserve, Henley/Huntleys Point (RP)
26 Bedlam Bay Regional Park, Gladesville/Henley (OP with woody weeds and some remnant/old planted trees)
27 Western Crescent, Gladesville (UN)
28 Tennyson Road, Gladesville (UN)
29 Riverglade Reserve, Huntleys Cove (RP)
30 Riverglade Reserve, Huntleys Cove (OP)
31 Olympic Park, Ryde (RP)
32 Mallee Reserve, Ryde/Gladesville (BR)
33 Wallumatta Nature Reserve, North Ryde (BR)
34 Buffalo Creek Reserve, Hunters Hill (RP)
35 Tyagarah Reserve, Ryde (OP with weedy small bush remnant)
36 Stanley Street, Putney (UN)
37 Morrison Bay Park, Putney (OP)
38 Putney Point, Putney (BR)
39 Putney Park, Putney (RP)
40 Bremner Park, Gladesville (RP)

Figure 2: Location of avifaunal survey sites in the study area (courtesy City of Ryde)



2.2.2 Survey methods

Terrestrial bird species were surveyed at each site in the study area. In bushland remnants and larger parkland sites the area search technique (Loyn 1987; InSight Ecology 2008) was deployed. This involved the surveyor steadily walking a loop route in which different forward and return legs, separated where possible by a distance of at least 100 metres, were taken through the main habitats present at each site. In urban neighbourhood sites, a block defined by usually 4 streets was walked, at a steady pace, along footpaths so that each route enclosed the entire sampled block without duplication of the course taken. The area of each of these blocks varied between approximately 5 and 10 ha, depending on allotment size and configuration and street width and length. Single line transects were walked in smaller sites (ie. Riverglade Reserve, Putney Point, Putney Park, Mallee Reserve, Tyagarah Reserve, Bremner Park and Olympic Park) where it was not feasible to deploy the area search method.

The order of surveying sites was reversed for this survey from that used in the first spring (October 2010) sampling effort which involved working from the north of the study area to its south. That is, the April 2011 survey commenced in the central and southern sectors of the study area – ie. Olympic Park, Mallee Reserve, Tyagarah Reserve to Putney Park and around to Bedlam Bay, Gladesville Reserve, Betts Park, Riverglade Reserve, Tarban Creek Reserve and nearby urban neighbourhood sites - continuing to northern sites including Boronia Park, Field of Mars Reserve (Wildlife Refuge), Lane Cove National Park, Wallumatta Nature Reserve and nearby parkland and urban neighbourhood sites. This change was undertaken to minimise the potential for the introduction of location or geographic bias into bird abundance, species richness and community structure data collected. This can arise when the same or similar geographical routes are taken to survey especially resident bird communities over more than one season. In addition, sites surveyed in the morning in spring (October 2010) were surveyed in the afternoon in autumn (April 2011). This mitigated against the introduction of time-of-day sampling bias in bird data obtained between the two different seasons.

All area searches and block walks avoided recording the same bird twice, particularly flocking, communally-living, and fast or very frequently moving species such as Noisy Miner, Rainbow Lorikeet, Welcome Swallow, Galah and Long-billed Corella. Particular care was taken in some parkland sites where, due to the small size of the reserve, forward and return search legs occurred within 100 metres of each other. This also helped to avoid committing the same error with more sedentary species such as Masked Lapwing, Australian Magpie, Magpie-lark, and Grey Butcherbird that often employ stalking or "sit-and-wait" foraging strategies.

All birds observed or heard at a site or along a line transect were recorded, including individuals flying over the site. Data recorded included the species present, number of individuals observed, sampling period, date, time and location of record, greenspace type, behaviour (ie. foraging/feeding, breeding, calling, mobbing, resting, flying), use of habitat, and other relevant information such as age, species composition and condition of remnants, revegetation and urban neighbourhood vegetation, weather, and bird interactions (eg. predation, predator avoidance, mating/mate pursuits). Using nomenclature consistent with Christidis and Boles (2008), these data were entered into a MS Excel spreadsheet in taxonomic order. All observations were made by the same experienced observer (A.H.) using a pair of Zeiss 10x40BT® binoculars fixed to a Pro-Harness® chest-strap. The survey was undertaken over a 10-day period in autumn (April 6-15) 2011. Surveys were generally conducted in peak morning (0730-1100 hours) and afternoon (1500-1730 hours) bird foraging periods (survey sessions) on each survey day. No surveying occurred in windy or wet weather. Three sessions or 21% of total survey time (14 sessions) were lost to wet and/or windy weather. This was offset by including additional sessions within the 10-day sampling window.

A total of 20.75 hours was spent on surveying birds in the study area. This was comparable to the October 2010 total survey effort of 24.75 hours. Bushland remnant sites were surveyed more intensively than other greenspace types - for 9.2 hours (50 minutes per site) or 44.6% of the total survey effort. Urban neighbourhood sites, in contrast, were surveyed for a total of 5.2 hours (21 minutes per site) representing 24.9% of the total survey effort. Revegetated parkland sites were surveyed for 3.2 hours (28 minutes per site) or 15.7% of the total effort. Open parkland sites were surveyed for 3.1 hours (26 minutes per site) or 14.9% of total survey time.

This distribution of survey effort across the different greenspace types was comparable with the spring (October 2010) survey program.

This variance in proportionate survey effort between remnant bushland and parkland and urban neighbourhood sites was not considered to significantly affect the results obtained or their interpretation. Bushland remnants often provide a broader and more complex suite of bird habitats and thus support taxonomically richer avian assemblages than revegetated and developed sites. Thus, they may require more survey effort per unit area to obtain an accurate sample of bird abundance, species richness, community structure and habitat use.

To aid reading, this report generally presents the common names of birds. Their scientific names are provided in the appendices.

2.3 Habitat assessment

A suite of habitat attributes were recorded at representative sites in each greenspace type in the study area. These included dominant plant species and community present, height of main tree species present, habitat condition and connectivity (remnants and revegetation), vegetation structure (in bush remnants and revegetated parkland), bird use of habitats present, estimated age and species composition of plantings (in revegetated parkland and urban blocks), type of urban neighbourhood habitats (ie. street verge, built structures, front- and rear-yard vegetation), and extent and type of disturbance (i.e. presence of weeds, feral and domestic animals, evidence of predation, level of human incursion). Attributes of landscape context were also noted for selected sites in different greenspace types, i.e. distance of planted or remnant vegetation to nearest neighbouring vegetation patch, position in the local and regional landscape, pattern of vegetation distribution, and edge type and size.

The photographic library of vegetation types, birds, habitats, landscapes and cultural features (where applicable) present at each site compiled during the October 2010 survey was added to during the April 2011 survey using a Canon PowerShot SX210 IS® 14x zoom digital camera. Images were stored in this library using Microsoft Office Picture Manager 2007® software. Some of these images are presented in this report. All images, data and related material were stored on a standard 500GB ATA HDD backed up to a 500GB external HDD.

2.4 Data analysis

Three key attributes of bird communities were selected for analysis from data collected at each site in each greenspace type in the study area. These were relative abundance, species richness, and composition of foraging guilds (as a key indicative component of bird community structure). A total of 40 replicates of greenspace type were used in analyses undertaken for this report. These were stratified across the surveyed sites and included 11 bushland remnant, 7 revegetated parkland, 7 open parkland, and 15 urban neighbourhood sites. Assignment of species recorded in the surveys to foraging guilds was based on existing professional knowledge and published data, especially from the authoritative “Handbook of Australian, New Zealand and Antarctic Birds (Volumes 1-7)” (various editors, see References). Bird use of habitat was analysed qualitatively from habitat attribute information collected during the spring (October 2010) and autumn (April 2011) surveys at representative sites within each greenspace type.

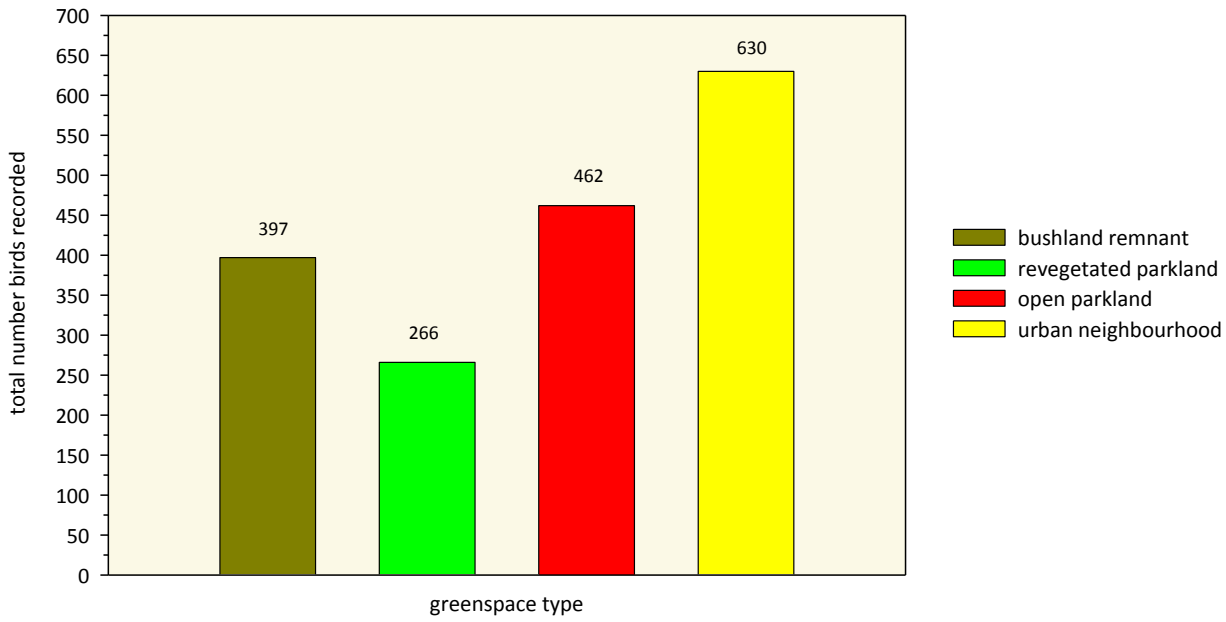
Bird survey data were examined for the total, mean, standard error and standard deviation from the mean for each greenspace type and for the overall study area using Microsoft Excel 2007® and SigmaPlot Version 11.2® (Systat Software, Inc. 2009), with the results presented in graphical and tabular form. Survey effort was calculated by greenspace type and for the study period. Conservation significance was assessed by comparing survey results with historical data for the study area and utilising expert ornithological knowledge.

3. Results

3.1 Relative abundance

A total of 1,755 individual birds were recorded during the autumn (April 2011) survey in the study area (Appendix 1). Thirty-five (35.9) percent (630 birds, mean 1.74, standard deviation [sd] 4.52) of these birds were recorded in urban neighbourhood sites. Bushland remnants accounted for 22.6% (397 birds, mean 1.09, sd 2.31) of the total. Revegetated parkland sites provided 15.1% of the total (266 birds, 0.73, sd 2.41). Open parkland contributed 26.3% of all birds recorded (462 birds, mean 1.27, sd 4.45). Figure 3 shows this variation in relative abundance of birds between the different greenspace types at the surveyed sites in the study area.

Figure 3: Total number of birds recorded by greenspace type, April 2011



The most abundant bird species recorded across all greenspace types surveyed in the study area were Rainbow Lorikeet (317 individuals), Noisy Miner (249), Welcome Swallow (105), the introduced Common Myna (96), Long-billed Corella (65 – Plates 1-2), Pied Currawong (64), Crested Pigeon (60), Australian Magpie (58), Superb Fairy-wren (56), Silvereye (47), White-browed Scrubwren (46), and Variegated Fairy-wren (35 – Plates 3-4). Bushland remnant sites were populated most abundantly by Rainbow Lorikeet (73 individuals), Noisy Miner (46), White-browed Scrubwren (35), Variegated Fairy-wren (35), Pied Currawong (24), and Superb Fairy-wren (16). Revegetated parkland sites were dominated by Noisy Miner (90), Rainbow Lorikeet

(55), Superb Fairy-wren (24), and Pied Currawong (18). Open parkland sites supported mostly Welcome Swallow (81), Long-billed Corella (57), Noisy Miner (40), Rainbow Lorikeet (37), Crested Pigeon (35), Australian Magpie (25), and Common Myna (19). Urban neighbourhood sites were the domain of Rainbow Lorikeet (152), Noisy Miner (73), Common Myna (65), the introduced Spotted Dove (23), Australian Magpie (23), and Crested Pigeon (22). No House Sparrow and only a relatively small number of Common Starling (19) were recorded during the survey. The other introduced species, Red-whiskered Bulbul, was recorded at only one site (2 birds in Mallee Reserve bushland remnant).

The least abundant bird species recorded across all greenspace types surveyed in the study area were small-medium insectivores dependent on larger, contiguous tracts of quality forest, shrub and groundcover habitats. In the study area these habitats exist mostly within Lane Cove River NP, Field of Mars Reserve (Wildlife Refuge), and Boronia Park. These included five summer migrants on their autumn migration north - Australasian Figbird (1 – Plate 5), Rufous Fantail (one juvenile), Grey Fantail (7 – Plate 6), Leaden Flycatcher (1) and Olive-backed Oriole (3), shrub-foraging residents Golden Whistler (7), Brown Thornbill (14) and Yellow Thornbill (9), specialist bark-foraging resident White-throated Treecreeper (4), blossom-foraging Yellow-faced Honeyeater (8), winter migrant Eastern Spinebill (6), the canopy-foraging Spotted Pardalote (8) and Striated Pardalote (2), and the moist forest frugivore Satin Bowerbird (1). The sedentary ground insectivore Eastern Yellow Robin was recorded at only one site in the survey – Field of Mars Reserve (Wildlife Refuge) Site A bushland remnant (2 birds). The Grey Shrike-thrush was not recorded during the survey. Least abundant non-passerines recorded were the threatened Powerful Owl (1), Australian Brush-turkey (1), Crimson Rosella (2), Eastern Rosella (2) and Australian King-Parrot (3). One White-bellied Sea-Eagle was observed flying over Stanley Street urban neighbourhood site towards Parramatta River and presumably to the known nest site at Wanngal Woodland within Sydney Olympic Park at Homebush.

Plate 1: Small flock of Long-billed Corella foraging on a Morrison Bay Park oval (open parkland site)

Plate 2: Long-billed Corella feeding on turf corms at a Morrison Bay Park oval (site as shown in Plate 1)

Plate 3: Male Variegated Fairy-wren in full adult plumage foraging in weedy ground-cover, Mallee Reserve bushland remnant (BR) site (October 2010)

Plate 4: Male Variegated Fairy-wren in eclipse plumage at the same location as shown in Plate 3 but in autumn (April 2011)

Plate 5: Australasian Figbird (male), an effective disperser of figs and other trees along the eastern and northern Australian coasts (en.wikipedia.org)

Plate 6: Adult Grey Fantail, a regular migrant that breeds in southern Australia in spring/summer and moves north in autumn (en. wikipedia.org)

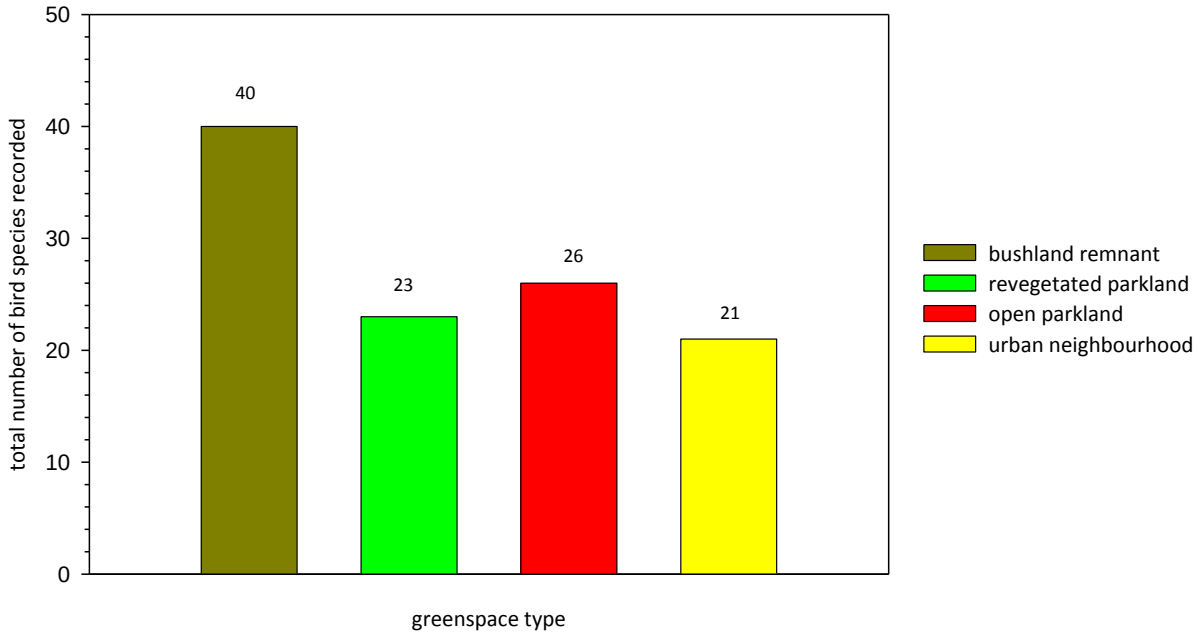
3.2 Bird species richness

A total of 51 bird species from 28 families were recorded during the survey in the study area (Appendix 1). This included 50 terrestrial species and one (White-faced Heron) aquatic/terrestrial species. Five of these terrestrial species have been introduced to Australia – Rock Dove, Spotted Dove, Red-whiskered Bulbul, Common Starling and Common Myna. Three other exotics - European Goldfinch, House Sparrow and Common Blackbird - were not recorded during the survey.

Bushland remnants accounted for 78.4% (40 out of 51) of all bird species recorded during the survey. Small native forest insectivores and a large forest owl dependent on larger contiguous tracts of quality forest and woodland were recorded only at the two Lane Cove NP sites, , and/or Boronia Park. They included Golden Whistler, Leaden Flycatcher, Spotted Pardalote, Striated Pardalote, Eastern Yellow Robin, Powerful Owl, White-throated Treecreeper, Crimson Rosella and Satin Bowerbird. Revegetated parkland sites supported 23 species or 45.1% of all avifauna recorded in the survey. Some native ground- and shrub-foraging insectivores such as White-browed Scrubwren, Superb Fairy-wren and Yellow Thornbill were detected at these sites. The invasive Noisy Miner occurred at moderate-high levels in both revegetated parkland and

bushland remnant sites. Open parkland supported 26 species (50.1%) of all avifauna recorded during the survey and included 4 introduced species. Birds of open areas such as Welcome Swallow, Long-billed Corella, the introduced Rock Dove, Spotted Dove and Common Myna, native Crested Pigeon, Magpie-lark and Australian Magpie characterised these sites. Noisy Miner and Rainbow Lorikeet foraged in isolated planted trees around the edges of open parkland. Urban neighbourhood sites were dominated by Rainbow Lorikeet, Noisy Miner, Common Myna, Spotted Dove, Australian Magpie and Crested Pigeon. These sites were the least diverse in species richness terms, accounting for 41.1% (21 species) of all avifauna surveyed. Figure 4 shows the variation in total bird species richness between the four greenspace types at the surveyed sites in the study area.

Figure 4: Bird species richness by greenspace type, April 2011



3.3 Bird community structure and habitat

3.3. 1 Composition of bird foraging guilds

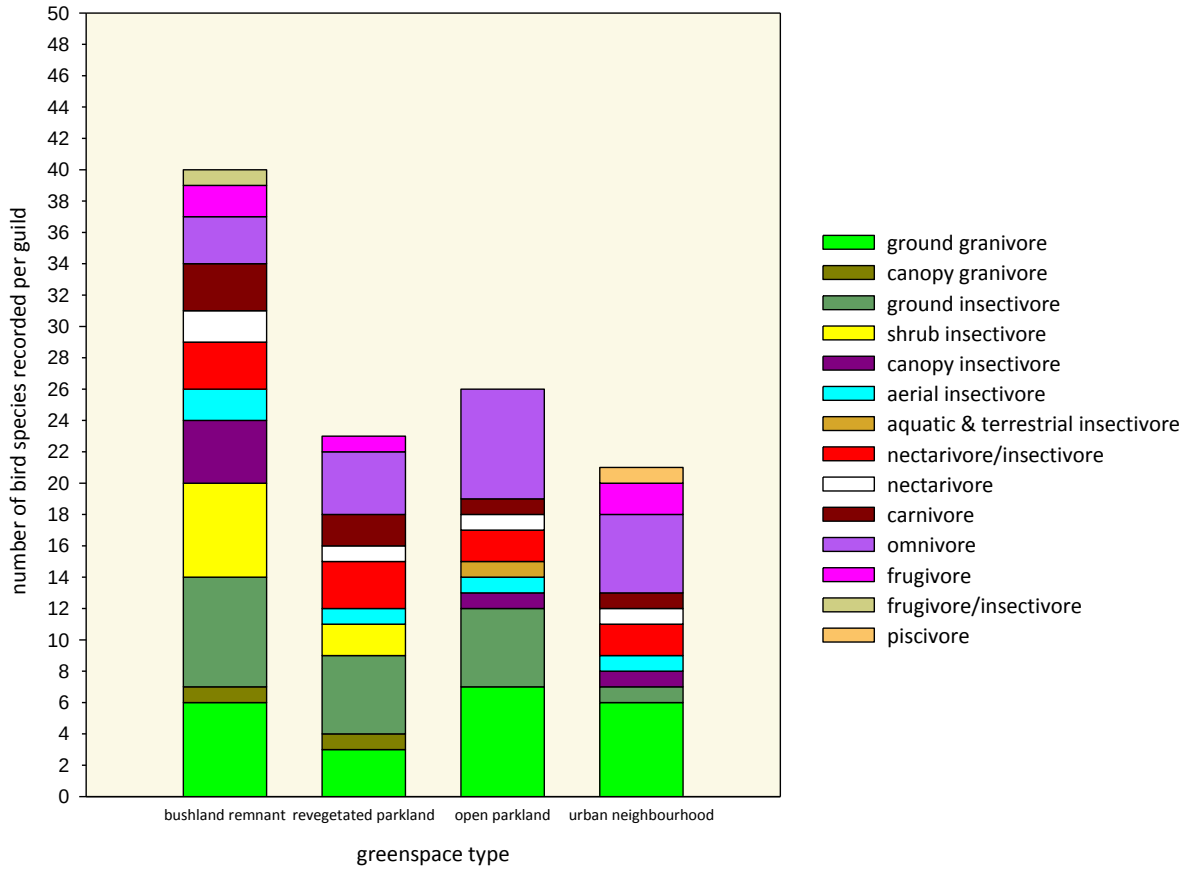
Foraging guild composition is a key indicative component of bird community structure (Ford 1989; Wiens 1989; Mills 2007). A total of 14 bird foraging guilds were recorded at the surveyed sites in the study area (Figure 5). These included 13 terrestrial guilds and one terrestrial/aquatic guild.

The main terrestrial guilds comprised ground insectivores (17.6% of all bird species recorded across all greenspace types), ground granivores (13.7%), omnivores (13.7%), shrub insectivores (11.7%), canopy insectivores (7.8%), nectarivores/insectivores (5.8%), carnivores (5.8%), and frugivores (5.8%). The main ground insectivorous species recorded were White-browed Scrubwren, Australian Magpie, Superb Fairy-wren, Variegated Fairy-wren, Willie Wagtail, and Magpie-lark. Ground granivores were represented by Spotted Dove, Rock Dove, Crested Pigeon, Galah, Sulphur-crested Cockatoo, Long-billed Corella and Red-browed Finch. Omnivores

commonly included Common Myna, Pied Currawong, Silvereye, Australian Raven and Australian White Ibis. Key shrub insectivores were Grey Fantail, Brown Thornbill, Yellow Thornbill and Golden Whistler. Canopy insectivores included Spotted Pardalote, Striated Pardalote, Black-faced Cuckoo-shrike and White-throated Treecreeper. Noisy Miner and Red Wattlebird were the main nectarivores/insectivores recorded while carnivores included Laughing Kookaburra and Grey Butcherbird. Frugivores included Australasian Figbird, Olive-backed Oriole and Satin Bowerbird.

Bushland remnant sites supported taxonomically richer assemblages of birds particularly ground insectivores, shrub insectivores, canopy insectivores, nectarivores/insectivores and carnivores than did the other greenspace types (Figure 5). Many of these guilds included species that were not recorded or recorded in substantially lower numbers in the more open greenspace types. Ground granivores were relatively evenly distributed across each greenspace type except in revegetated parkland where fewer species of this guild were recorded. Revegetated parkland sites recorded reasonably diverse ground insectivore, nectarivore/insectivore and omnivore taxa. Open parkland and urban neighbourhood sites supported a more species-rich omnivorous guild and ground granivore taxa comparable to bushland remnant sites. The only member of the aquatic/terrestrial insectivore guild – White-faced Heron – was recorded at the Morrison Bay open parkland site.

Figure 5: Composition of bird foraging guilds by greenspace type, April 2011



3.3.2 Bird habitats and their use

A range of bird habitats were recorded in each greenspace type during the survey in the study area. Bushland remnants were a mixture of larger generally contiguous patches of sandstone slope and gully forest, allocasuarina woodland and mangroves along Lane Cove River, Kittys Creek, Buffalo Creek and Boronia Creek and smaller (0.1-2 ha) isolated patches of Sydney Turpentine Ironbark Forest along Tarban Creek, Parramatta River foreshore and Mallee and Tyagarah Reserves. These remnants are part of a once more extensive indigenous forest and woodland that occurred prior to Sydney's urbanisation (see Benson and Howell 1990a, 1994). These patches contain ground cover, shrub and canopy layer habitats for insectivorous, granivorous, frugivorous, omnivorous and nectarivorous birds. A core group of forest- and woodland-dependent endemics were recorded in the larger remnants within Lane Cove NP, Field of Mars Reserve (Wildlife Refuge) and Boronia Creek Reserve. These included Eastern Yellow Robin, Brown Thornbill, Striated Pardalote, Powerful Owl, Crimson Rosella, Australian King-Parrot, White-throated Treecreeper, Golden Whistler, and the migratory Grey Fantail and Leaden Flycatcher. Other habitats occurring in the remnants were grass swards and rushes in Lane Cove NP near Buffalo Creek Reserve, a small number of standing dead trees (stags) in Tarban Creek Reserve, rock shelves and outcrops, fallen logs, and aquatic habitats (pools, running water and fringing vegetation) along Boronia, Kittys, Buffalo and Tarban Creeks.

Revegetated parkland sites provided a narrower suite of bird habitats than bushland remnants. The quality of these sites varied according to the age, size, floristic composition, areal extent and distance of the plantings from bushland remnants. Older (10-40 year-old) native mixed species plantings provided more layers of potential bird foraging, shelter and nesting habitat than younger plantings. Older planted sites surveyed included Putney Park, Olympic Park, Gladesville Reserve (oval and west), Riverglade Reserve (east) and Tarban Creek Reserve. Younger sites sampled were at Riverglade Reserve (west), Gladesville Reserve (east), Mallee Reserve, Bremner Park and Buffalo Creek Reserve. Older plantings offered a greater selection of perches, foraging microhabitat such as decorticating bark, leaf rolls and fallen debris, and potential breeding habitat for some indigenous and introduced passerines. In contrast, younger (ca. 3-6 year-old) indigenous plantings comprised fewer foraging, roosting and breeding opportunities, often consisting of only one canopy layer and some ground cover such as *Lomandra longifolia* clumps. A small group of native ground and shrub insectivores were recorded in older planted sites and included Superb Fairy-wren, White-browed Scrubwren, Yellow Thornbill, Willie Wagtail and Australian Brush-turkey. Nectarivores/insectivores also occurred – Yellow-faced Honeyeater, Red Wattlebird and Noisy Miner. Tree hollows, stags, fallen decaying logs and in-situ rock substrates were generally rare or absent from revegetated parkland sites.

Open parkland habitats were structurally simpler than their revegetated counterparts. They included grassed open space, weed-infested stormwater drains and drainage lines, built structures (e.g. playgrounds, picnic amenities), isolated individual or single rows of planted trees, and air space. Magdala Park, Boronia Park (ovals), Riverglade Reserve (oval), Bedlam Bay Regional Park (oval) and Tyagarah Reserve (oval) typified open parkland habitats sampled in the study area. Holy Cross College and Morrison Bay Park sites contained a mixture of open playing fields, built structures and narrow planted strips of allocasuarina, tallowwood and other eucalypts, usually fringing ovals or canals. Birds of open parkland habitats were a mix of hardy

indigenous and introduced species able to forage, roost, shelter and/or successfully breed in these more open environments. They included ground granivores - Spotted Dove, Rock Dove, Crested Pigeon, Galah, Sulphur-crested Cockatoo, Crested Pigeon, Long-billed Corella and Red-browed Finch, ground insectivores - Australian Magpie, Magpie-lark, Willie Wagtail, Masked Lapwing and Superb Fairy-wren, an aerial insectivore Welcome Swallow, nectarivores/insectivores - Noisy Miner and Red Wattlebird, a nectarivore - Rainbow Lorikeet, omnivores - Common Myna, Common Starling, Australian Raven, Australian White Ibis, Silver Gull, Pied Currawong, Common Starling and Silvereye, a carnivore – Grey Butcherbird, and an aquatic/terrestrial insectivore - White-faced Heron.

Urban neighbourhood sites provided a range of novel and often floristically diverse habitats for bird species able to forage, roost, and, in some cases, breed in built-up residential areas. These habitats included sealed surfaces - roads, streets, gutters, footpaths, mown and vegetated street verge - with brush box *Lophostemon confertus* as the dominant native street tree, commonly pruned to a maximum height of 5-16 m, built structures - houses, fences, roof-mounted antennae, powerlines, streetlight poles, stormwater drains and home gardens comprising usually exotic and some indigenous shrubs with dense foliage and nectar-rich flowers to 3 m, and up to 30 m tall indigenous (e.g. eucalypts, paperbarks, silky oak *Grevillea robusta*, allocasuarina) and exotic (e.g. jacaranda, date palm, poplar, oak, cypress, liquidambar, maple) trees in the front and rear yards of properties. Birds of these habitats were similar to those of open parkland sites. Typically they included ground granivores - Rock Dove, Spotted Dove, Crested Pigeon, Galah, Long-billed Corella and Sulphur-crested Cockatoo, only one ground insectivore - Australian Magpie, an aerial insectivore – Welcome Swallow, nectarivores/insectivores - Noisy Miner and Red Wattlebird, a nectarivore - Rainbow Lorikeet, omnivores - Australian White Ibis, Common Myna, Common Starling, Australian Raven and Pied Currawong, and the carnivorous Grey Butcherbird. Supplementary feeding in backyards and winter food shortages in remnants might help account for the presence of Grey Butcherbird at these sites.

Plates 7-34 display a range of habitats, microhabitats and food types used by birds and other fauna observed during the survey in the study area. The Common Ringtail Possum shown in Plate 18 is a key prey species of the threatened Powerful Owl. A recent Common Ringtail Possum carcass was found suspended from overhead powerlines outside a property in Quarry Road during the survey. This property is part of the Badajoz Road urban neighbourhood site (Site 12). The property owners described finding two decapitated possum carcasses suspended from the powerlines about one-two weeks prior to the April 2011 survey. The owners removed the first carcass because of its strong smell, possibly suggesting that a Powerful Owl was using the site as a cache or temporary processing site since the second carcass did not noticeably smell and so was fresher. Presumably the possum had been captured by the owl in Field of Mars Reserve (Wildlife Refuge), located approximately 400 metres to the east and south or from along Buffalo Creek near Pidding Park situated approximately 100 metres to the southwest. The owl seems likely to have carried the prey to the site for processing and consumption of selected body parts such as the head, a characteristic Powerful Owl predation pattern. Anecdotal evidence was also received from a Gladesville Road, Hunters Hill resident while surveying in Tarban Creek Reserve that one Powerful Owl has been roosting in an old Lilli Pilli in the resident's backyard for the past 10 years. The resident's neighbour has reported

Sugar Gliders (although possibly Common Ringtail Possums) and Tawny Frogmouths in her backyard.

Plate 7: Powerful Owl roosting in a moist forest gully remnant in the study area

Plate 8: A fruiting rainforest tree in a moist gully remnant provided food for frugivorous birds and bats

Plate 9: Old-growth paperbark in a bushland remnant provided foraging substrate for treecreepers, thornbills and other forest-dependent birds in the study area

Plate 10: White-throated Treecreeper (top left centre of image below) foraging into decorticating paperbark on the tree shown in Plate 9

Plate 11: Flowering *Banksia spinulosa* provided nectar for Eastern Spinebill and other fauna at Field of Mars Reserve (Wildlife Refuge) Site A

Plate 12: A waterhole in a sandstone outcrop at Lane Cove Cove NP (Sugarloaf Point) site provided bathing and water for a range of bird and other forest-dependent fauna

Plate 13: Eucalypt canopy and understorey in a small Sydney Turpentine Ironbark Forest remnant at Mallee and Tyagarah Reserves supplied food and shelter for a range of insectivorous birds and other fauna

Plate 14: Ground-shrouding weedy vines and exotic shrubs provided foraging and refuge habitat for Variegated Fairy-wren and White-browed Scrubwren at Mallee and Tyagarah Reserves

Plate 15: Privet incursion at Tarban Creek bushland remnant site (upper section) showing eucalypts at rear

Plate 16: Ripening privet fruit (below) are dispersed by orioles, Silvereye and some pigeons (site in Plate 15)

Plate 17: Active Common Ringtail Possum den nest at Lane Cove NP (Sugarloaf Point) bushland remnant site

Plate 18: Adult male Common Ringtail Possum near den nest (below) at site shown in Plate 17

Plate 19: Pied Currawong observed foraging in planted eucalypt foliage at Putney Park revegetated parkland site.

Plate 20: Tall eucalypt canopy and bark substrates provide foraging habitat for several insectivorous birds (Tarban Creek Reserve revegetated parkland site)

Plate 21: Mown grass surfaces and surrounding vegetation were foraging habitats for Welcome Swallow, Magpie-lark and Superb Fairy-wren (Bedlam Bay open parkland site)

Plate 22: A planted strip of Lomandra and other ground cover vegetation enabled Superb Fairy-wrens to move between both sides of Bedlam Bay open parkland site

Plate 23: Recently mown grass surfaces supplied insects for Australian White Ibis and other ground-foraging birds (Boronia Park No. 2 Oval open parkland site)

Plate 24: Australian White Ibis foraging in open parkland habitat (below) at the site shown in Plate 23

Plate 25: Open space above recently mown grass surfaces supported insects which were taken by a 30-strong flock of Welcome Swallow (Holy Cross College)

Plate 26: Welcome Swallow resting on mown grass debris strips in between foraging forays at the site shown in Plate 25 (duller immature bird shown in foreground)

Plate 27: White-faced Heron using its foot to flush small moths and other insects from kikuyu grass scuffed by sporting activity at Morrison Bay open parkland site

Plate 28: Nest box in established paperbark along street verge at Hillcrest Avenue urban neighbourhood (UN) site

Plate 29: Red Flowering Gum *Corymbia ficifolia* provided nectar for Noisy Miner and Rainbow Lorikeet at Hillcrest Avenue UN site

Plate 30: Red Flowering Gum (below) produced strong nectar flows for honeyeaters at the site shown in Plate 29

Plate 31: Long-billed Corella feeding feeding in dense canopy foliage on fruits of *Liquidambar styraciflua* in a home garden at Stanley Street UN site

Plate 32: Liquidambar seed pods provided food for Long-billed Corella at the site shown in Plate 31

Plate 33: Street verge plantings provide important food and microhabitat for insects such as this *Banksia ericifolia* and eucalypt area (Tennyson Road UN site)

Plate 34: *Banksia ericifolia* inflorescences (below) produced important autumn nectar flows for honeyeaters at the site shown in Plate 33

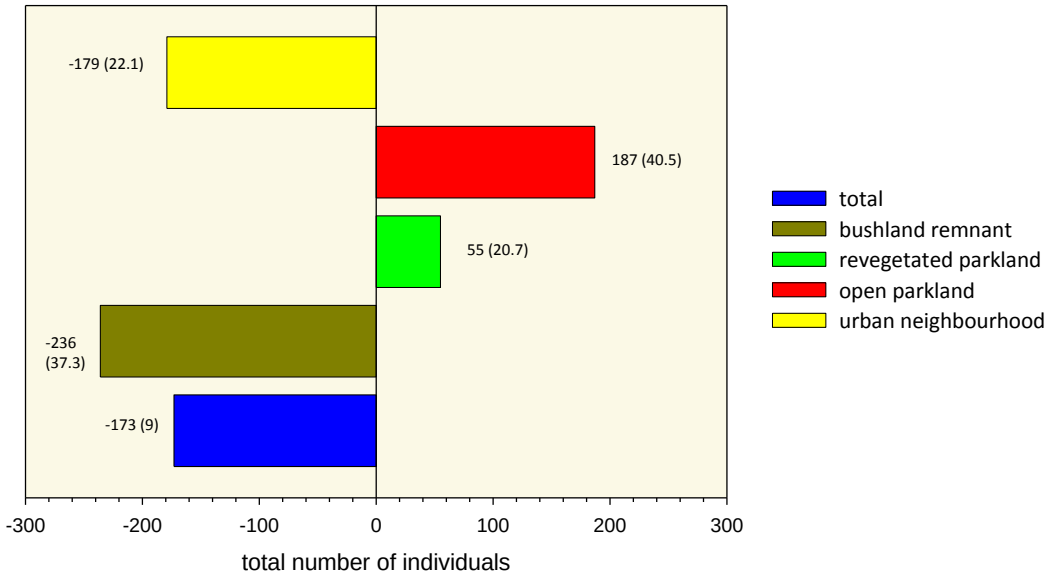
3.4 Interseasonal changes in bird communities

A number of marked changes were evident in bird communities of the study area between spring and autumn. These are related to variation in relative abundance, species richness, and composition of sampled avian assemblages and are described below.

3.4.1 Relative abundance

The autumnal decline in the total number of individual birds recorded in the study area featured substantial reductions of birds in bushland remnants (236 or 37.3% fewer individuals in autumn compared with spring) and urban neighbourhood sites (179 or 22.1% fewer birds). These losses were offset to a degree by increased numbers of birds recorded in autumn relative to spring in open parkland (187 or 40.5% more individuals) and revegetated parkland (55 or 20.7% more birds). Overall, however, there were 173 (or 9%) fewer birds recorded across all greenspace types in the study area in autumn compared with spring. Figure 6 shows this pattern of change in relative abundance of sampled bird communities at the surveyed sites in the study area.

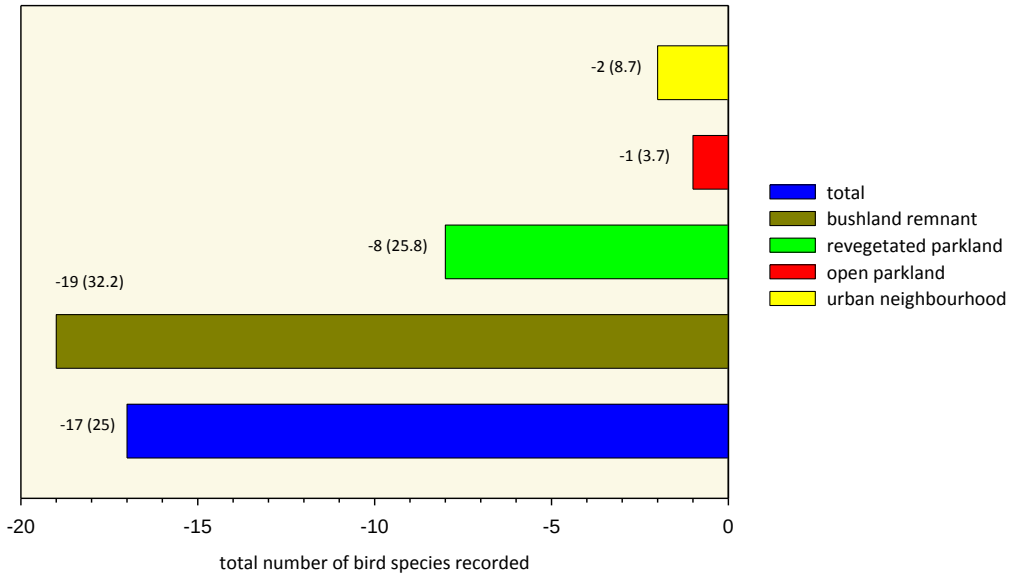
Figure 6: Change in total bird abundance by greenspace type, October 2010-April 2011 (% change in brackets)



3.4.2 Bird species richness

Twenty-five percent or 17 fewer bird species were recorded in autumn than in spring. This reduction occurred across all greenspace types but most markedly in bushland remnants (19 or 32.2% fewer species in autumn compared with spring) and revegetated parkland sites (8 or 25.8% fewer species). Urban neighbourhood sites recorded 8.7% or 2 fewer species in autumn while open parkland only 3.7% or 1 less species. Figure 7 displays this trend graphically.

Figure 7: Change in bird species richness by greenspace type, October 2010-April 2011 (% change in brackets)

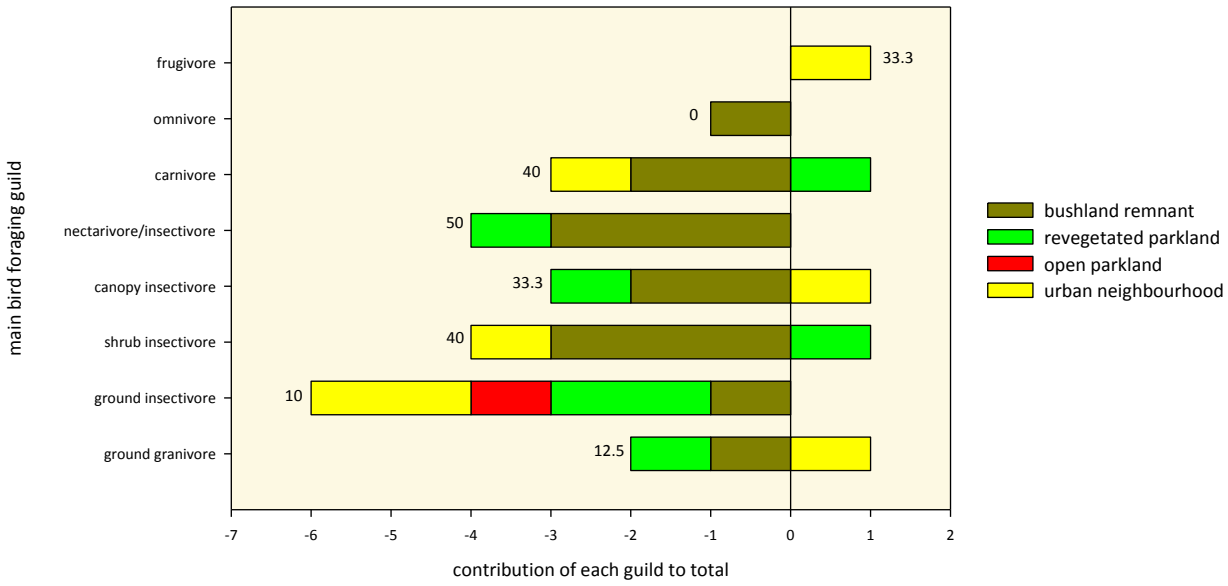


3.4.3 Bird community structure

The structure of terrestrial bird communities changed substantially between spring and autumn at surveyed sites in the study area. Six of the eight main bird foraging guilds recorded fewer species in autumn than in spring. Across all greenspace types, these decreases were most pronounced for shrub insectivores (4 or 40% fewer species in autumn than in spring), nectarivores/insectivores (3 or 50% fewer species), carnivores (2 or 40% fewer species), and canopy insectivores (2 or 33.3% fewer species). Ground granivores and ground insectivores experienced a milder loss of species in autumn (one species each or 12.5% and 10%, respectively. Frugivores increased by 33.3% (1 species) in autumn relative to spring while the total number of species of omnivores remained unchanged across both seasons (7 species in spring and in autumn).

When categorised by greenspace type, bushland remnant and revegetated parkland sites revealed substantial decreases in bird species in autumn relative to spring. Bushland remnant sites experienced losses of bird species across 7 of the 8 main foraging guilds with the most significant being shrub insectivores (33% decrease), nectarivores/insectivores (50% decrease), canopy insectivores (33% decrease), and carnivores (40% decrease). Revegetated parkland sites recorded losses of ground insectivores (28% decrease), canopy insectivores (100% decrease), ground granivores (25% decrease) and nectarivores/insectivores (25% decrease). However, shrub insectivores and carnivores increased in revegetated parkland in autumn (50% increases for each of these guilds). Open parkland sites were the most stable in terms of variation in guild composition across spring and autumn, recording only one fluctuation – a 16% decrease in ground insectivorous species – across the 8 main guilds. Urban neighbourhood sites similarly displayed little change over this period with only ground insectivores, shrub insectivores and carnivores decreasing. Ground granivores, canopy insectivores and frugivores increased over this period at these sites. Figure 8 depicts these interseasonal changes in bird foraging guild composition across each greenspace type at surveyed sites in the study area.

Figure 8: Change in the composition of main bird foraging guilds by greenspace type, October 2010-April 2011. The percent total change per guild across all relevant greenspace types is shown at the end of each bar. The coloured sections of each bar represent respective increases or decreases in the number of bird species recorded for each foraging guild in different greenspace types over this period.



3.5 Breeding activity

Breeding activity among bird communities in the study area had mostly ceased by the start of the April survey. This is normally expected since terrestrial bird communities of southern and eastern Australia ordinarily breed during the spring-summer period (ie. September to February).

Only 18 records of breeding and breeding-related activity were therefore obtained during the autumn survey in the study area. This involved a total of 9 species and most of these records were of adult birds with dependent or partly-dependent juveniles. Typically these included the multiple clutch, urban dominant species - Noisy Miner (5 records including 2 of nest construction and 3 with recent fledglings), Rainbow Lorikeet (3 records – no nesting, all of dependent young), and Galah (one nesting record). Two fledglings with adult Grey Butcherbird records were also obtained. Some records were of immature (ie. fully fledged) birds moving with adult birds in a foraging group. These included 13 immature Welcome Swallow with 17 adults at Holy Cross College open parkland site, 10 immature birds with 12 adult Welcome Swallow at Bedlam Bay open parkland site, 8 new season Australian Magpie with adults at Magdala Park open parkland site and 3 immature magpies at Beazley Street urban neighbourhood site, 3 Masked Lapwing with adults at Holy Cross College open parkland site, 5 young Variegated Fairy-wren (Mallee Reserve bushland remnant), and 3 young Superb Fairy-wren (Bedlam Bay open parkland edges). Thus, a total of 57 young birds were recorded during the survey at sites in the study area.

Revegetated parkland and urban neighbourhood sites accounted for most (67%) of the observed bird breeding activity. The remaining breeding records were distributed evenly across small bushland remnants (16.5%) and open parkland sites (16.5%). There was a marked

absence of breeding records for the larger bushland remnant sites and the younger revegetated parkland sites. Birds breeding in urban neighbourhood sites typically utilised densely vegetated and often substantially coppiced Brush Box and eucalypt street verge and home garden trees.

3.6 Conservation significance of avifauna

No bird species of international conservation significance were recorded during the survey in the study area. However, 21 species listed under either or all three international conservation agreements – China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) – have been recorded in or near the study area over the past 27 years (see InSight Ecology 2010). These are intercontinental migratory waders that arrive in spring in Australia and depart in autumn for their northern Asian breeding grounds, thus avoiding the northern hemisphere winter. They also include White-throated Needletail, Fork-tailed Swift, White-bellied Sea-Eagle (recorded in the April 2011 survey), Cattle Egret, Eastern Great Egret, Crested Tern, Common Tern and Oriental Cuckoo.

No bird species listed as endangered or vulnerable under the national Environment Protection and Biodiversity Conservation Act (1999) were recorded during the survey in the study area. However, 5 species listed under this legislation have been previously recorded in or near the study area. These include Swift Parrot (endangered, E1 listing), Eastern Bristlebird (E1), Regent Honeyeater (E1), Crested Shrike-tit (vulnerable), and White-fronted Chat (nominated for listing as vulnerable in September 2010). Three of these species - Eastern Bristlebird, Crested Shrike-tit and White-fronted Chat – have gone or are likely to have gone extinct in the study area (see InSight Ecology 2010).

A further two species - Cotton Pygmy-goose and Black-necked Stork – are listed as endangered in NSW under the NSW Threatened Species Conservation (TSC) Act (1995). These birds have been recorded in Lane Cove River valley in the last 14 years (InSight Ecology 2010) but were not detected during the April 2011 River to River Corridors Project survey. The Powerful Owl is listed as vulnerable under the NSW TSC Act 1995 and was recorded in the study area during both the October 2010 and April 2011 surveys. Therefore, a total of 8 nationally and NSW listed threatened bird species have been recorded in or near the study area. One additional species – White-bellied Sea-Eagle – while not listed as threatened under NSW TSC Act 1995 is listed as Marine and Migratory under EPBC Act 1999.

A suite of 17 indigenous bird species of conservation significance within the highly fragmented regional and local Sydney urban landscape were recorded during the survey in the study area. These included 12 ground, shrub and canopy insectivores, a nectarivore (Eastern Spinebill), the frugivorous Satin Bowerbird, the canopy granivores Australian King-Parrot and Crimson Rosella, and one piscivore (White-bellied Sea-Eagle). The most significant of these species in conservation terms within the highly urbanised Sydney environment are the ground-foraging Eastern Yellow Robin, White-browed Scrubwren, Variegated Fairy-wren and Superb Fairy-wren, the shrub insectivores Grey Fantail, Rufous Fantail, Yellow Thornbill, Brown Thornbill, Golden Whistler and Leaden Flycatcher, the bark-gleaning White-throated Treecreeper, and the canopy insectivore Striated Pardalote.

4. Discussion

4.1 Bird assemblages of the study area – patterns and processes

4.1.1 Bird responses to changes in Sydney's greenspace

Over the past 223 years, Sydney's native vegetation cover has been systematically removed and converted to housing for what are now more than 4 million people. All that remains are some small, highly fragmented patches that are experiencing further decline in habitat condition from invasive species and edge impacts. Today's pattern of habitat distribution, size, connectivity and condition in the study area generally reflects this broad-scale process of change to the configuration, composition and continuity of habitats across the Sydney region. It is a process characteristic of the impact of broad-scale landscape change on biodiversity across cities in Australia (e.g. Perth - Recher and Serventy 1991; How and Dell 2000; Adelaide - Tait et al. 2005; Melbourne - van der Ree 2004, White et al. 2005; Sydney - Benson and Howell 1990b; Flannery 1999; Brisbane - Garden et al. 2006) and worldwide (see UNEP Convention on Biological Diversity 2007).

Counteracting this landscape-scale process of extensive habitat loss, fragmentation and modification, have been episodes of revegetation, mostly on publicly owned land over at least the past three decades. At the local and regional scale, this has introduced an array of indigenous and exotic vegetation into this landscape. Coupled with earlier plantings along streets, on private properties and in parks, these activities have shaped the type, amount, quality and condition of habitats available to birds and other fauna. In effect, there has been an incremental transformation of this landscape, especially in Sydney's inner-west, south and north-west, from one of mainly sealed surfaces with minimal vegetation cover to a complex mosaic of ribbons, patches and conduits of green interwoven with 'red-roof suburbia'.

Bird assemblages have responded to these changes over time by either adapting, colonising or disappearing from habitats in this landscape. A cohort of medium to large bodied indigenous and introduced birds dominates the native and exotic vegetation planted in parks, along streets, and in the front- and rear-yards of houses across the study area and other districts. These are opportunistic, highly adaptable and often aggressive species that survive, reproduce, and have ultimately colonised these novel urban habitats. These include Noisy Miner, Rainbow Lorikeet, Red Wattlebird, Crested Pigeon, Australian Raven, Australian Magpie, Magpie-lark, Grey Butcherbird and Pied Currawong. The introduced species are the ground-foraging granivores, Spotted Dove and Rock Dove, and the ubiquitous omnivores, Common Myna and Common Starling.

Bird assemblages in the smaller, highly isolated bushland remnants of the study area are much less taxonomically and functionally diverse than those occupying the larger contiguous remnants (Lane Cove River valley and its tributaries – Buffalo, Kittys, and Boronia Creeks). The smaller remnants at Betts Park, Tarban Creek, Putney Point, Mallee and Tyagarah Reserves and Wallumatta NR support only a relatively small number of resilient species which are the residual of what were once, prior to intensive urbanisation, much richer guilds. Historical records confirm the incremental loss of small woodland and forest ground and shrub insectivores and nectarivores/insectivores from these and other small Sydney bushland

remnants (Blakers et al. 1984; Barrett et al. 2003). Species now apparently extinct from these smaller, isolated remnants include mostly forest and some grassland dependent endemics - Grey Shrike-thrush, Crested Shrike-tit, Varied Sittella, Spotted Quail-thrush, Yellow-tufted Honeyeater, Speckled Warbler, Jacky Winter (despite some more recent reports), Little Grassbird, Diamond Firetail and Australasian Pipit. Small numbers of the ground-foraging insectivore Eastern Yellow Robin still occur in small isolated remnants such as Betts Park and Tarban Creek Reserve.

Other native ground-foraging insectivores - White-browed Scrubwren, Variegated Fairy-wren and Superb Fairy-wren - seem to be maintaining small breeding populations in weedy undergrowth of Mallee and Tyagarah Reserves, Tarban Creek, and Bedlam Bay Regional Park. In the larger remnants of Field of Mars Reserve (Wildlife Refuge), Lane Cove NP and Boronia Park Reserve, birds that have gone locally extinct over the past 50 or more years include Superb Lyrebird, Rockwarbler, Eastern Bristlebird, Crested Shrike-tit, Pheasant Coucal, Eastern Barn Owl, Noisy Pitta, White-fronted Chat, and the introduced Nutmeg Mannikin and Common Greenfinch. Powerful Owls, however, appear to be expanding their Sydney urban population with Lane Cove River forest providing key roosting, nesting and foraging habitat.

4.1.2 The Noisy Miner conquest

The most abundant and successful of the 'urban adaptees' are the Noisy Miner and Rainbow Lorikeet, followed by Spotted Dove and Red Wattlebird. The Noisy Miner is a colony-living 'honeyeater' that aggressively protects food sources and breeding territories, repelling intruders and competitors through mobbing behaviour. This species has rapidly colonised almost all urban greenspace types and their habitat niches across Sydney over at least the past decade (see Higgins et al. 2001; Parsons et al. 2003; French et al. 2005; Parsons et al. 2006). In doing so, Noisy Miners may have either pushed out other species or taken over habitat niches vacated by species during earlier rounds of extinction, although further work is needed to confirm this.

In the study area, species that may have been adversely affected by the Noisy Miner could include smaller honeyeaters such as Yellow-faced Honeyeater, Eastern Spinebill and White-plumed Honeyeater, small shrub and canopy-foraging insectivores – Striated Pardalote, Brown Thornbill, Golden Whistler, Striated Thornbill and Brown Gerygone, and the once-common introduced House Sparrow and Common Blackbird. Neither of these two latter species was recorded during the survey. Competition for food and nest sites from Spotted Dove, Common Myna and Common Starling, predation by Grey Butcherbird, Pied Currawong and Australian Raven and mammalian carnivores, and a reduction in the amount of suitable nest sites may have been other key factors implicated in the recent decline of these two species across suburban Sydney. It is also feasible that the relatively low numbers of Willie Wagtail recorded in this study may reflect these combined pressures of competition from Noisy Miners and predation by avian and mammalian carnivores, although further work would be needed to confirm this. The Willie Wagtail is an indigenous, open-nesting, ground-foraging insectivore usually considered to be resilient and well adapted to urban life.

Habitats offering open canopies, nectar-rich plants such as grevillea cultivars, banksia, callistemon, strelitzia and camellia, dense foliage supplying nest sites and insects (e.g.

eucalypts, paperbark, camellia and brush box – especially pruned brush box street trees that produce prolific flowers and attract insects and have many multiple branches with dense foliage), supplementary food and water supplies (often from houses and parks), and plenty of edge habitat have contributed to the success of the Noisy Miner in Sydney and other highly urbanised landscapes such as Melbourne (see, for example, White et al. 2005) and Brisbane (see Catterall 2004; Garden et al. 2006). Where these conditions are less favourable, such as in the more closed and continuous canopies of Lane Cove NP and Field of Mars Reserve (Wildlife Refuge), Noisy Miners are absent or confined to the edges. Strategic management of urban greenspace for biodiversity conservation should, if possible, utilise this knowledge of Noisy Miner ecology.

The broadening of Noisy Miner diet to include grain-based food scraps available from outdoor café tables, rubbish bins and footpaths (A.H. pers obs) suggests that this species is fast acquiring omnivore status in suburban Sydney. Consequently, Noisy Miners are able to directly compete for food with the introduced Common Myna and Common Starling, although nest site preferences differ markedly between these species. Co-existence rather than exclusion, however, seems the more likely long-term outcome for these three species in this landscape.

In these ways, Noisy Miners may be viewed as potential 'engineers' of structural change in Sydney's urban bird communities. Their ability to readily and frequently (up to 3-4 clutches per season) breed in and thus rapidly colonise urban habitats, broaden their diet and adapt their foraging strategy, and potentially displace other indigenous and exotic species, from within and possibly outside their foraging guild, has established the Noisy Miner as the dominant bird species in suburban Sydney. This has important implications for the strategic conservation management of other avifauna and their habitat, and indeed overall biodiversity values, in Ryde-Hunters Hill and neighbouring LGAs.

4.1.3 Interseasonal changes in bird communities

Terrestrial bird communities differed significantly in their abundance, diversity and composition between spring and autumn at surveyed sites in the study area. Nine percent more individual birds were recorded in spring than in autumn while 25% more bird species were detected in spring (InSight Ecology 2011a). Much of this abundance differential occurred within bushland remnant (37% fewer birds in autumn) and urban neighbourhood (22% less birds in autumn) sites. The species richness differential was most evident in bushland remnants (32% fewer species in autumn) and revegetated parkland (25% fewer species in autumn).

These changes mainly reflected the influence of the southern Australian terrestrial bird breeding season (spring-summer), greater availability of food in spring-summer than autumn, and the presence of warm season breeding migratory species such as Black-faced Monarch, Rufous Fantail, Leaden Flycatcher, Shining Bronze-Cuckoo, Eastern Koel, Dollarbird, Sacred Kingfisher and blossom-nomadic honeyeaters (e.g. Little Wattlebird, Noisy Friarbird) which bolstered numbers of passerines recorded in bushland remnants. By the end of March/start of April most of these migrants had departed the study area on their northern migration. The lack of detection of resident forest-dependent passerines such as Eastern Whipbird and Striated Thornbill and reduced autumn numbers of other residents - Eastern Yellow Robin, Golden Whistler and White-throated Treecreeper - possibly reflected a contraction of these birds away

from patches such as Field of Mars Reserve and Buffalo Creek to the core parts of their home ranges, ie. Lane Cove River valley. Other factors implicated may have included dispersal of young birds away from natal areas, predation, disturbance by dogs and humans, and a lack of observer detection given that these species were no longer calling and defending breeding territories by autumn. Older revegetated parkland sites mirrored, to some extent, seasonal patterns of variation in abundance and species richness, particularly for small understorey and cover-dependent species.

Counteracting these losses was autumnal influxes of birds to open parkland (40% increased abundance) and revegetated parkland (20% increased bird numbers) sites. Open parkland sites particularly played an important role in providing food and foraging habitat in the non-breeding season. Sites such as Morrison Bay Park, Riverglade Reserve and Holy Cross College grounds supplied seeding grasses, tubers of kikuyu and other turf grasses, insects, and air space for open country birds such as Long-billed Corella, Crested Pigeon, Australian White Ibis, Australian Magpie and Welcome Swallow. Most of these species occurred in greater numbers than in spring at ovals and parks. Revegetated parkland sites such as Buffalo Creek Reserve and Putney Park supported ground and shrub insectivores that were more commonly recorded in bushland remnants, e.g. White-browed Scrubwren, Superb Fairy-wren and Yellow Thornbill.

This supplementary role of habitat and food provision was also offered by urban neighbourhood sites, albeit with a slight reduction in the number of bird species supported and a substantial reduction in the number of birds present. Home gardens offered reliable watering points and autumn or year-round flowering shrubs such as the exotic Orange Jessamine *Murraya paniculata*, Bird of Paradise *Strelitzia reginae* and camellia, and cultivated grevillea and melaleuca. These provided water, nectar and insects for Noisy Miner, Rainbow Lorikeet, Red Wattlebird and Common Myna among other species. Street verges and backyards provided densely foliaged eucalypts, bottlebrush (most had finished flowering by April), flowering paperbarks, silky oak, elm, maple and liquidambar. Rainbow Lorikeets were present in larger autumnal numbers than Noisy Miner in urban neighbourhood sites, bushland remnants, and across all greenspace types. This most likely reflected the abundance of high nectar yielding home garden and street verge groundcovers, shrubs and trees and the proximity of suitable tree hollows in bushland remnants such as Boronia Park, Lane Cove NP (Sugarloaf Point), Field of Mars Reserve (Wildlife Refuge), Tarban Creek Reserve, and the Villa Maria property.

Seasonal changes in the structure of terrestrial bird communities surveyed in the study area also occur in other bird communities in Melbourne, Adelaide and Sydney (see, for example, White et al 2005; Tait et al 2005; InSight Ecology 2008). These are driven by spatial and temporal fluctuations in food supply, habitat quality, amount, configuration and connectivity, predation, fire, inter- and intra-specific competition for mates, nest sites and shelter, autecological factors such as resilience and adaptive capacity, population size and fecundity, and behavioural characteristics, and landscape-scale effects such as pollution, land clearance and erosion events happening elsewhere in the catchment or region but impacting at the local scale (see InSight Ecology 2011b). The loss of tall dead trees with suitable forks for White-bellied Sea-Eagle nesting is an example of a deleterious landscape-scale impact on this species which has a large home range.

Substantial autumnal decreases recorded in the study area for shrub insectivores, canopy insectivores and nectarivores/insectivores seem likely to have occurred in response to reduced availability of foliar and bark invertebrates and nectar. Omnivorous birds such as Pied Currawong, Silvereye, Australian Raven and Common Myna were able to maintain their numbers during this seasonal shift in food availability by foraging across a wider range of food types and habitats. Open parkland and urban neighbourhood habitats helped to offset these losses by continuing to provide food, roosts, water and even nests (for Noisy Miner) for a cohort of foraging guilds the composition of which changed little over the spring-autumn period. The aerial insectivore Welcome Swallow congregated in companies of 20-30 birds at two open parkland sites hawking near-surface insect prey from recently mown grass surfaces. This behaviour is often typical for this species in autumn when new season young birds mix with older individuals in foraging forays.

4.2 Urban greenspace as bird habitat in the study area

4.2.1 Habitat connectivity: the importance of greenspace networks

The bushland remnants of the study area provide a diverse suite of habitats for bird assemblages that are richer in species composition and community structure than many of their counterparts in nearby local government areas such as Canada Bay, Strathfield, Auburn and Burwood. They support insectivores which can be considered to be at risk of local extinction given the high level of habitat fragmentation and isolation in this landscape and pressure on key foraging, refuge and breeding resources from competitors, predators and humans. Alleviation of this pressure warrants continued conservation action in the study area, as does the protection of remnants against threats and improvement of the condition of their habitats.

The impetus for reducing pressure on these resources is already available in parts of the study area. A combination of established allocasuarina, paperbark, eucalypt and shrub-based other plantings along Tarban Creek at Riverglade Reserve, in Boronia Park Reserve and at Gladesville Reserve will, in time, establish denser understorey vegetation to help reduce the attractiveness of these areas for Noisy Miner invasion. Although, for this to be effective dense understorey plantings are needed across a larger scale and should be strategically integrated with existing bushland patches. Best-practice bush regeneration (including staged removal of heavily weed-infested areas) of existing dense ground cover vegetation in Mallee and Tyagarah Reserves is also needed to minimise any impact of weed removal on small breeding Variegated Fairy-wren, White-browed Scrubwren and possibly Superb Fairy-wren populations.

Enhancing and re-establishing habitat connectivity in the study area for particularly dispersal-limited avifauna is the focus of the River to River Corridors Project. This will target key points within the two identified potential wildlife corridors with strategic revegetation and habitat rehabilitation and protection activities.

4.2.2 Revegetated parkland: valuable bird habitat or Noisy Miner utopia?

Revegetated parkland provided foraging habitat for 46% of all bird species observed during the survey. However, most of these species were aggressive, resilient, invasive or predatory birds - Noisy Miner, Rainbow Lorikeet, Red Wattlebird, Pied Currawong, and Grey Butcherbird. These

species are commonly associated with structurally simpler, more open canopy habitats characterised by substantial amounts of edge and flowering tall trees and shrubs.

Only a small suite of remaining woodland/forest species appeared able to exploit the food, shelter and nesting resources of revegetated parkland. This was largely because of the high numbers of edge-affiliated species present, particularly Noisy Miner and, to a lesser extent, Red Wattlebird and the young age of many plantings. The latter species has become a relatively recent colonist of this type of greenspace in Sydney. Other factors included the number of nest predators present (Grey Butcherbird, Pied Currawong, Australian Raven), stage of growth (many stands were less than 10 years old), narrow width and moderate-high angularity of stands, lack of stand structural complexity, poor habitat condition (weed-invaded, fire-affected), minimal or little connectivity between revegetation patches, and frequent disturbance by humans, cats and dogs.

The real value of Ryde-Hunters Hill's revegetated parkland lies in its potential to connect highly isolated remnants, riparian habitat and urban neighbourhood vegetation across the local landscape. In doing so, plantings will contribute to restoring habitat linkages and potential wildlife corridors at the local *and* regional scale. If focus is given to increasing the structural complexity of habitats - especially creating wide, denser understorey plantings to exclude Noisy Miners - and the variety of microhabitats while also improving their condition, then these plantings should help restore a level of ecological function to the study area. More direct interventions may also need to be considered.

4.2.3 Urban neighbourhood habitats: looking beyond footpath and fence

Ryde and particularly Hunters Hill are older established Sydney suburbs. Successive phases of planting of native and introduced vegetation have occurred along the streets and in residential front- and rear-yards since this time, culminating in the insertion and maintenance of brush box, paperbark tea-tree, elms and oaks as the main street tree species. As a result, urban neighbourhoods are well foliaged and appear to provide food and suitable foraging, nesting and refuge habitats for a range of birds, bats and insects. Proximity to, and some connections with, old established parks and newer, bush-regenerated open space could theoretically enhance these functions.

The ornithological and ecological reality, however, is that urban neighbourhood habitats in the study area mostly cater for a cohort of resilient, urban-adapted species. With the exception of Superb Fairy-wren and occasionally Silvereye, small bush birds are excluded from these sites. This reflects the lack of structural complexity of habitats available for exploitation by these smaller species. Competitive and predatory interactions between species and disturbance and predation by cats, rats, dogs and humans are also implicated. Supplementary feeding and water provisioning of birds by residents and planting of grevillea, callistemon and other high nectar-producing species in gardens have also favoured the colonisation of urban neighbourhood habitats by larger birds, especially the Noisy Miner, Red Wattlebird and Rainbow Lorikeet and regular visitation by the carnivorous Laughing Kookaburra and Grey Butcherbird. Landscape attributes such as distance from nearest remnant or revegetation patch and poor habitat connectivity may also be factors that have contributed to this dearth of small native birds.

There is a need to view urban neighbourhood habitats as more than just streetscape vegetation, without devaluing the contribution of street trees to the structure of Australian urban bird communities (see Young et al. 2007). The role and function of front- and rear-yard habitats in providing viable foraging, breeding and shelter habitat for birds need to be properly understood. These habitats include mown lawns, cultivated garden beds, planted ground cover, shrubs and trees, individual remnant trees, and garden ornaments such as ponds, fountains and birdbaths. How do these habitats function to facilitate the movement of small birds into and through urban neighbourhoods? Would they perform better in this role if species such as the Noisy Miner and Pied Currawong were present in fewer numbers? What specific actions would represent best value for money and effort invested in helping to re-connect previously isolated Eastern Yellow Robin, White-browed Scrubwren, Variegated Fairy-wren and/or Superb Fairy-wren populations? These are examples of the types of questions that need to be addressed prior to planning and implementing bush revegetation for small birds on publicly and privately owned urban neighbourhood habitats.

Potential therefore exists to provide suitable habitat to attract some small bush birds back into Ryde-Hunters Hill's urban neighbourhood. The building blocks of interstitial or 'stepping stone' habitat are there, at least for species capable of foraging in, moving through, and possibly breeding in planted garden hedges, shrubs and lawns such as the Superb Fairy-wren and possibly White-browed Scrubwren. However, a long-term (10 years+) community-based program is needed to plan and implement the strategic revegetation of key parts of this landscape for other bushland bird species. This is one of the key goals of the current initiative but will require further funding beyond the life of this project.

4.3 Conservation targets – focusing management action

A cornerstone of best-practice ecosystem management involves identifying and protecting, through strategic intervention, species, communities and habitats of conservation significance. Several opportunities exist to enhance current biodiversity conservation management activities and protect bird communities and their habitats in the study area. The emphasis is on protecting small bush birds because they appear to have declined markedly in Australian urban landscapes over the past two decades (Recher and Serventy 1991; Sewell and Catterall 1998; Barrett et al. 2003; Parsons et al. 2006). However, other bird species with intermediate sensitivities to the loss of habitat size, shape, connectivity and condition would be also benefited by these actions.

Protection of the condition and ecological integrity of the three key larger bushland remnants in the study area against degrading impacts should be of high priority and continued to be pursued through existing bushland management plans. This will require reduction of threats to birds and other fauna posed by feral and domestic cats, rats, dogs and foxes, weed reduction and management, fire protection, and management of human incursions such as rubbish dumping and trailbike use. Strategic planting and best-practice bush regeneration will be needed to improve the ecological condition and, where feasible, the connectivity of smaller bushland remnants.

The restoration of riparian habitats and strategic revegetation of parkland are other opportunities to improve the quality, connectivity and functional value of these greenspace

types for small bush birds in the study area. Here the emphasis is on improving the structural complexity and floristic diversity of local indigenous plantings (including denser plantings), widening revegetation strips to reduce the amount of edge habitat for the Noisy Miner and other invasive species, filling gaps between plantings to improve connectivity at the local and landscape scales, and considering direct control of Noisy Miner numbers.

Conservation targets in urban neighbourhood and open parkland habitats should complement those pursued in adjoining revegetated parkland and bush remnants. These focus on targeting the linkage of 'stepping stones' or 'corridors' for small birds through new and existing strategic plantings in streets and home gardens, adoption of small bird-friendly practices - garden re-design, pet management (especially cat and dog control), reduction of watering points and reduction of supplementary feeding, and coordination with adjoining councils as part of the larger and interconnected urban landscape.

References

Alberti, M., 2010, Maintaining ecological integrity and sustaining ecosystem function in urban areas. *Current Opinion in Environmental Sustainability*, 2: 178-184

Barrett, G., Silcocks, A., Barry, S., Cunningham, R., and Poulter, R., 2003. *The New Atlas of Australian Birds.* Birds Australia (RAOU), Melbourne.

Benson, D.H. and Howell, J., 1990a. Sydney's vegetation 1788-1988: utilisation, degradation and rehabilitation. *Proceedings of the Ecological Society of Australia* 16, 115-127.

Benson, D. H. and Howell, J. 1990b. *Taken For Granted: The Bushland of Sydney and its Suburbs*. Kangaroo Press, Sydney.

Benson, D. and Howell, J.,1994. The natural vegetation of the Sydney 1:100 000 map sheet. *Cunninghamia* 3, 677-787.

Blakers, M., Davies, S. J. J. F., and Reilly, P. N., 1984. *The Atlas of Australian Birds.* Melbourne University Press.

Catterall, C. P., 2004. Birds, garden plants and suburban bushlots: where good intentions meet unexpected outcomes. In: *Urban Wildlife: More Than Meets the Eye* (Eds D. Lunney & S. Burgin) pp. 21-31. Royal Zoological Society of NSW, Mosman, NSW.

Christidis, L. and Boles, W. E., 2008. *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Melbourne.

Cooks River Foreshores Working Group, 2006. Annual Report of the CRFWG 2005-06, City of Canterbury. Available from URL: http://www.canterbury.nsw.gov.au/resources/documents/CRFWG_2006.pdf

Commonwealth of Australia, 2005. *Sustainable Cities.* Report of the House of Representatives Standing Committee on Environment and Heritage, Canberra.

Flannery, T., 1999. The sandstone city. In: *The Birth of Sydney* (ed. T. Flannery) pp. 1-42. Text Publishing, Melbourne.

Ford, H. A., 1989. *Ecology of Birds: An Australian Perspective*. Surrey Beatty & Sons Pty. Ltd, Chipping Norton, Sydney.

French, K., Major, R., and Hely, K., 2005. Use of native and exotic garden plants by suburban nectarivorous birds. *Biological Conservation* 121, 545-559.

Garden, J., McAlpine, C., Peterson, A., Jones, D., and Possingham, H., 2006. Review of the ecology of Australian urban fauna: A focus on spatially explicit processes. *Austral Ecology* 31, 126-148.

Higgins, P. J., (Ed.) 1999. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird.* Oxford University Press, Melbourne.

Higgins, P. J. and Davies, S. J. J. F., (Eds.) 1996. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons.* Oxford University Press, Melbourne.

Higgins, P.J, Peter, J. M., and Steele, W. K., (Eds) 2001. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 5: Tyrant-flycatchers to Chats.* Oxford University Press, Melbourne.

Higgins, P. J. and Peter, J. M., (Eds.) 2002. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 6: Pardalotes to Shrike-thrushes*. Oxford University Press, Melbourne.

Higgins, P. J., Peter, J. M., and Cowling, S. J., (Eds.) 2006. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 7: Boatbill to Starlings*. Oxford University Press, Melbourne.

How, R. and Dell, J., 2000. Ground vertebrate fauna of Perth's vegetation remnants: impact of 170 years of urbanisation. *Pacific Conservation Biology* 6, 198-217.

Hunters Hill Municipal Council, 2009. Riverglade Reserve Plan of Management, amended August 2009.

InSight Ecology, 2008. Bird communities and habitats of Strathfield Local Government Area, 2007-2008. Technical report by InSight Ecology for Strathfield Municipal Council.

InSight Ecology, 2010. Review of Ecological Literature and Avifaunal Data. Report by InSight Ecology for City of Ryde and Hunters Hill Council – River to River Corridors Project

InSight Ecology, 2011a. Avifaunal communities of the River to River Corridors Project study area: October 2010 survey report. Technical report (Report 2) for City of Ryde and Hunters Hill Council, January 2011.

InSight Ecology, 2011b. Landscape ecological and recreational context of the River to River Corridors Project study area: Methods, results and management implications. Technical report (Report 3a) by InSight Ecology for River to River Corridors Project Team (City of Ryde and Hunters Hill Council, Sydney), June 2011.

Loyn, R. H., 1987. Effects of patch area and habitat on bird abundances, species numbers and tree health in fragmented Victorian forests. In: *Nature Conservation: The Role of Remnants of Native Vegetation* (Eds. D. A. Saunders, G. W. Arnold, A. A. Burbidge and A. J. M. Hopkins), pp. 65-75. Surrey Beatty & Sons and CSIRO, Sydney.

Marchant, S. and Higgins, P.J., (Eds.) 1990. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks.* Oxford University Press, Melbourne.

Marchant, S. and Higgins, P.J., (Eds.) 1993. *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2: Raptors to Lapwings.* Oxford University Press, Melbourne.

McDonald, R. I., Kareiva, P., and Forman, R. T.T., 2008. The implications of current and future urbanization for global protected areas and biodiversity conservation. *Biological Conservation* 141, 1695-1703.

Mills, A.M., 2007. Foraging segregation in a breeding bird guild declines following nesting. *Canadian Journal of Zoology* 85, 141-150.

Natural Resource Management Ministerial Council, 2010. Australia's Biodiversity Conservation Strategy 2010-2030. Australian Government, Department of Sustainability, Environment, Water, Population and Communities, Canberra.

NSW Department of Planning, 2005. *City of Cities: A Plan for Sydney's Future – Sydney Metropolitan Strategy*. Government of NSW, Sydney.

NSW Department of Planning, 2010. Sydney Metropolitan Strategy final version, NSW Government, Sydney.

Parsons, H., French, K., and Major, R. E., 2003. The influence of remnant bushland on the composition of suburban bird assemblages in Australia. *Landscape and Urban Planning* 66, 43-56.

Parsons, H., Major, R.E., and French, K., 2006. Species interactions and habitat associations of birds inhabiting urban areas of Sydney, Australia. *Austral Ecology* 31, 217-227.

Pickett, S.T.A. and Cadenasso, M.L., 2006. Advancing urban ecological studies: Frameworks, concepts, and results from the Baltimore Ecosystem Study. *Austral Ecology* 31, 114–125.

Pickett, S.T.A., Cadenasso, M.L., Grove, J.M., Boone, C.G., Groffman, P.M., Irwin, E., Kaushal, S.S., Marshall, V., McGrath, B.P., Nilon, C.H., Pouyat, R.V., Szlavecz, K., Troy, A., Warren. P., 2011. Urban ecological systems: Scientific foundations and a decade of progress. *Journal of Environmental Management* 92, 331-362

Recher, H. A. and Serventy, D. L., 1991. Long-term changes in the relative abundance of birds in Kings Park, Perth, Western Australia. *Conservation Biology* 5, 90-102.

Ryde Flora and Fauna Study, 2006-2008. Three reports on bushland reserves by Biosphere Environmental Consultants P/L for City of Ryde

Secretariat of the Convention on Biological Diversity, 2006. *Global Biodiversity Outlook 2.* Montreal, Quebec, Canada, 81 pp.

Sewell, S. R. and Catterall, C. P. 1998. Bushland modification and styles of urban development: their effects on birds in south-east Queensland. *Wildlife Research* 25, 41-63.

Systat Software, Inc., 2009. User's Guide – Parts 1 & 2 for SigmaPlot Version 11.2 supplied under licence to InSight Ecology.

Tait, C. J., Daniels, C. B., and Hill, R. S., 2005. Changes in species assemblages within the Adelaide metropolitan area, Australia, 1836-2002. *Ecological Applications* 15, 346-359.

UNEP Convention on Biological Diversity, 2007. *Cities and Biodiversity: Achieving the 2010 Biodiversity Target.* Proceedings of United Nations Environment Programme Mayors' Meeting, Curitiba, Brazil, 26-28 March 2007.

van der Ree, R., 2004. The impact of urbanisation on the mammals of Melbourne – do atlas records tell the whole story or just some of the chapters? In: *Urban Wildlife: More Than Meets the Eye* (Eds D. Lunney & S. Burgin) pp. 195-204. Royal Zoological Society of NSW, Mosman, NSW.

White, J. G., Antos, M. J., Fitzsimons, J. A., and Palmer G. C., 2005. Non-uniform bird assemblages in urban environments: the influence of streetscape vegetation. *Landscape and Urban Planning* 71, 123-135.

Wiens, J. A. 1989. *The Ecology of Bird Communities, Volume 1: Foundations and Patterns.* Cambridge University, Cambridge, UK.

Young, K. M., Daniels, C. B., and Johnston, G., 2007. Species of street tree is important for southern hemisphere bird trophic guilds. *Austral Ecology* 32, 541-550.

Appendix

Appendix 1: All individual birds recorded by InSight Ecology during the 6-15 April 2011 survey of the study area
* introduced species

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
1	Australian Brush-turkey	Alectura lathami	60411	0840-0925	35	Tyagarah Reserve	1	0	0	0	foraging	in bamboo section & weedy creekline (remnant)
2	Rock Dove *	Columba livia	70411	0945-1005	19	Hillcrest Avenue	0	0	0	3	flyover	
3	Rock Dove *	Columba livia	70411	1035-1050	28	Tennyson Road	0	0	0	5	flyover	
4	Rock Dove *	Columba livia	90411	1630-1655	14	Beazley Street	0	0	0	2	foraging	
5	Rock Dove *	Columba livia	90411	1700-1715	15	Monash Road	0	0	0	1	foraging	
6	Rock Dove *	Columba livia	110411	0915-0955	5	Holy Cross College	0	0	5	0	foraging	
7	Rock Dove *	Columba livia	110411	0915-0955	5	Holy Cross College	0	0	3	0	foraging	
8	Spotted Dove *	Streptopelia chinensis	60411	1710-1730	16	Eltham Street	0	0	0	8	foraging	
9	Spotted Dove *	Streptopelia chinensis	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	3	0	foraging	
10	Spotted Dove *	Streptopelia chinensis	70411	0945-1005	19	Hillcrest Avenue	0	0	0	2	perching	
11	Spotted Dove *	Streptopelia chinensis	70411	1015-1030	27	Western Crescent	0	0	0	2	foraging	
12	Spotted Dove *	Streptopelia chinensis	70411	1035-1050	28	Tennyson Road	0	0	0	1	foraging	
13	Spotted Dove *	Streptopelia chinensis	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	2	0	0	0	foraging	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
14	Spotted Dove *	Streptopelia chinensis	80411	1615-1625	30	Riverglade Reserve	0	0	2	0	foraging	
15	Spotted Dove *	Streptopelia chinensis	90411	1630-1655	14	Beazley Street	0	0	0	3	calling, perching	
16	Spotted Dove *	Streptopelia chinensis	90411	1700-1715	15	Monash Road	0	0	0	6	foraging	
17	Spotted Dove *	Streptopelia chinensis	100411	0915-0935	10	Westminster Road	0	0	0	1	calling	
18	Crested Pigeon	Ocyphaps lophotes	60411	0750-0830	31	Olympic Park	0	1	0	0	flyover	
19	Crested Pigeon	Ocyphaps lophotes	60411	1015-1100	37	Morrison Bay Park	0	0	16	0	foraging	
20	Crested Pigeon	Ocyphaps lophotes	70411	1015-1030	27	Western Crescent	0	0	0	4	calling	
21	Crested Pigeon	Ocyphaps lophotes	80411	1005-1030	18	Mary Street	0	0	0	2	foraging	
22	Crested Pigeon	Ocyphaps lophotes	80411	1615-1625	30	Riverglade Reserve	0	0	6	0	foraging	
23	Crested Pigeon	Ocyphaps lophotes	90411	0855-0910	9	Park Road	0	0	0	2	perching	
24	Crested Pigeon	Ocyphaps lophotes	90411	0915-0940	17	Abigail Street	0	0	0	1	perching	
25	Crested Pigeon	Ocyphaps lophotes	90411	1700-1715	15	Monash Road	0	0	0	4	foraging	
26	Crested Pigeon	Ocyphaps lophotes	90411	1720-1740	12	Badajoz Road	0	0	0	5	foraging	
27	Crested Pigeon	Ocyphaps lophotes	100411	0805-0835	1	Moncrieff Drive	0	0	0	1	foraging	
28	Crested Pigeon	Ocyphaps lophotes	100411	0915-0935	10	Westminster Road	0	0	0	2	foraging	
29	Crested Pigeon	Ocyphaps lophotes	110411	0915-0955	5	Holy Cross College	0	0	13	0	foraging	
30	Crested Pigeon	Ocyphaps lophotes	110411	1650-1715	34	Buffalo Creek Reserve	0	1	0	0	foraging, calling	
31	Crested Pigeon	Ocyphaps lophotes	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	perching	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
32	White-faced Heron	Egretta novaehollandiae	60411	1015-1100	37	Morrison Bay Park	0	0	1	0	foraging	
33	Australian White Ibis	Threskiornis molucca	60411	0950-1010	40	Bremner Park	0	4	0	0	flyover	
34	Australian White Ibis	Threskiornis molucca	60411	1015-1100	37	Morrison Bay Park	0	0	8	0	foraging	
35	Australian White Ibis	Threskiornis molucca	90411	0720-0735	7	Boronia Park	0	0	8	0	foraging	on No.2 oval (freshly mown)
36	Australian White Ibis	Threskiornis molucca	110411	0915-0955	5	Holy Cross College	0	0	1	0	foraging	
37	White-bellied Sea-Eagle	Haliaeetus leucogaster	60411	1635-1700	36	Stanley Street	0	0	0	1	flyover	from up Parramatta River
38	Masked Lapwing	Vanellus miles	60411	0930-0940	35	Tyagarah Reserve	0	0	1	0	foraging	oval section
39	Masked Lapwing	Vanellus miles	60411	1015-1100	37	Morrison Bay Park	0	0	6	0	foraging	
40	Masked Lapwing	Vanellus miles	110411	0915-0955	5	Holy Cross College	0	0	6	0	foraging, calling	1 grp of 4 (incls 3 young), other grp of 2 - lower oval
41	Silver Gull	Chroicocephalus novaehollandiae	60411	1015-1100	37	Morrison Bay Park	0	0	5	0	foraging	
42	Silver Gull	Chroicocephalus novaehollandiae	80411	1615-1625	30	Riverglade Reserve	0	0	3	0	foraging	
43	Galah	Eolophus roseicapillus	60411	1015-1100	37	Morrison Bay Park	0	0	2	0	foraging	
44	Galah	Eolophus roseicapillus	60411	1710-1730	16	Eltham Street	0	0	0	2	flyover	
45	Galah	Eolophus roseicapillus	110411	1005-1055	33	Wallumatta Nature Reserve	2	0	0	0	nesting	in *Angophora costata* trackside (pics)
46	Long-billed Corella	Cacatua tenuirostris	60411	1015-1100	37	Morrison Bay Park	0	0	57	0	foraging	digging grass corms out on park surface
47	Long-billed Corella	Cacatua tenuirostris	60411	1635-1700	36	Stanley Street	0	0	0	3	foraging	in tall liquidambar in Mitchell Street

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48	Long-billed Corella	Cacatua tenuirostris	80411	1630-1715	29	Riverglade Reserve	0	3	0	0	flyover	from Villa Maria pines
49	Long-billed Corella	Cacatua tenuirostris	90411	1630-1655	14	Beazley Street	0	0	0	2	flyover	
50	Sulphur-crested Cockatoo	Cacatua galerita	60411	1635-1700	36	Stanley Street	0	0	0	2	foraging	
51	Sulphur-crested Cockatoo	Cacatua galerita	70411	1555-1615	23	Tarban Creek Reserve	0	1	0	0	foraging	
52	Sulphur-crested Cockatoo	Cacatua galerita	90411	0745-0845	8	Boronia Park	1	0	0	0	perching	
53	Sulphur-crested Cockatoo	Cacatua galerita	90411	1630-1655	14	Beazley Street	0	0	0	2	calling, perching	
54	Sulphur-crested Cockatoo	Cacatua galerita	110411	0915-0955	5	Holy Cross College	0	0	1	0	calling	
55	Sulphur-crested Cockatoo	Cacatua galerita	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	calling	
56	Sulphur-crested Cockatoo	Cacatua galerita	130411	1705-1740	6	Lane Cove NP north	2	0	0	0	foraging	
57	Rainbow Lorikeet	Trichoglossus haematodus	60411	0750-0830	31	Olympic Park	0	15	0	0	foraging	with 2 young in street verge along aquatic centre
58	Rainbow Lorikeet	Trichoglossus haematodus	60411	0840-0925	32	Mallee Reserve	3	0	0	0	calling	
59	Rainbow Lorikeet	Trichoglossus haematodus	60411	0930-0940	35	Tyagarah Reserve	0	0	3	0	flyover	oval section
60	Rainbow Lorikeet	Trichoglossus haematodus	60411	1015-1100	37	Morrison Bay Park	0	0	11	0	foraging	
61	Rainbow Lorikeet	Trichoglossus haematodus	60411	1610-1630	39	Putney Park	0	4	0	0	flyover	
62	Rainbow Lorikeet	Trichoglossus haematodus	60411	1635-1700	36	Stanley Street	0	0	0	7	foraging, calling	with 1 young

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
63	Rainbow Lorikeet	Trichoglossus haematodus	60411	1710-1730	16	Eltham Street	0	0	0	2	foraging	
64	Rainbow Lorikeet	Trichoglossus haematodus	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	5	0	foraging & flyover	
65	Rainbow Lorikeet	Trichoglossus haematodus	70411	0945-1005	19	Hillcrest Avenue	0	0	0	10	foraging, calling	with young in backyard shrubs & trees
66	Rainbow Lorikeet	Trichoglossus haematodus	70411	1015-1030	27	Western Crescent	0	0	0	7	foraging	
67	Rainbow Lorikeet	Trichoglossus haematodus	70411	1035-1050	28	Tennyson Road	0	0	0	4	foraging	
68	Rainbow Lorikeet	Trichoglossus haematodus	70411	1530-1550	21	Tarban Creek Reserve	3	0	0	0	foraging, calling	
69	Rainbow Lorikeet	Trichoglossus haematodus	70411	1555-1615	23	Tarban Creek Reserve	0	11	0	0	foraging, calling	
70	Rainbow Lorikeet	Trichoglossus haematodus	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	15	0	0	0	foraging, calling	
71	Rainbow Lorikeet	Trichoglossus haematodus	80411	0750-0820	25	Gladesville Reserve	0	10	0	0	foraging, calling	in flowering planted eucs with nest box
72	Rainbow Lorikeet	Trichoglossus haematodus	80411	0750-0820	25	Gladesville Reserve	0	4	0	0	flyover	
73	Rainbow Lorikeet	Trichoglossus haematodus	80411	0845-0935	24	Betts Park	3	0	0	0	foraging	
74	Rainbow Lorikeet	Trichoglossus haematodus	80411	0940-0955	20	Kelly Street	0	0	0	15	feeding, foraging, calling	pics of birds feeding in house seed tray
75	Rainbow Lorikeet	Trichoglossus haematodus	80411	1005-1030	18	Mary Street	0	0	0	10	foraging, calling	
76	Rainbow Lorikeet	Trichoglossus haematodus	80411	1615-1625	30	Riverglade Reserve	0	0	3	0	flyover	
77	Rainbow Lorikeet	Trichoglossus haematodus	80411	1630-1715	29	Riverglade Reserve	0	5	0	0	foraging, calling	
78	Rainbow Lorikeet	Trichoglossus haematodus	80411	1630-1715	29	Riverglade Reserve	0	2	0	0	flyover	to Villa Maria

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79	Rainbow Lorikeet	Trichoglossus haematodus	90411	0720-0735	7	Boronia Park	0	0	10	0	flyover	to Lane Cove River
80	Rainbow Lorikeet	Trichoglossus haematodus	90411	0745-0845	8	Boronia Park	17	0	0	0	foraging, calling	in tall blackbutts
81	Rainbow Lorikeet	Trichoglossus haematodus	90411	0855-0910	9	Park Road	0	0	0	12	foraging, flying, calling	street verge shrubs, home garden eucs etc
82	Rainbow Lorikeet	Trichoglossus haematodus	90411	0915-0940	17	Abigail Street	0	0	0	15	foraging, calling	feeding on euc fruits along Ryde Road
83	Rainbow Lorikeet	Trichoglossus haematodus	90411	1630-1655	14	Beazley Street	0	0	0	12	calling, foraging	
84	Rainbow Lorikeet	Trichoglossus haematodus	90411	1700-1715	15	Monash Road	0	0	0	12	foraging, calling	
85	Rainbow Lorikeet	Trichoglossus haematodus	90411	1720-1740	12	Badajoz Road	0	0	0	36	foraging, calling, roosting	obs pre-roosting backyard tall eucs Badajoz Rd
86	Rainbow Lorikeet	Trichoglossus haematodus	100411	0805-0835	1	Moncrieff Drive	0	0	0	15	foraging, calling	
87	Rainbow Lorikeet	Trichoglossus haematodus	100411	0845-0910	2	Blaxland Street	0	0	0	13	foraging, calling	
88	Rainbow Lorikeet	Trichoglossus haematodus	100411	0915-0935	10	Westminster Road	0	0	0	12	foraging, calling	
89	Rainbow Lorikeet	Trichoglossus haematodus	110411	0915-0955	5	Holy Cross College	0	0	5	0	foraging, flying	
90	Rainbow Lorikeet	Trichoglossus haematodus	110411	1005-1055	33	Wallumatta Nature Reserve	10	0	0	0	foraging, calling	
91	Rainbow Lorikeet	Trichoglossus haematodus	110411	1650-1715	34	Buffalo Creek Reserve	0	4	0	0	foraging, calling	
92	Rainbow Lorikeet	Trichoglossus haematodus	120411	1510-1615	11	Field of Mars Reserve Site A	6	0	0	0	flyover	
93	Rainbow Lorikeet	Trichoglossus haematodus	120411	1620-1705	13	Field of Mars Reserve Site B	5	0	0	0	foraging, calling	
94	Rainbow Lorikeet	Trichoglossus haematodus	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	4	0	0	0	foraging, calling	

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95	Rainbow Lorikeet	Trichoglossus haematodus	130411	1705-1740	6	Lane Cove NP north	7	0	0	0	foraging, calling	
96	Australian King-Parrot	Alisterus scapularis	80411	1630-1715	29	Riverglade Reserve	0	2	0	0	flyover	from south side of path to Villa Maria & beyond
97	Australian King-Parrot	Alisterus scapularis	110411	1650-1715	34	Buffalo Creek Reserve	0	1	0	0	perching	
98	Crimson Rosella	Platycercus elegans	130411	1705-1740	6	Lane Cove NP north	2	0	0	0	perching	
99	Eastern Rosella	Platycercus eximius	110411	1005-1055	33	Wallumatta Nature Reserve	2	0	0	0	perching	
100	Powerful Owl	Ninox strenua	90411	0745-0845	8	Boronia Park	1	0	0	0	roosting	male mobbed by 10 currawong at roost site
101	Laughing Kookaburra	Dacelo novaeguineae	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	1	0	0	0	foraging, calling	
102	Laughing Kookaburra	Dacelo novaeguineae	80411	0845-0935	24	Betts Park	1	0	0	0	foraging, calling	
103	Laughing Kookaburra	Dacelo novaeguineae	90411	0745-0845	8	Boronia Park	2	0	0	0	foraging	Brickmakers Ck (upstream)
104	Laughing Kookaburra	Dacelo novaeguineae	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	foraging	
105	Laughing Kookaburra	Dacelo novaeguineae	110411	1650-1715	34	Buffalo Creek Reserve	0	1	0	0	foraging	
106	Laughing Kookaburra	Dacelo novaeguineae	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	foraging, calling	
107	Laughing Kookaburra	Dacelo novaeguineae	130411	1705-1740	6	Lane Cove NP north	1	0	0	0	foraging	on recently burnt ground
108	White-throated Treecreeper	Cormobates leucophaea	90411	0745-0845	8	Boronia Park	2	0	0	0	foraging, calling	in Brickmakers Ck (upstream) on old paperbark
109	White-throated	Cormobates leucophaea	120411	1510-1615	11	Field of Mars Reserve Site A	1	0	0	0	foraging	male, loosely with mixed foraging grp

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	Treecreeper											(EYR, BT, VFW)
110	White-throated Treecreeper	Cormobates leucophaea	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	calling	heard upstream nr backyard eucs S side Buffalo Ck
111	Satin Bowerbird	Ptilonorhynchus violaceus	90411	0745-0845	8	Boronia Park	1	0	0	0	foraging	nr fruiting tree
112	Superb Fairy-wren	Malurus cyaneus	70411	0815-0920	26	Bedlam Bay Regional Park	2	5	6	0	foraging, calling	3 groups, total 13 birds - 1 top section weedy walkway (2 birds), other in weedy and planted bayside strip nr boatshed (5 birds), third group in weedy edge of mown ampitheatre around oval
113	Superb Fairy-wren	Malurus cyaneus	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	11	0	0	0	foraging, calling, perching	3 groups foraging edge of mangroves and in lantana lower slopes; feral cat sighted 1640 edge burnt bracken north bank
114	Superb Fairy-wren	Malurus cyaneus	80411	0750-0820	25	Gladesville Reserve	0	6	0	0	foraging	nr water's edge
115	Superb Fairy-wren	Malurus cyaneus	80411	0845-0935	24	Betts Park	3	0	0	0	foraging, calling	
116	Superb Fairy-wren	Malurus cyaneus	80411	1630-1715	29	Riverglade Reserve	0	5	0	0	foraging, calling	in typha dam/stormwater detention basin & lomandra
117	Superb Fairy-wren	Malurus cyaneus	80411	1630-1715	29	Riverglade Reserve	0	4	0	0	foraging, calling	in reedy creek nr W bridge
118	Superb Fairy-wren	Malurus cyaneus	110411	1650-1715	34	Buffalo Creek Reserve	0	5	0	0	foraging, calling	along trackside and Buffalo Ck edge with & into revege

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119	Superb Fairy-wren	Malurus cyaneus	150411	0930-1010	4	Magdala Park	0	0	10	0	foraging	2 grps of 5 each foraging newly mown east edge of oval along planted river bank
120	Variegated Fairy-wren	Malurus lamberti	60411	0840-0925	32	Mallee Reserve	10	0	0	0	foraging	no full colour males, 3 females, 2 eclipse males, rest young birds; same location as Oct 10 survey
121	Variegated Fairy-wren	Malurus lamberti	90411	0745-0845	8	Boronia Park	5	0	0	0	foraging, calling	pair obs bark-foraging 12 m in mid-canopy & blackbutts; 2nd grp of 3 in old paperbark grove upper Brickmakers Ck
122	Variegated Fairy-wren	Malurus lamberti	120411	1510-1615	11	Field of Mars Reserve Site A	5	0	0	0	foraging, calling	
123	Variegated Fairy-wren	Malurus lamberti	120411	1620-1705	13	Field of Mars Reserve Site B	3	0	0	0	foraging	
124	Variegated Fairy-wren	Malurus lamberti	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	6	0	0	0	foraging, calling	
125	Variegated Fairy-wren	Malurus lamberti	130411	1705-1740	6	Lane Cove NP north	6	0	0	0	foraging, calling	
126	White-browed Scrubwren	Sericornis frontalis	70411	0815-0920	26	Bedlam Bay Regional Park	4	4	0	0	foraging, calling	2 groups of 4 each - 1 grp near weedy steelgrid walkway and other in planted margin beside bay nr boatshed
127	White-browed Scrubwren	Sericornis frontalis	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	5	0	0	0	foraging, calling	along lantana lower slope nr creek (nr feral cat sighting @ 1640)
128	White-browed Scrubwren	Sericornis frontalis	80411	0750-0820	25	Gladesville Reserve	0	3	0	0	foraging	nr waters edge

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129	White-browed Scrubwren	Sericornis frontalis	80411	0845-0935	24	Betts Park	7	0	0	0	foraging, calling	3 groups of 2+1: in drainage line weeds below street, further south along track & across road along high school edge
130	White-browed Scrubwren	Sericornis frontalis	80411	1630-1715	29	Riverglade Reserve	0	2	0	0	foraging, calling	pair in dense Gahnia beside W creek
131	White-browed Scrubwren	Sericornis frontalis	90411	0745-0845	8	Boronia Park	4	0	0	0	foraging, calling	in regen area above Brickmakers Ck falls
132	White-browed Scrubwren	Sericornis frontalis	110411	1650-1715	34	Buffalo Creek Reserve	0	2	0	0	foraging, calling	
133	White-browed Scrubwren	Sericornis frontalis	120411	1510-1615	11	Field of Mars Reserve Site A	4	0	0	0	foraging, calling	
134	White-browed Scrubwren	Sericornis frontalis	120411	1620-1705	13	Field of Mars Reserve Site B	5	0	0	0	foraging, calling	2 grps of 3 and 2 along lower slopes nr Buffalo Ck
135	White-browed Scrubwren	Sericornis frontalis	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	foraging, calling	
136	White-browed Scrubwren	Sericornis frontalis	130411	1705-1740	6	Lane Cove NP north	4	0	0	0	foraging, calling	in burnt and unburnt areas
137	Yellow Thornbill	Acanthiza nana	110411	1650-1715	34	Buffalo Creek Reserve	0	7	0	0	foraging, calling	along ck/reveg path edge
138	Yellow Thornbill	Acanthiza nana	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	foraging	
139	Brown Thornbill	Acanthiza pusilla	90411	0745-0845	8	Boronia Park	4	0	0	0	foraging, calling	in old paperbark grove upper Brickmakers Ck
140	Brown Thornbill	Acanthiza pusilla	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging, territory defence	
141	Brown Thornbill	Acanthiza pusilla	120411	1620-1705	13	Field of Mars Reserve Site B	3	0	0	0	foraging, calling	in eucs along cemetery edge
142	Brown Thornbill	Acanthiza pusilla	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	3	0	0	0	foraging, calling	in Melaleucas trackside and eucs

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143	Brown Thornbill	Acanthiza pusilla	130411	1705-1740	6	Lane Cove NP north	2	0	0	0	foraging, calling	
144	Spotted Pardalote	Pardalotus punctatus	90411	0745-0845	8	Boronia Park	2	0	0	0	foraging	bark-foraging
145	Spotted Pardalote	Pardalotus punctatus	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	calling	
146	Spotted Pardalote	Pardalotus punctatus	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling	
147	Spotted Pardalote	Pardalotus punctatus	120411	1620-1705	13	Field of Mars Reserve Site B	2	0	0	0	foraging, calling	
148	Spotted Pardalote	Pardalotus punctatus	130411	1705-1740	6	Lane Cove NP north	1	0	0	0	calling	
149	Striated Pardalote	Pardalotus striatus	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	foraging, calling	
150	Eastern Spinebill	Acanthorhynchus tenuirostris	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	1	0	0	0	foraging, calling	male, opp Richmond Crescent
151	Eastern Spinebill	Acanthorhynchus tenuirostris	80411	0845-0935	24	Betts Park	1	0	0	0	calling	male
152	Eastern Spinebill	Acanthorhynchus tenuirostris	120411	1510-1615	11	Field of Mars Reserve Site A	1	0	0	0	foraging, calling	male; in flowering *Banksia spinulosa*
153	Eastern Spinebill	Acanthorhynchus tenuirostris	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	3	0	0	0	foraging, calling	
154	Yellow-faced Honeyeater	Lichenostomus chrysops	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	calling	
155	Yellow-faced Honeyeater	Lichenostomus chrysops	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	flyover	
156	Yellow-faced Honeyeater	Lichenostomus chrysops	150411	0930-1010	4	Magdala Park	0	5	0	0	foraging, perched, flying	in planted eucs east edge & moved N up river
157	Noisy Miner	Manorina melanocephala	60411	0750-0830	31	Olympic Park	0	17	0	0	foraging, calling	no dependent young; in flowering eucs
158	Noisy Miner	Manorina melanocephala	60411	0840-0925	32	Mallee Reserve	6	0	0	0	foraging, calling	

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159	Noisy Miner	Manorina melanocephala	60411	0930-0940	35	Tyagarah Reserve	0	0	4	0	foraging, calling	
160	Noisy Miner	Manorina melanocephala	60411	0950-1010	40	Bremner Park	0	13	0	0	foraging, calling	
161	Noisy Miner	Manorina melanocephala	60411	1015-1100	37	Morrison Bay Park	0	0	7	0	foraging	with 1 young
162	Noisy Miner	Manorina melanocephala	60411	1540-1600	38	Putney Point	6	0	0	0	foraging, calling	
163	Noisy Miner	Manorina melanocephala	60411	1610-1630	39	Putney Park	0	20	0	0	foraging, calling	in flowering yellow bloodwood
164	Noisy Miner	Manorina melanocephala	60411	1635-1700	36	Stanley Street	0	0	0	17	foraging, calling	in flowering murraya hedges
165	Noisy Miner	Manorina melanocephala	60411	1710-1730	16	Eltham Street	0	0	0	20	foraging	1-2 dependent young but most independent
166	Noisy Miner	Manorina melanocephala	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	6	0	foraging	
167	Noisy Miner	Manorina melanocephala	70411	0945-1005	19	Hillcrest Avenue	0	0	0	20	foraging, calling	with 2 part-dependent young, in large backyard eucalypts
168	Noisy Miner	Manorina melanocephala	70411	1015-1030	27	Western Crescent	0	0	0	9	foraging	
169	Noisy Miner	Manorina melanocephala	70411	1035-1050	28	Tennyson Road	0	0	0	7	foraging	
170	Noisy Miner	Manorina melanocephala	70411	1530-1550	21	Tarban Creek Reserve	8	0	0	0	foraging, calling	
171	Noisy Miner	Manorina melanocephala	70411	1555-1615	23	Tarban Creek Reserve	0	13	0	0	foraging, calling	
172	Noisy Miner	Manorina melanocephala	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	9	0	0	0	foraging, calling	
173	Noisy Miner	Manorina melanocephala	80411	0750-0820	25	Gladesville Reserve	0	12	0	0	foraging, nesting	1 bird observed lantana twig to nest in brush box & chasing currawongs

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
174	Noisy Miner	Manorina melanocephala	80411	0845-0935	24	Betts Park	4	0	0	0	foraging, calling	
175	Noisy Miner	Manorina melanocephala	80411	0940-0955	20	Kelly Street	0	0	0	12	foraging, calling, nesting	1 obs carrying nest material to street verge brush box & foraging in flowering murraya
176	Noisy Miner	Manorina melanocephala	80411	1005-1030	18	Mary Street	0	0	0	19	foraging, calling	
177	Noisy Miner	Manorina melanocephala	80411	1615-1625	30	Riverglade Reserve	0	0	1	0	foraging	
178	Noisy Miner	Manorina melanocephala	80411	1630-1715	29	Riverglade Reserve	0	12	0	0	foraging, calling	foraging in planted banksia & along both creeks
179	Noisy Miner	Manorina melanocephala	90411	0720-0735	7	Boronia Park	0	0	10	0	foraging, calling	in perimeter planted eucs
180	Noisy Miner	Manorina melanocephala	90411	0855-0910	9	Park Road	0	0	0	9	foraging, calling	
181	Noisy Miner	Manorina melanocephala	90411	0915-0940	17	Abigail Street	0	0	0	21	foraging, flying, calling	
182	Noisy Miner	Manorina melanocephala	90411	1630-1655	14	Beazley Street	0	0	0	22	foraging, calling	in late flowering street verge bottlebrush & eucs
183	Noisy Miner	Manorina melanocephala	90411	1700-1715	15	Monash Road	0	0	0	15	foraging, calling	
184	Noisy Miner	Manorina melanocephala	90411	1720-1740	12	Badajoz Road	0	0	0	15	foraging, calling	
185	Noisy Miner	Manorina melanocephala	100411	0805-0835	1	Moncrieff Drive	0	0	0	26	foraging, calling	in flowering street eucs, flowering murraya hedges and tibouchina
186	Noisy Miner	Manorina melanocephala	100411	0845-0910	2	Blaxland Street	0	0	0	12	foraging, calling	in flowering camellia, murraya garden hedges
187	Noisy Miner	Manorina melanocephala	100411	0915-0935	10	Westminster Road	0	0	0	12	foraging, calling	in some flowering old paperbark in street verge

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
188	Noisy Miner	Manorina melanocephala	110411	0915-0955	5	Holy Cross College	0	0	10	0	foraging	ovals & planted tallowwood perimeters
189	Noisy Miner	Manorina melanocephala	110411	1005-1055	33	Wallumatta Nature Reserve	13	0	0	0	foraging, calling, mobbing	
190	Noisy Miner	Manorina melanocephala	110411	1650-1715	34	Buffalo Creek Reserve	0	3	0	0	foraging, calling	
191	Noisy Miner	Manorina melanocephala	150411	0930-1010	4	Magdala Park	0	0	2	0	foraging	
192	Red Wattlebird	Anthochaera carunculata	60411	0750-0830	31	Olympic Park	0	1	0	0	calling	
193	Red Wattlebird	Anthochaera carunculata	60411	0840-0925	32	Mallee Reserve	2	0	0	0	calling	
194	Red Wattlebird	Anthochaera carunculata	60411	0950-1010	40	Bremner Park	0	1	0	0	foraging	
195	Red Wattlebird	Anthochaera carunculata	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	6	0	foraging	in privet and wild olive & flowering *Banksia integrifolia*
196	Red Wattlebird	Anthochaera carunculata	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	1	0	0	0	foraging, calling	
197	Red Wattlebird	Anthochaera carunculata	80411	0845-0935	24	Betts Park	1	0	0	0	calling	
198	Red Wattlebird	Anthochaera carunculata	80411	1630-1715	29	Riverglade Reserve	0	1	0	0	calling	in older reveg E side of path
199	Red Wattlebird	Anthochaera carunculata	80411	1630-1715	29	Riverglade Reserve	0	2	0	0	foraging, calling	
200	Red Wattlebird	Anthochaera carunculata	90411	0745-0845	8	Boronia Park	1	0	0	0	calling	
201	Red Wattlebird	Anthochaera carunculata	90411	1630-1655	14	Beazley Street	0	0	0	2	foraging, calling	
202	Red Wattlebird	Anthochaera carunculata	90411	1700-1715	15	Monash Road	0	0	0	1	foraging	

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203	Red Wattlebird	Anthochaera carunculata	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	foraging	
204	Black-faced Cuckoo-shrike	Coracina novaehollandiae	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	1	0	calling	
205	Black-faced Cuckoo-shrike	Coracina novaehollandiae	80411	0845-0935	24	Betts Park	1	0	0	0	calling	
206	Black-faced Cuckoo-shrike	Coracina novaehollandiae	90411	1630-1655	14	Beazley Street	0	0	0	1	calling, perching	in single backyard camphor laurel 10 Beazley St
207	Golden Whistler	Pachycephala pectoralis	90411	0745-0845	8	Boronia Park	1	0	0	0	foraging	adult female foraging in old paperbark grove, upper Brickmakers Creek
208	Golden Whistler	Pachycephala pectoralis	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging	pair, in grp with BT, GF, VFW, Silvereye, EYR
209	Golden Whistler	Pachycephala pectoralis	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	foraging, calling	female calling
210	Golden Whistler	Pachycephala pectoralis	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	foraging	female
211	Golden Whistler	Pachycephala pectoralis	130411	1705-1740	6	Lane Cove NP north	2	0	0	0	foraging, calling	male and female
212	Australasian Figbird	Sphecotheres vieilloti	90411	1630-1655	14	Beazley Street	0	0	0	2	calling, perching	in street verge eucs
213	Olive-backed Oriole	Oriolus sagittatus	60411	1610-1630	39	Putney Park	0	1	0	0	foraging	perched in eucs
214	Olive-backed Oriole	Oriolus sagittatus	60411	1710-1730	16	Eltham Street	0	0	0	1	foraging	
215	Olive-backed Oriole	Oriolus sagittatus	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	perching	briefly perched in top eucs below rock shelf
216	Grey Butcherbird	Cracticus torquatus	60411	0750-0830	31	Olympic Park	0	3	0	0	foraging, calling	
217	Grey Butcherbird	Cracticus torquatus	60411	0840-0925	32	Mallee Reserve	1	0	0	0	calling	

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218	Grey Butcherbird	Cracticus torquatus	60411	1015-1100	37	Morrison Bay Park	0	0	1	0	foraging	
219	Grey Butcherbird	Cracticus torquatus	60411	1540-1600	38	Putney Point	2	0	0	0	foraging, calling	with 1 young
220	Grey Butcherbird	Cracticus torquatus	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	2	0	foraging	
221	Grey Butcherbird	Cracticus torquatus	70411	0945-1005	19	Hillcrest Avenue	0	0	0	3	foraging, calling	
222	Grey Butcherbird	Cracticus torquatus	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	2	0	0	0	foraging, calling	
223	Grey Butcherbird	Cracticus torquatus	80411	0845-0935	24	Betts Park	2	0	0	0	foraging	
224	Grey Butcherbird	Cracticus torquatus	80411	0940-0955	20	Kelly Street	0	0	0	1	foraging, calling	
225	Grey Butcherbird	Cracticus torquatus	80411	1005-1030	18	Mary Street	0	0	0	1	foraging	
226	Grey Butcherbird	Cracticus torquatus	80411	1615-1625	30	Riverglade Reserve	0	0	1	0	foraging	
227	Grey Butcherbird	Cracticus torquatus	80411	1630-1715	29	Riverglade Reserve	0	1	0	0	foraging	
228	Grey Butcherbird	Cracticus torquatus	90411	0720-0735	7	Boronia Park	0	0	2	0	foraging, calling	
229	Grey Butcherbird	Cracticus torquatus	90411	0855-0910	9	Park Road	0	0	0	1	perching	
230	Grey Butcherbird	Cracticus torquatus	90411	1630-1655	14	Beazley Street	0	0	0	1	calling	
231	Grey Butcherbird	Cracticus torquatus	100411	0845-0910	2	Blaxland Street	0	0	0	1	calling	
232	Grey Butcherbird	Cracticus torquatus	110411	0915-0955	5	Holy Cross College	0	0	1	0	foraging	
233	Grey Butcherbird	Cracticus torquatus	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	foraging	
234	Grey Butcherbird	Cracticus torquatus	110411	1650-1715	34	Buffalo Creek Reserve	0	2	0	0	foraging	1 young with 1 adult

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235	Australian Magpie	Cracticus tibicen	60411	0750-0830	31	Olympic Park	0	5	0	0	foraging	
236	Australian Magpie	Cracticus tibicen	60411	0840-0925	32	Mallee Reserve	1	0	0	0	foraging	
237	Australian Magpie	Cracticus tibicen	60411	0930-0940	35	Tyagarah Reserve	0	0	2	0	foraging	
238	Australian Magpie	Cracticus tibicen	60411	0950-1010	40	Bremner Park	0	2	0	0	foraging	
239	Australian Magpie	Cracticus tibicen	60411	1610-1630	39	Putney Park	0	1	0	0	foraging	
240	Australian Magpie	Cracticus tibicen	60411	1635-1700	36	Stanley Street	0	0	0	3	foraging, calling	
241	Australian Magpie	Cracticus tibicen	60411	1710-1730	16	Eltham Street	0	0	0	1	foraging	
242	Australian Magpie	Cracticus tibicen	70411	0945-1005	19	Hillcrest Avenue	0	0	0	2	foraging	
243	Australian Magpie	Cracticus tibicen	70411	1035-1050	28	Tennyson Road	0	0	0	1	foraging	
244	Australian Magpie	Cracticus tibicen	70411	1530-1550	21	Tarban Creek Reserve	3	0	0	0	foraging, calling	
245	Australian Magpie	Cracticus tibicen	70411	1555-1615	23	Tarban Creek Reserve	0	1	0	0	foraging	
246	Australian Magpie	Cracticus tibicen	80411	0940-0955	20	Kelly Street	0	0	0	4	foraging, calling	
247	Australian Magpie	Cracticus tibicen	80411	1005-1030	18	Mary Street	0	0	0	1	foraging	
248	Australian Magpie	Cracticus tibicen	90411	0720-0735	7	Boronia Park	0	0	2	0	foraging, calling	
249	Australian Magpie	Cracticus tibicen	90411	0915-0940	17	Abigail Street	0	0	0	1	foraging	
250	Australian Magpie	Cracticus tibicen	90411	1630-1655	14	Beazley Street	0	0	0	7	calling, foraging	incl young birds
251	Australian Magpie	Cracticus tibicen	90411	1700-1715	15	Monash Road	0	0	0	1	foraging	

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252	Australian Magpie	Cracticus tibicen	100411	0845-0910	2	Blaxland Street	0	0	0	2	foraging, calling	
253	Australian Magpie	Cracticus tibicen	110411	0915-0955	5	Holy Cross College	0	0	1	0	foraging	
254	Australian Magpie	Cracticus tibicen	150411	0930-1010	4	Magdala Park	0	0	20	0	foraging	on recently mown oval and perimeter surfaces
255	Pied Currawong	Strepera graculina	60411	0750-0830	31	Olympic Park	0	4	0	0	foraging, calling	
256	Pied Currawong	Strepera graculina	60411	0840-0925	32	Mallee Reserve	2	0	0	0	foraging, calling	
257	Pied Currawong	Strepera graculina	60411	1610-1630	39	Putney Park	0	2	0	0	foraging, calling	
258	Pied Currawong	Strepera graculina	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	4	0	foraging	
259	Pied Currawong	Strepera graculina	70411	1015-1030	27	Western Crescent	0	0	0	1	calling	
260	Pied Currawong	Strepera graculina	70411	1555-1615	23	Tarban Creek Reserve	0	1	0	0	foraging	
261	Pied Currawong	Strepera graculina	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	3	0	0	0	foraging, calling	
262	Pied Currawong	Strepera graculina	80411	0750-0820	25	Gladesville Reserve	0	6	0	0	foraging	
263	Pied Currawong	Strepera graculina	80411	0940-0955	20	Kelly Street	0	0	0	2	foraging, calling	
264	Pied Currawong	Strepera graculina	80411	1630-1715	29	Riverglade Reserve	0	2	0	0	flying	flying to & from Villa Maria
265	Pied Currawong	Strepera graculina	90411	0745-0845	8	Boronia Park	10	0	0	0	mobbing, calling, feeding	mobbing roosted Powerful Owl; some eating ripe fruit
266	Pied Currawong	Strepera graculina	90411	0855-0910	9	Park Road	0	0	0	1	perching	
267	Pied Currawong	Strepera graculina	90411	0915-0940	17	Abigail Street	0	0	0	5	foraging, flying, calling	

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268	Pied Currawong	Strepera graculina	90411	1700-1715	15	Monash Road	0	0	0	2	foraging	
269	Pied Currawong	Strepera graculina	90411	1720-1740	12	Badajoz Road	0	0	0	1	perching	
270	Pied Currawong	Strepera graculina	100411	0805-0835	1	Moncrieff Drive	0	0	0	2	foraging, calling	
271	Pied Currawong	Strepera graculina	110411	0915-0955	5	Holy Cross College	0	0	3	0	foraging, calling	
272	Pied Currawong	Strepera graculina	110411	1005-1055	33	Wallumatta Nature Reserve	2	0	0	0	foraging, calling	
273	Pied Currawong	Strepera graculina	110411	1650-1715	34	Buffalo Creek Reserve	0	3	0	0	foraging, calling	
274	Pied Currawong	Strepera graculina	120411	1510-1615	11	Field of Mars Reserve Site A	1	0	0	0	foraging	
275	Pied Currawong	Strepera graculina	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	foraging	
276	Pied Currawong	Strepera graculina	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	bathing & drinking	in natural s/st shelf waterholes
277	Pied Currawong	Strepera graculina	130411	1705-1740	6	Lane Cove NP north	3	0	0	0	foraging, calling	
278	Pied Currawong	Strepera graculina	150411	0930-1010	4	Magdala Park	0	0	1	0	perching	
279	Rufous Fantail	Rhipidura rufifrons	60411	0840-0925	32	Mallee Reserve	1	0	0	0	foraging	
280	Grey Fantail	Rhipidura albiscapa	60411	0840-0925	32	Mallee Reserve	1	0	0	0	foraging	
281	Grey Fantail	Rhipidura albiscapa	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	1	0	0	0	foraging, calling	with VFWs; juv bird
282	Grey Fantail	Rhipidura albiscapa	80411	1630-1715	29	Riverglade Reserve	0	1	0	0	foraging, calling	with SFW & WBSW creek banks
283	Grey Fantail	Rhipidura albiscapa	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling	cool season pattern of foraging up & down bark like WTTC
284	Grey Fantail	Rhipidura albiscapa	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	foraging, calling	

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285	Grey Fantail	Rhipidura albiscapa	130411	1705-1740	6	Lane Cove NP north	1	0	0	0	foraging, calling	
286	Willie Wagtail	Rhipidura leucophrys	60411	1015-1100	37	Morrison Bay Park	0	0	2	0	foraging	
287	Willie Wagtail	Rhipidura leucophrys	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	2	0	foraging	
288	Willie Wagtail	Rhipidura leucophrys	80411	1615-1625	30	Riverglade Reserve	0	0	1	0	foraging	
289	Willie Wagtail	Rhipidura leucophrys	80411	1630-1715	29	Riverglade Reserve	0	3	0	0	foraging, calling	
290	Willie Wagtail	Rhipidura leucophrys	90411	0745-0845	8	Boronia Park	1	0	0	0	foraging	
291	Willie Wagtail	Rhipidura leucophrys	110411	0915-0955	5	Holy Cross College	0	0	1	0	foraging	
292	Willie Wagtail	Rhipidura leucophrys	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	1	0	0	0	foraging	
293	Willie Wagtail	Rhipidura leucophrys	150411	0930-1010	4	Magdala Park	0	0	2	0	foraging	
294	Australian Raven	Corvus coronoides	60411	0750-0830	31	Olympic Park	0	3	0	0	foraging, calling	
295	Australian Raven	Corvus coronoides	70411	1015-1030	27	Western Crescent	0	0	0	1	foraging	
296	Australian Raven	Corvus coronoides	70411	1035-1050	28	Tennyson Road	0	0	0	1	flyover	
297	Australian Raven	Corvus coronoides	80411	0750-0820	25	Gladesville Reserve	0	2	0	0	foraging	
298	Australian Raven	Corvus coronoides	80411	1005-1030	18	Mary Street	0	0	0	3	foraging	
299	Australian Raven	Corvus coronoides	90411	0855-0910	9	Park Road	0	0	0	2	perching	
300	Australian Raven	Corvus coronoides	90411	0915-0940	17	Abigail Street	0	0	0	2	foraging, calling	
301	Australian Raven	Corvus coronoides	90411	1700-1715	15	Monash Road	0	0	0	1	foraging	
302	Australian Raven	Corvus coronoides	100411	0805-0835	1	Moncrieff Drive	0	0	0	1	perching	

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303	Australian Raven	Corvus coronoides	100411	0915-0935	10	Westminster Road	0	0	0	2	foraging	
304	Australian Raven	Corvus coronoides	110411	0915-0955	5	Holy Cross College	0	0	10	0	foraging, calling	rubbish bin lid-lifting issue
305	Leaden Flycatcher	Myiagra rubecula	120411	1620-1705	13	Field of Mars Reserve Site B	1	0	0	0	foraging	1 female in blackbutt upper canopy along Buffalo Ck
306	Magpie-lark	Grallina cyanoleuca	60411	0750-0830	31	Olympic Park	0	1	0	0	foraging	
307	Magpie-lark	Grallina cyanoleuca	60411	1015-1100	37	Morrison Bay Park	0	0	4	0	foraging	
308	Magpie-lark	Grallina cyanoleuca	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	2	0	foraging	
309	Magpie-lark	Grallina cyanoleuca	80411	1615-1625	30	Riverglade Reserve	0	0	2	0	foraging	
310	Magpie-lark	Grallina cyanoleuca	150411	0930-1010	4	Magdala Park	0	0	8	0	foraging	on recently mown oval and perimeter surfaces
311	Eastern Yellow Robin	Eopsaltria australis	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging	along upslope track with grp of VFW, GW, BT, Silvereye
312	Silvereye	Zosterops lateralis	60411	0840-0925	32	Mallee Reserve	4	0	0	0	foraging, calling	
313	Silvereye	Zosterops lateralis	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	13	0	foraging, calling	in fruiting privet and wild olive edge of oval
314	Silvereye	Zosterops lateralis	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	6	0	0	0	foraging, calling	
315	Silvereye	Zosterops lateralis	80411	0750-0820	25	Gladesville Reserve	0	4	0	0	foraging	
316	Silvereye	Zosterops lateralis	80411	1630-1715	29	Riverglade Reserve	0	3	0	0	foraging, calling	W section nr bridge & car park
317	Silvereye	Zosterops lateralis	90411	0745-0845	8	Boronia Park	7	0	0	0	foraging, calling	eating ripe fruit in Brickmakers Ck (lower)

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318	Silvereye	Zosterops lateralis	110411	1650-1715	34	Buffalo Creek Reserve	0	2	0	0	foraging, calling	
319	Silvereye	Zosterops lateralis	120411	1510-1615	11	Field of Mars Reserve Site A	2	0	0	0	foraging, calling	probing upper canopy bark for insects
320	Silvereye	Zosterops lateralis	120411	1620-1705	13	Field of Mars Reserve Site B	2	0	0	0	foraging	
321	Silvereye	Zosterops lateralis	130411	1535-1635	3	Lane Cove NP at Sugarloaf Point	2	0	0	0	foraging, calling	
322	Silvereye	Zosterops lateralis	130411	1705-1740	6	Lane Cove NP north	2	0	0	0	foraging, calling	
323	Welcome Swallow	Hirundo neoxena	60411	0840-0925	32	Mallee Reserve	2	0	0	0	foraging	
324	Welcome Swallow	Hirundo neoxena	60411	0930-0940	35	Tyagarah Reserve	0	0	4	0	foraging, calling	
325	Welcome Swallow	Hirundo neoxena	60411	0950-1010	40	Bremner Park	0	1	0	0	foraging	
326	Welcome Swallow	Hirundo neoxena	60411	1015-1100	37	Morrison Bay Park	0	0	4	0	foraging	
327	Welcome Swallow	Hirundo neoxena	60411	1635-1700	36	Stanley Street	0	0	0	3	foraging	
328	Welcome Swallow	Hirundo neoxena	60411	1710-1730	16	Eltham Street	0	0	0	1	foraging	
329	Welcome Swallow	Hirundo neoxena	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	22	0	foraging	in a group over oval surface
330	Welcome Swallow	Hirundo neoxena	70411	0945-1005	19	Hillcrest Avenue	0	0	0	1	foraging	
331	Welcome Swallow	Hirundo neoxena	80411	0845-0935	24	Betts Park	3	0	0	0	foraging, calling	
332	Welcome Swallow	Hirundo neoxena	80411	0940-0955	20	Kelly Street	0	0	0	1	foraging	
333	Welcome Swallow	Hirundo neoxena	80411	1005-1030	18	Mary Street	0	0	0	4	foraging	
334	Welcome Swallow	Hirundo neoxena	80411	1615-1625	30	Riverglade Reserve	0	0	2	0	foraging	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
335	Welcome Swallow	Hirundo neoxena	80411	1615-1625	30	Riverglade Reserve	0	0	9	0	foraging, calling	
336	Welcome Swallow	Hirundo neoxena	110411	0915-0955	5	Holy Cross College	0	0	30	0	foraging, calling, perching	hawking low over oval and resting on old mown mounds (pics)
337	Welcome Swallow	Hirundo neoxena	130411	1705-1740	6	Lane Cove NP north	8	0	0	0	foraging	over top of blackbutts
338	Welcome Swallow	Hirundo neoxena	150411	0930-1010	4	Magdala Park	0	0	10	0	foraging	over recently mown oval surface
339	Tree Martin	Petrochelidon nigricans	80411	0845-0935	24	Betts Park	2	0	0	0	foraging, calling	
340	Tree Martin	Petrochelidon nigricans	130411	1705-1740	6	Lane Cove NP north	8	0	0	0	foraging	over top of blackbutts
341	Red-whiskered Bulbul *	Pycnonotus jocosus	60411	0840-0925	32	Mallee Reserve	2	0	0	0	foraging	
342	Common Starling *	Sturnus vulgaris	60411	1015-1100	37	Morrison Bay Park	0	0	13	0	foraging	
343	Common Starling *	Sturnus vulgaris	70411	0945-1005	19	Hillcrest Avenue	0	0	0	2	foraging	
344	Common Starling *	Sturnus vulgaris	90411	1630-1655	14	Beazley Street	0	0	0	2	calling, foraging	
345	Common Myna*	Sturnus tristis	60411	0840-0925	32	Mallee Reserve	5	0	0	0	foraging	
346	Common Myna*	Sturnus tristis	60411	1015-1100	37	Morrison Bay Park	0	0	2	0	foraging	
347	Common Myna*	Sturnus tristis	60411	1710-1730	16	Eltham Street	0	0	0	2	foraging	
348	Common Myna*	Sturnus tristis	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	1	0	foraging, calling	in fruiting privet and wild olive edge of oval
349	Common Myna*	Sturnus tristis	70411	0945-1005	19	Hillcrest Avenue	0	0	0	8	foraging, calling	
350	Common Myna*	Sturnus tristis	70411	1015-1030	27	Western Crescent	0	0	0	5	foraging	

Record No.	Common Name	Scientific Name	Date	Time	Site No.	Site Name	Bushland Remnant	Revegetated Parkland	Open Parkland	Urban Neighbour-hood	Behaviour	Comments
351	Common Myna*	Sturnus tristis	70411	1620-1720	22	Tarban Creek north bank (incls Villa Maria)	7	0	0	0	foraging, calling, perching	in mangrove edge too
352	Common Myna*	Sturnus tristis	80411	1615-1625	30	Riverglade Reserve	0	0	16	0	foraging	
353	Common Myna*	Sturnus tristis	90411	1630-1655	14	Beazley Street	0	0	0	13	foraging, calling	
354	Common Myna*	Sturnus tristis	90411	1700-1715	15	Monash Road	0	0	0	14	foraging, calling	
355	Common Myna*	Sturnus tristis	90411	1720-1740	12	Badajoz Road	0	0	0	19	foraging, calling	concentration around Callaghan st shops
356	Common Myna*	Sturnus tristis	100411	0805-0835	1	Moncrieff Drive	0	0	0	3	foraging	
357	Common Myna*	Sturnus tristis	100411	0845-0910	2	Blaxland Street	0	0	0	2	foraging	
358	Red-browed Finch	Neochmia temporalis	70411	0815-0920	26	Bedlam Bay Regional Park	0	0	6	0	foraging	
359	Red-browed Finch	Neochmia temporalis	90411	0745-0845	8	Boronia Park	4	0	0	0	foraging, calling	in seeding trackside grasses
360	Red-browed Finch	Neochmia temporalis	110411	1005-1055	33	Wallumatta Nature Reserve	1	0	0	0	calling	
361	Red-browed Finch	Neochmia temporalis	150411	0930-1010	4	Magdala Park	0	0	9	0	foraging	along mown eastern edge and into adjacent planted weedy river bank