

BIODIVERSITY SURVEYS, SPRING 2018

PREPARED FOR CITY OF RYDE BY
APPLIED ECOLOGY P/L





INTRODUCTION

Presented by Anne Carey and Dr Meredith
Brainwood, Applied Ecology P/L

OVERVIEW OF PRESENTATION

- ▶ Project background and context

- ▶ Survey methods

- ▶ Survey results

- ▶ Comparison with previous survey (Biosphere, 2008)

- ▶ Where to from here...

- ▶ BIODIVERSITY GROUPS:

- ▶ Avian fauna

- ▶ Mammals

- ▶ Herpetofauna (reptiles & frogs)

- ▶ Microbats

- ▶ Invertebrates

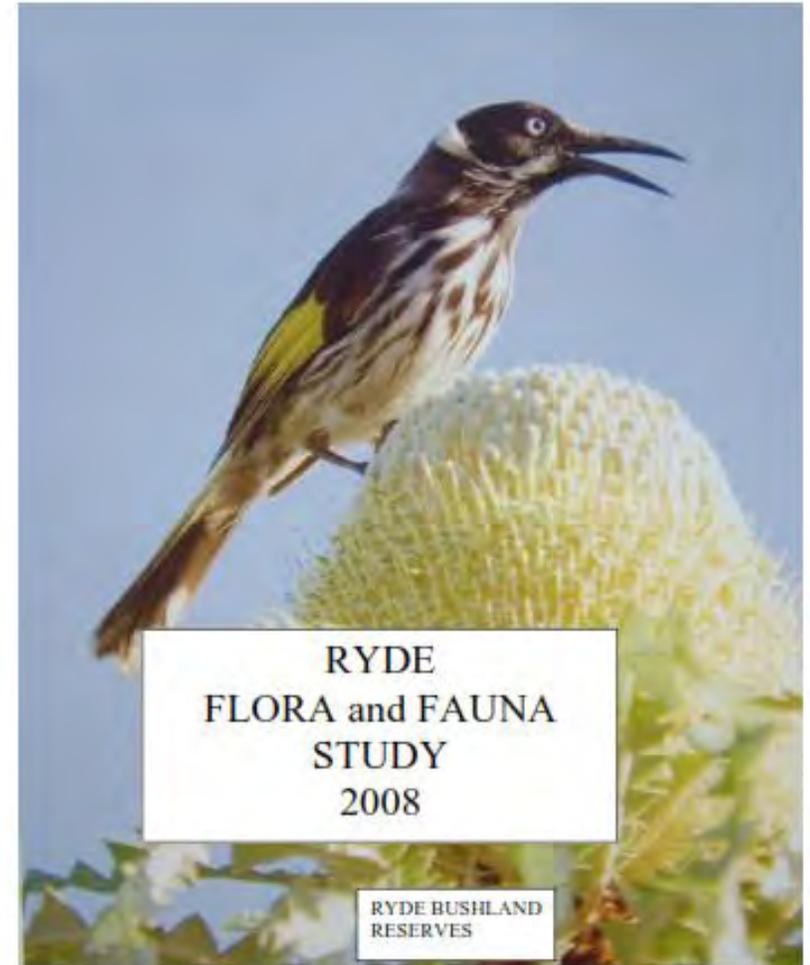
- ▶ Native flora

- ▶ Introduced flora

- ▶ Vegetation communities

PROJECT BACKGROUND

- ▶ Part of a series of flora and fauna studies for City of Ryde LGA
- ▶ Main aims are “standardised baseline information” about biodiversity of reserves
- ▶ Includes vertebrate and invertebrate fauna, endemic and introduced flora
- ▶ Stage 3 (2008) focused on smaller reserves in the LGA
- ▶ Information about species richness and abundance will inform management decisions for the reserves...



Biosphere Environmental Consultants Pty Ltd



PROJECT CONTEXT

- BIOSPHERE 2006

- Brush Farm Park, Darvall Park, Lambert Park, Field of Mars Reserve

- BIOSPHERE 2007

- Terrys Creek reserves, Kittys Creek reserves, Buffalo Creek reserves, Memorial Park

- BIOSPHERE 2008

- Other bushland reserves

- ANNE CLEMENTS & ASSOC 2016

- Brush Farm Park, Darvall Park, Lambert Park, Field of Mars Reserve

- APPLIED ECOLOGY 2017

- Terrys Creek reserves, Kittys Creek reserves, Buffalo Creek reserves, Field of Mars additional quadrats

- APPLIED ECOLOGY 2018

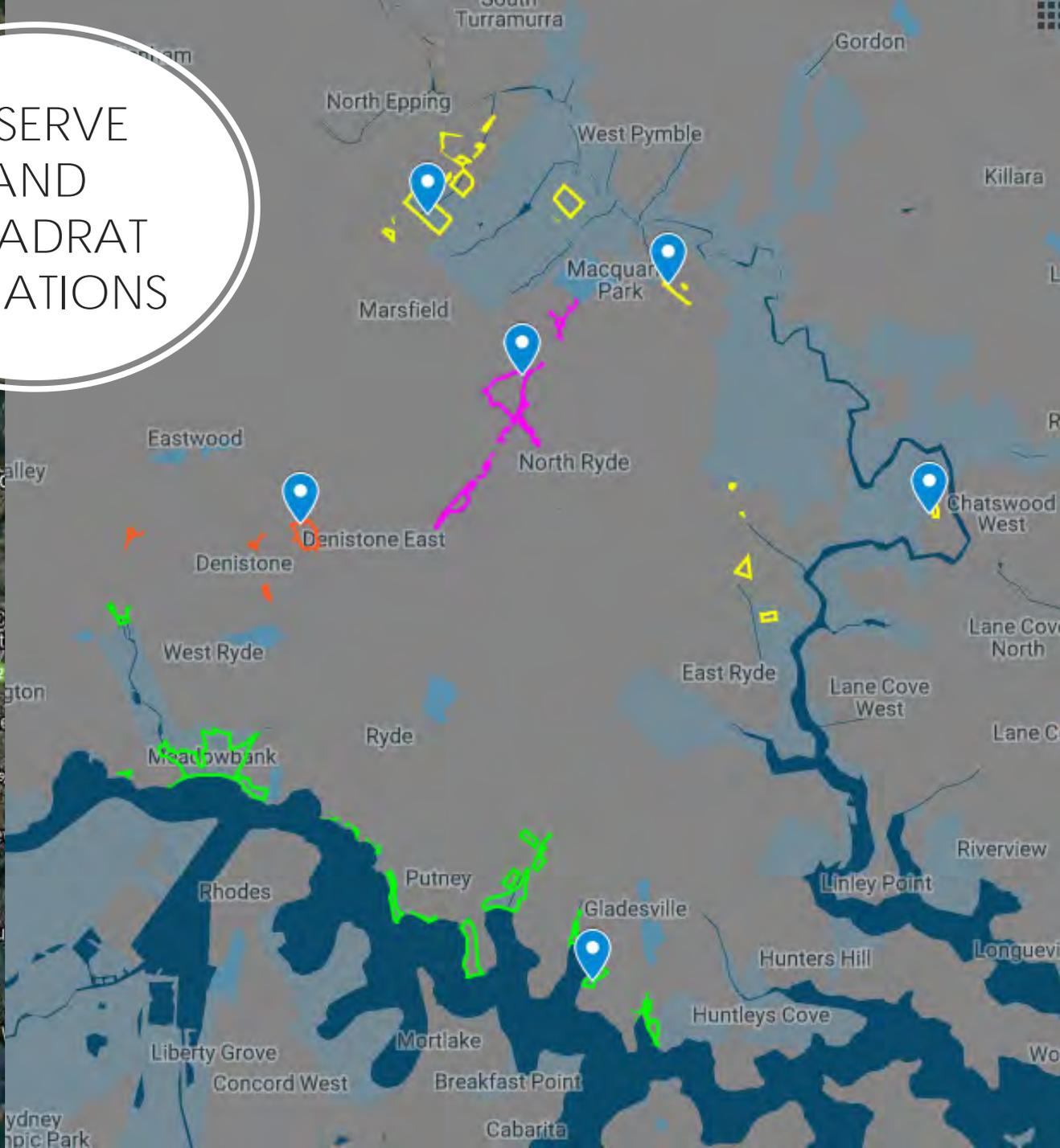
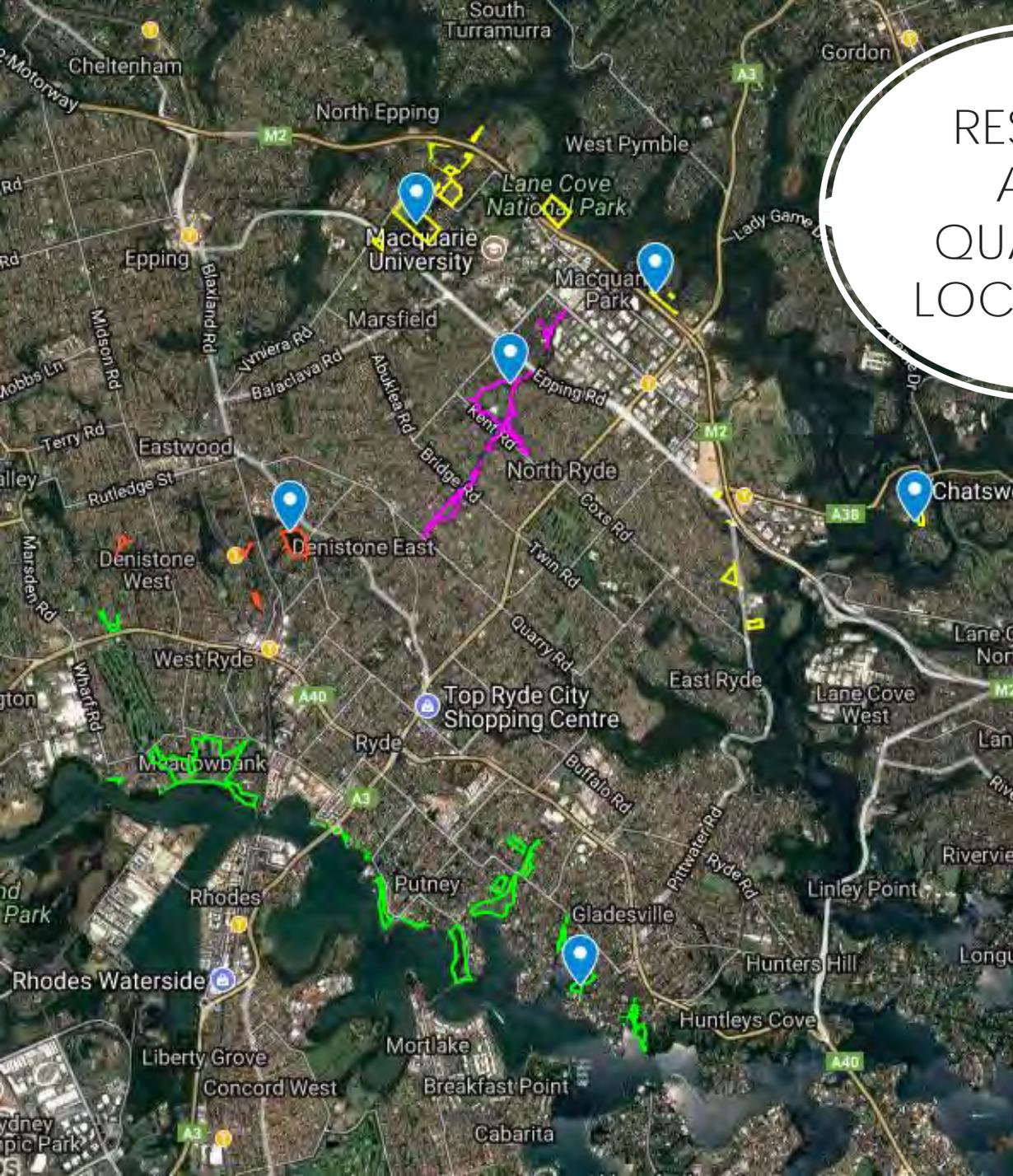
- Other bushland reserves



APPLIED ECOLOGY 2018

- ▶ Quadrat surveys (20m x 20m):
 - ▶ Timed searches for mammals, herps and invertebrates (2 per season, autumn and spring)
 - ▶ Detailed flora surveys including % cover classes (Braun-Blanquet)
- ▶ General surveys for reserves to develop species richness inventories

RESERVE
AND
QUADRAT
LOCATIONS





SURVEY METHODOLOGIES

BASED ON METHODS DESCRIBED BY BIOSPHERE 2006-2008



QUAD 20 MINUTE TIME SEARCHES

Hand searching/listening

- ▶ Herps
- ▶ Inverts

OTHER SEARCHES

- ▶ Fish, tadpoles, macroinvertebrates
20 minute dip netting + observations
- ▶ Inverts
ad hoc observations during other survey activities
- ▶ Mammals +
searches for evidence – scats, diggings, nests etc.

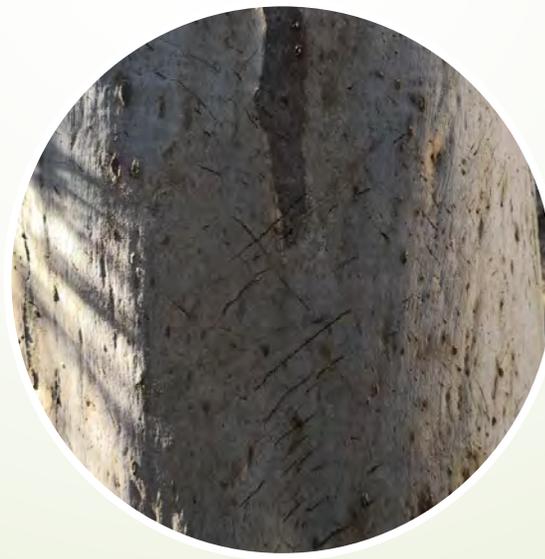
MAJOR CORRIDOR NAME	QUAD SEARCHES
NORTHERN	6
WESTERN	2
SHRIMPTONS CK	2
PARRAMATTA RIVER	2

MAJOR CORRIDOR NAME	DIP-NETTING/INSPECTION
NORTHERN	2
WESTERN	0
SHRIMPTONS CK	2
PARRAMATTA RIVER	2



SEARCHES FOR EVIDENCE

- SCATS
- HAIR
- BONES
- SCRATCHES
- CHEWS
- DIGGINGS
- PELLETS



DIURNAL BIRDS

Listening, direct observation

RESERVE GROUPING	20 MINUTE QUADRAT SESSIONS PER SEASON	ADDITIONAL BIRD SESSIONS
NORTHERN	6	25
WESTERN	2	8
SHRIMPTONS	2	8
PARRAMATTA RIVER	2	33

NOCTURNAL BIRDS

Spotlighting/listening Call playback
25W megaphone, smartphone, 50w spotlight

- Barking Owl (*Ninox connivens*)
- Eastern Barn Owl (*Tyto delicatula*),
- Masked Owl (*Tyto novaehollandiae*)
- Sooty Owl (*Tyto tenebricosa tenebricosa*)





SPOTLIGHTING

- ▶ MAMMALS
- ▶ HERPS
- ▶ NOCTURNAL BIRDS
- ▶ FISH
- ▶ INVERTS

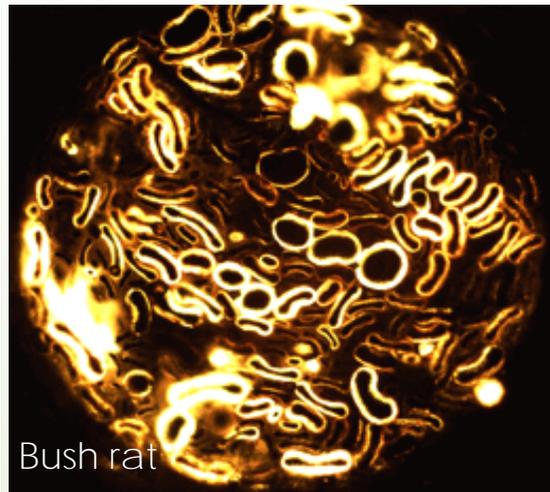
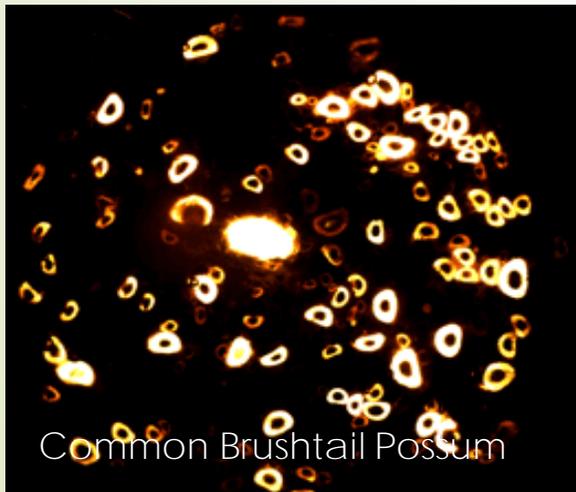
MAJOR CORRIDOR NAME	SPOTLIGHTING SESSIONS PER SEASON
NORTHERN	2
WESTERN	2
SHRIMPTONS CK	2
PARRAMATTA RIVER	2

Spotlighting was undertaken using 50- 100 watt hand held spotlights as appropriate which were used to sweep surrounding vegetation in search of eye-shine or animal movements. Time was spent listening for calls at 10 minute intervals for 1 minute. Creeks, soaks, surface waters were inspected for fish and frogs.

OTHER METHODS - HAIRTUBES

➤ MAMMAL SPECIFIC

RESERVE GROUPING	TARGET EFFORT PER SEASON	ACTUAL EFFORT AUTUMN	ACTUAL EFFORT SPRING
NORTHERN	100	126	498
WESTERN	50	75	156
SHRIMPTONS	100	166	192
PARRAMATTA RIVER	150	168	250



CAMERA TRAPPING ▶ PRIMARILY MAMMALS

RESERVE GROUPING	TARGET EFFORT PER SEASON	ACTUAL EFFORT AUTUMN	ACTUAL EFFORT SPRING
NORTHERN	40	145	200
WESTERN	40	40	52
SHRIMPTONS	40	49	49
PARRAMATTA RIVER	40	32	50



MICROBATS – SURVEY METHODS

RESERVE GROUPING	TARGET EFFORT PER SEASON	ACTUAL EFFORT AUTUMN	ACTUAL EFFORT SPRING
NORTHERN	7	14	41
WESTERN	7	20	6
SHRIMPTONS	7	16	17
PARRAMATTA RIVER	7	7	23

1. Deployed at fixed locations in reserves for 5 to 7 nights (depending on weather)
2. Carried through the reserve during spotlighting surveys



“ANABAT” BAT DETECTOR



- Records high frequency sound wave cycles to produce accurate representation of bat calls
- Important information about shape, slope and characteristic frequency is used for identification
- Record and/or real time monitor



MICROBAT CALLS

From: Bat Calls of NSW. Pennay et al, 2004

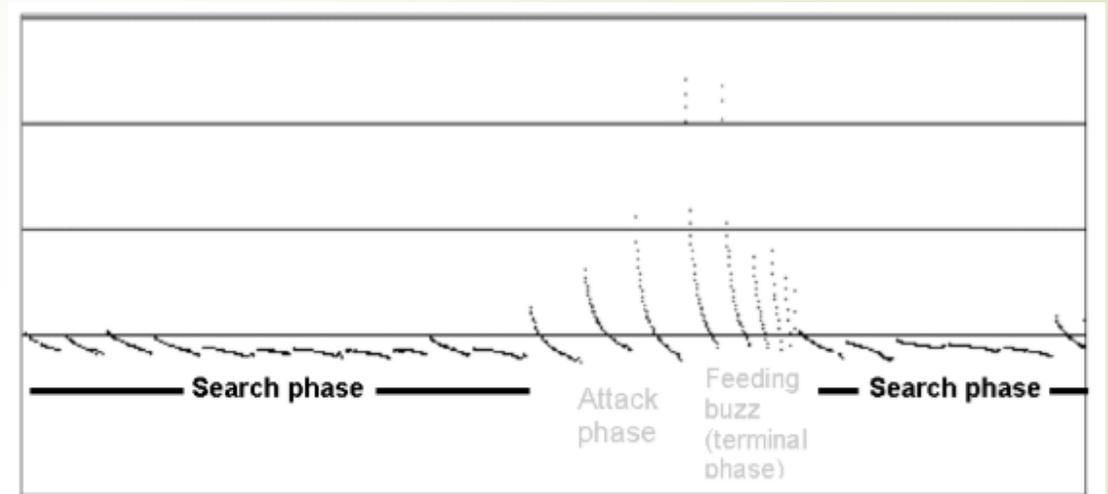
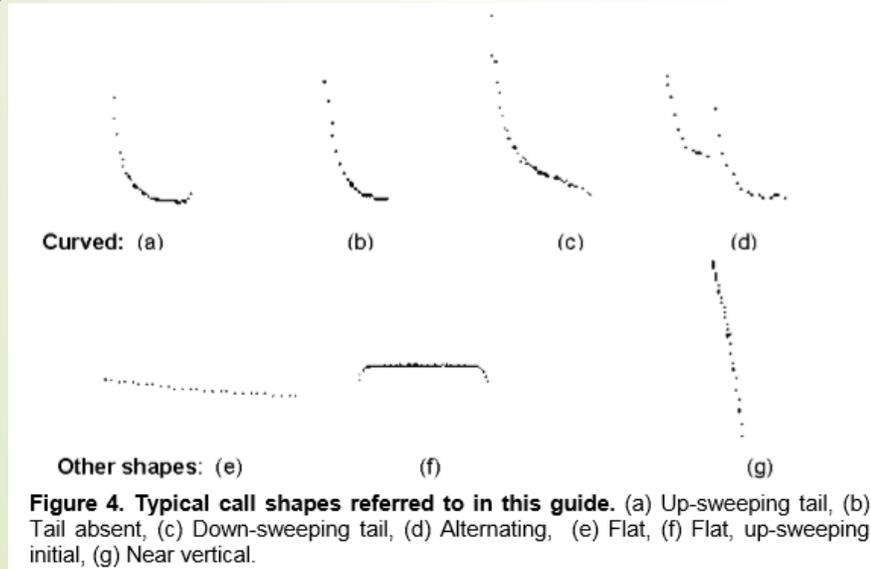
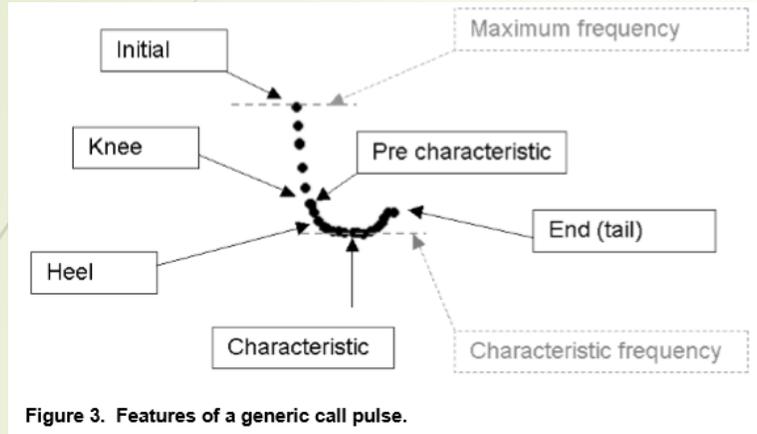


Figure 5. Phases of a *Mormopterus* species 4 call sequence, illustrating search phase pulses used for identification in this guide.

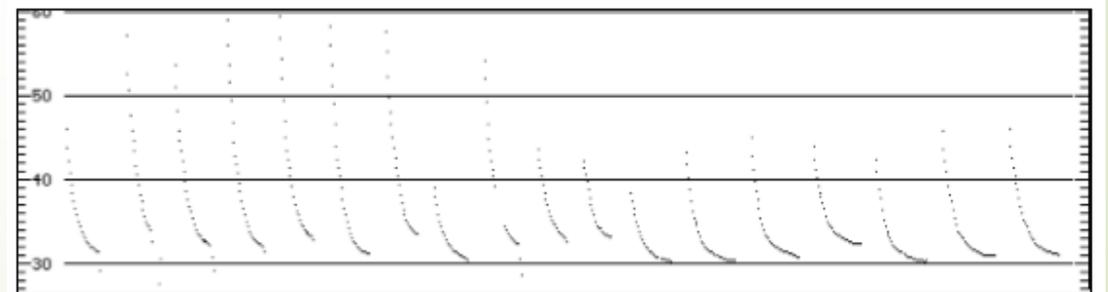
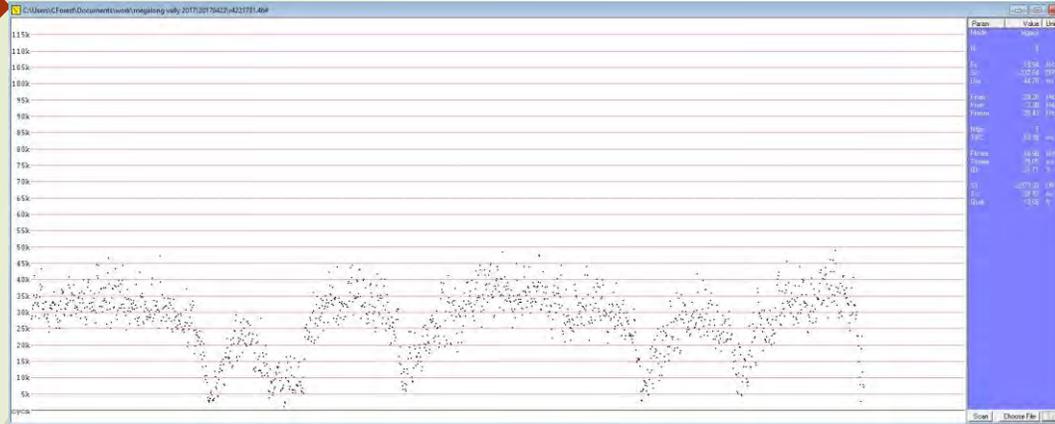
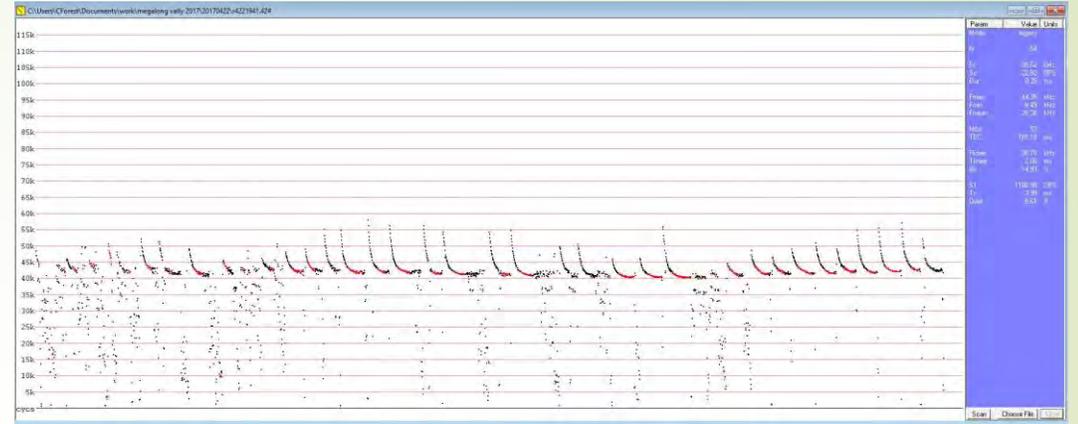


Figure 6. 'Excited' release call of *Chalinolobus gouldii*, showing several higher steeper pulses before producing normal pulses.

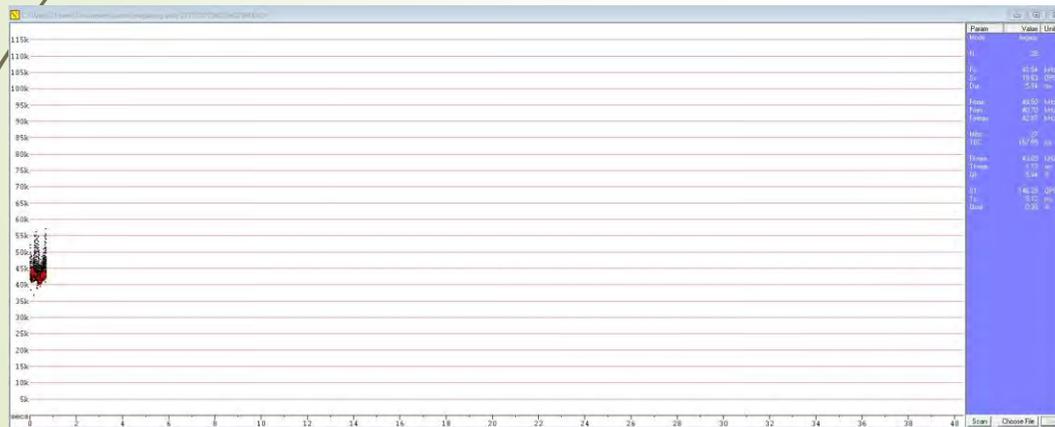
INSECT NOISE



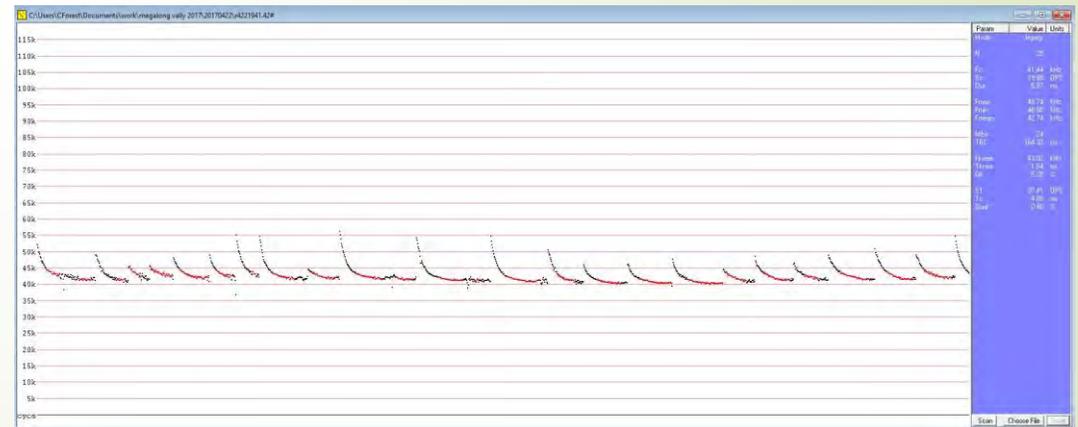
CHOCOLATE WATTLED BAT - CALL WITH INSECT NOISE

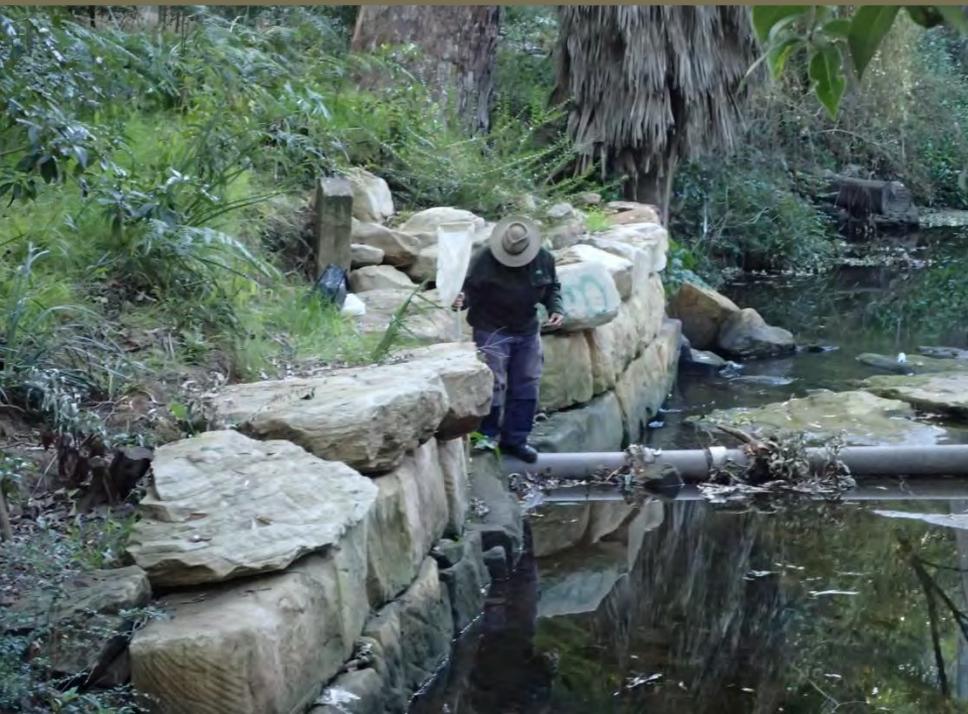


REAL TIME CALL



INSECT NOISE FILTERED OUT – READY FOR IDENTIFICATION





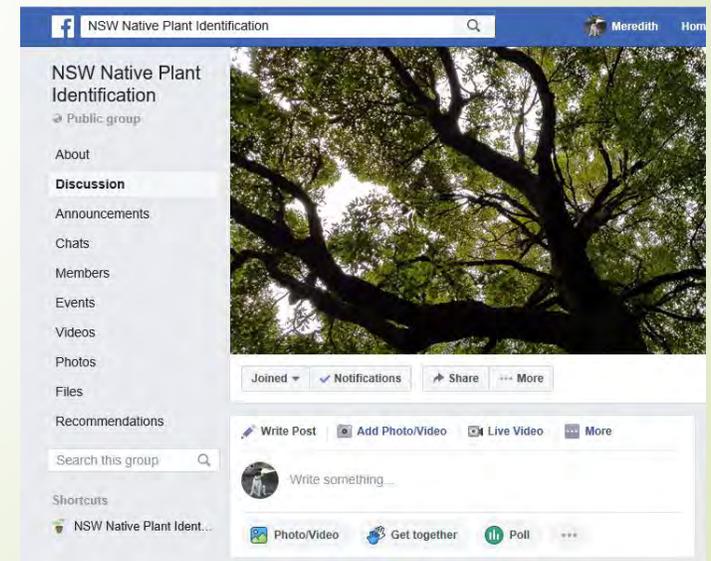
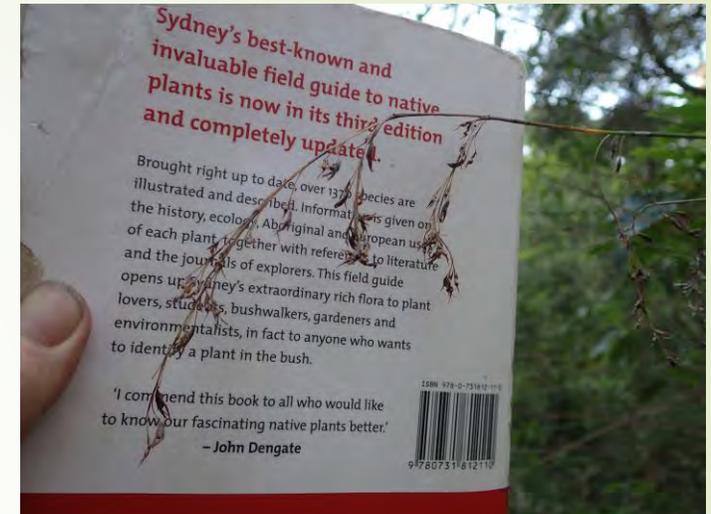
INVERTEBRATE SURVEY METHODS

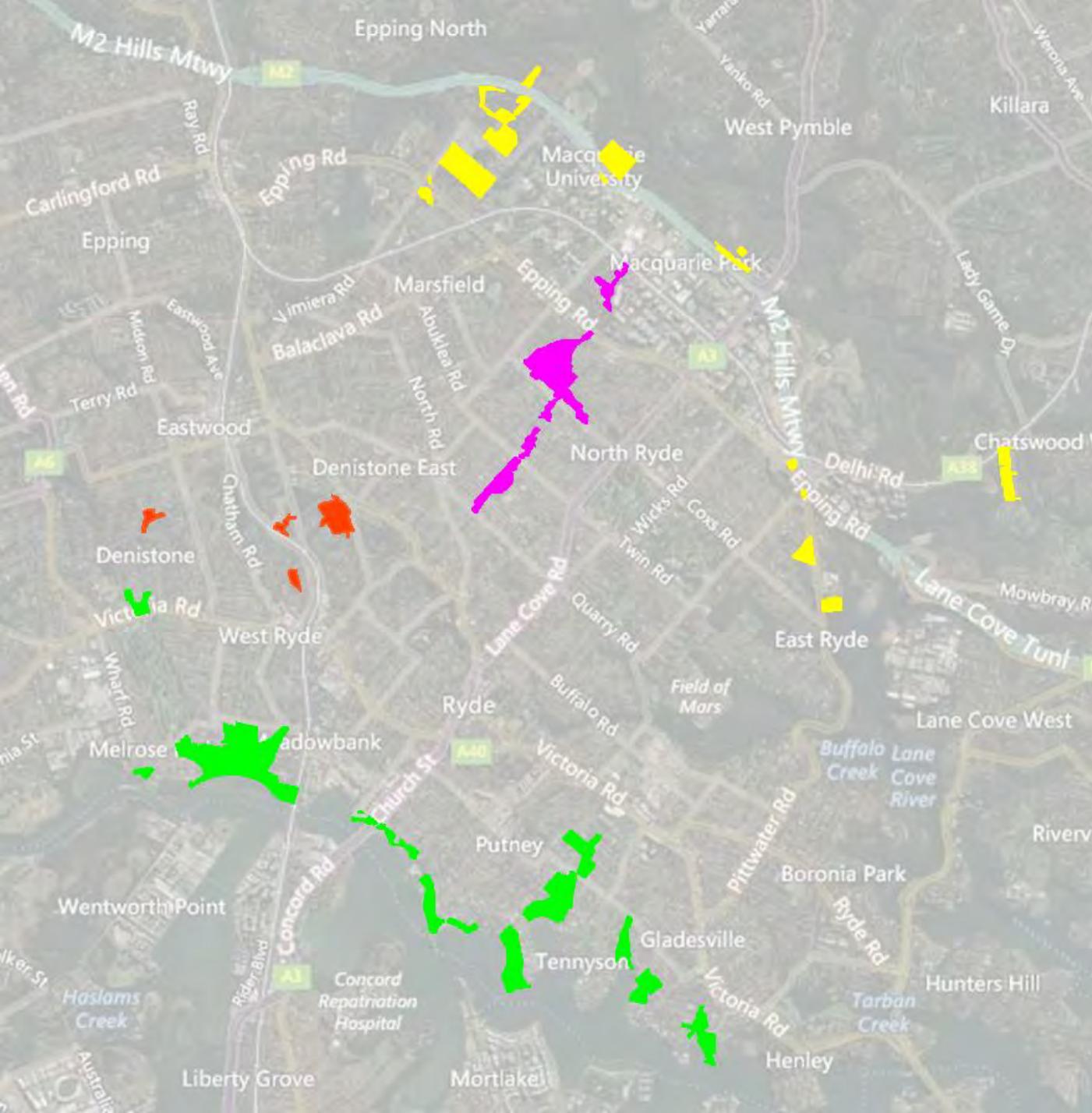
- ▶ Timed quadrat searches – 2 x 20 minute search effort per season per quadrat
- ▶ We used a stratified approach:
 - ▶ Soil and leaf litter
 - ▶ Under bark on large trees
 - ▶ In foliage
 - ▶ Under rocks and logs
- ▶ Opportunistic searches, including:
 - ▶ Dip netting creeks
 - ▶ Searches of undergrowth for soft bodied organisms
 - ▶ Light trapping using night lights for two evenings

FLORA AND VEGETATION METHODS

➤ SURVEY METHODOLOGY

- Random meander (Cropper, 1993) surveys to develop species inventory for native species and introduced species
- Ground truth vegetation mapping (OEH, 2013)
- Braun-Blanquet cover classes for species present in 6 quadrats, 20m x 20m (based on OEH's VIS survey methodology)
- Repeat surveys in autumn and spring 2018





Area	Park Name	Area	Park Name
Parramatta River Reserves	BANJO PATERSON RESERVE	Northern Reserves	BOOBAJOOL RESERVE
	BENNELONG PARK		BUNDARA RESERVE
	BILL MITCHELL PARK		CHRISTIE PARK
	BREMNER PARK		FIELDER PARK
	GLADES BAY PARK		KOBADA PARK
	KISSING POINT PARK		MARSFIELD PARK
	KOONADAN RESERVE		MYALL RESERVE
	LOOKING GLASS BAY PARK		NORTH RYDE PARK
	MALLEE RESERVE		STEWART PARK
	MAZE PARK		TASMAN PARK
	MEADOWBANK PARK		TRAFALGAR PARK
	MELROSE PARK		WATERLOO PARK
	MEMORIAL PARK		YURRAH RESERVE
	MORRISON BAY PARK		Western Reserves
PUTNEY PARK	LYNN PARK		
SETTLERS PARK	MIRIAM PARK		
TYAGARAH PARK	SYMON'S RESERVE		
Shrimptons Creek Reserves	BOOTH RESERVE		
	ELS HALL PARK		
	FLINDERS PARK		
	GREENWOOD PARK		
	QUANDONG RESERVE		
	SANTA ROSA PARK		
	TINDARRA RESERVE		
	WILGA RESERVE		



FAUNA RESULTS OVERVIEW

RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	111	94	75
NORTHERN	80	55	40
WESTERN	45	54	23
SHRIMPTONS	49	50	27
PARRAMATTA RIVER	70	70	47





NATIVE BIRDS			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	69	65	52
NORTHERN	45	35	27
WESTERN	25	37	16
SHRIMPTONS	23	30	14
PARRAMATTA RIVER	45	49	33



INTRODUCED BIRDS			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	5	7	5
NORTHERN	3	2	1
WESTERN	0	4	0
SHRIMPTONS	1	4	1
PARRAMATTA RIVER	4	7	4



NATIVE MAMMALS EX. MICROBATS			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	7	5	5
NORTHERN	7	5	5
WESTERN	2	3	2
SHRIMPTONS	3	3	3
PARRAMATTA RIVER	3	3	3

Common Brushtail Possum
 Common Ringtail Possum
 Grey-headed Flying-fox
 Long-nosed Bandicoot
 Short-beaked Echidna
 Sugar Glider
 Swamp Wallaby



05/05/2018 05:07DM



05/05/2018 00:39 08°C



SPYPOINT 2.4i 00



07:20:40 AM 2018/03/25 18°C



07:41:02 PM 2018/04/09 18





STC_0018

5

INTRODUCED MAMMALS			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
NORTHERN	4	4	2
WESTERN	4	3	1
SHRIMPTONS	3	4	2
PARRAMATTA RIVER	4	5	3



08:33:57 PM 2018/04/

05:26:39 AM 2018/05/04 19 °C

08/10/2018 14:55 16 °C

SPYPOINT SOLAR

068F 20C 20/03/2018 04:51:49

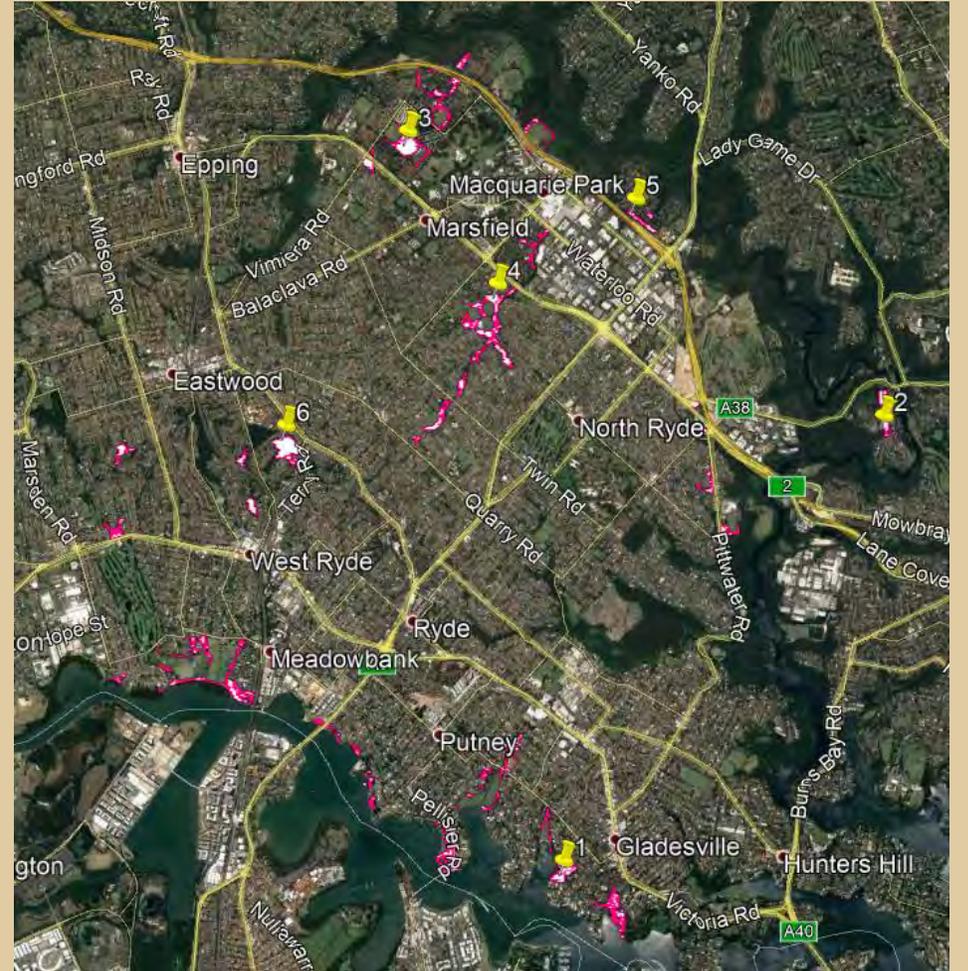


REPTILES			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	9	7	5
NORTHERN	6	6	3
WESTERN	4	4	3
SHRIMPTONS	6	5	3
PARRAMATTA RIVER	3	4	2
FROGS			
RESERVE GROUPING	2018	2008	SPECIES IN COMMON
OVERALL	4	2	2
NORTHERN	4	1	1
WESTERN	1	2	0
SHRIMPTONS	3	2	2
PARRAMATTA RIVER	3	1	1

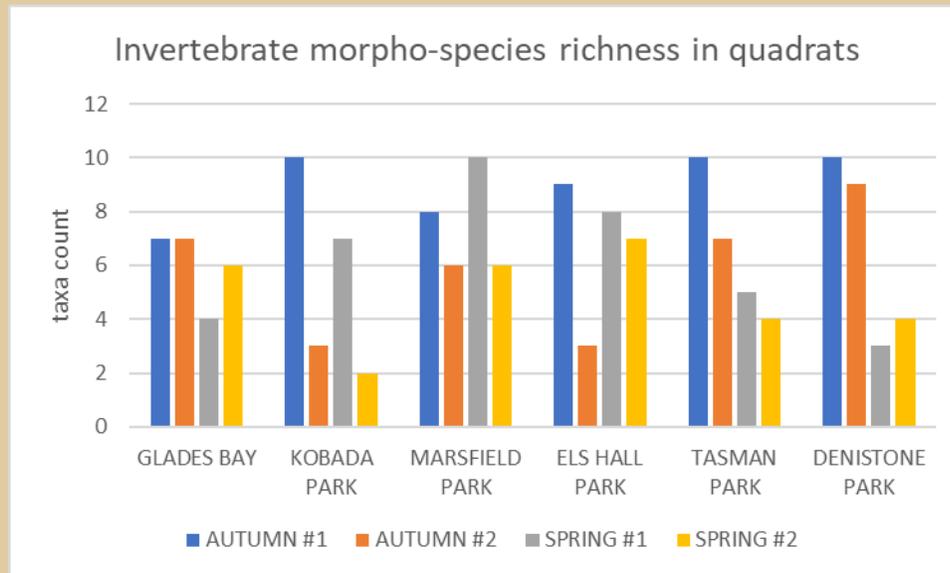


Invertebrate surveys

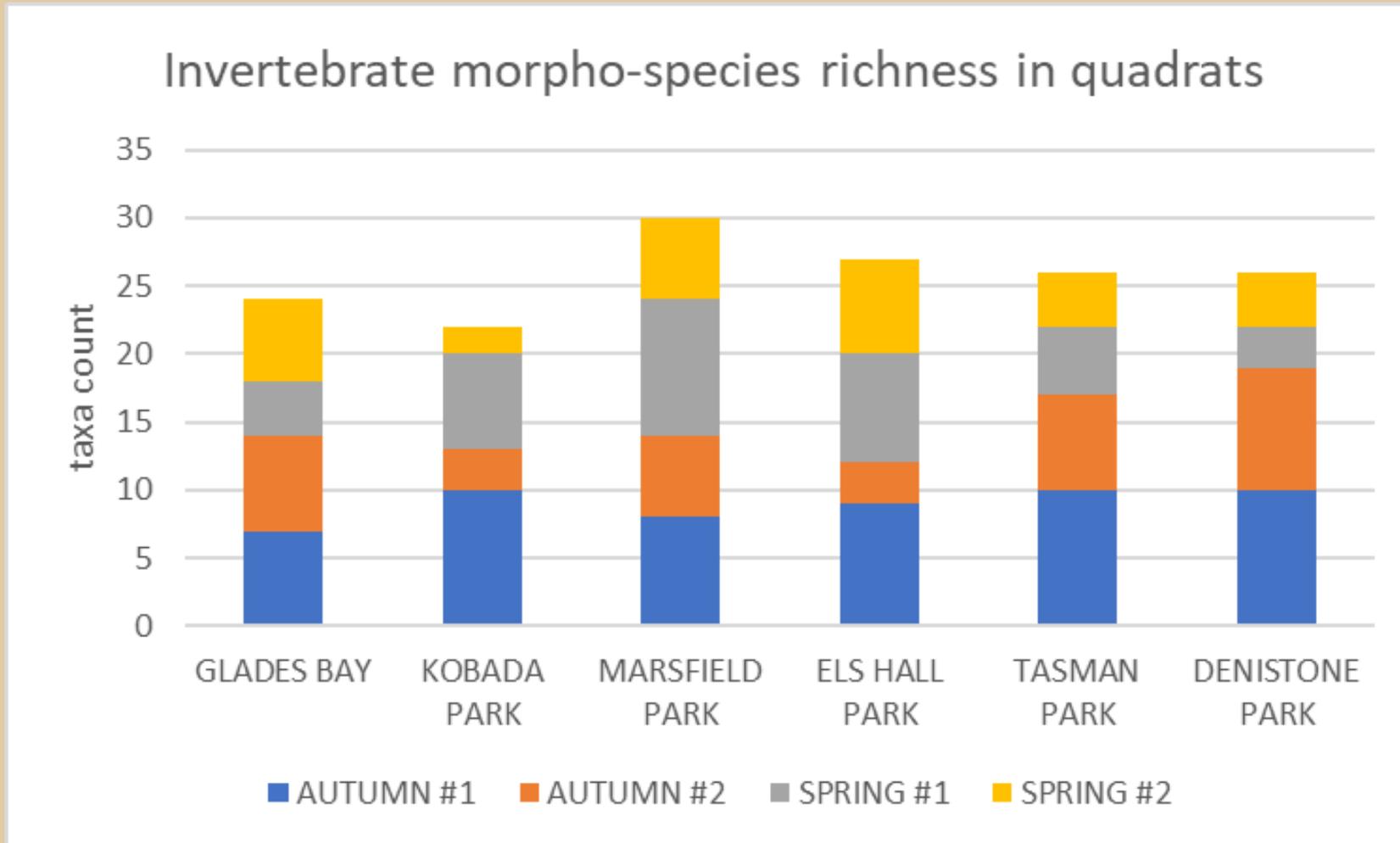
- Timed surveys in 6 quadrats – 20 minutes each
- Repeated in April and May (autumn) and September and October (spring) 2018
- Species identified to morphotypes, and abundance estimated for larger populations



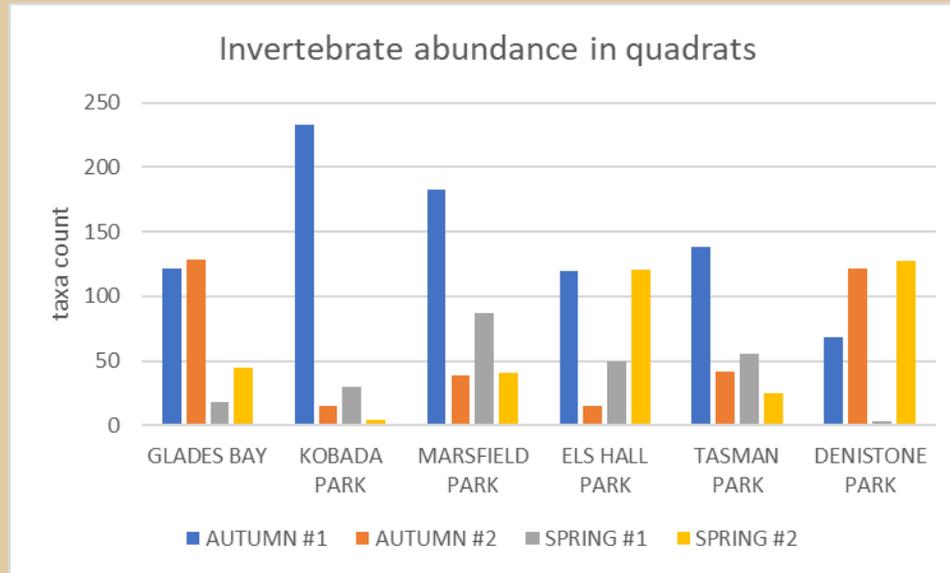
Invertebrate species richness



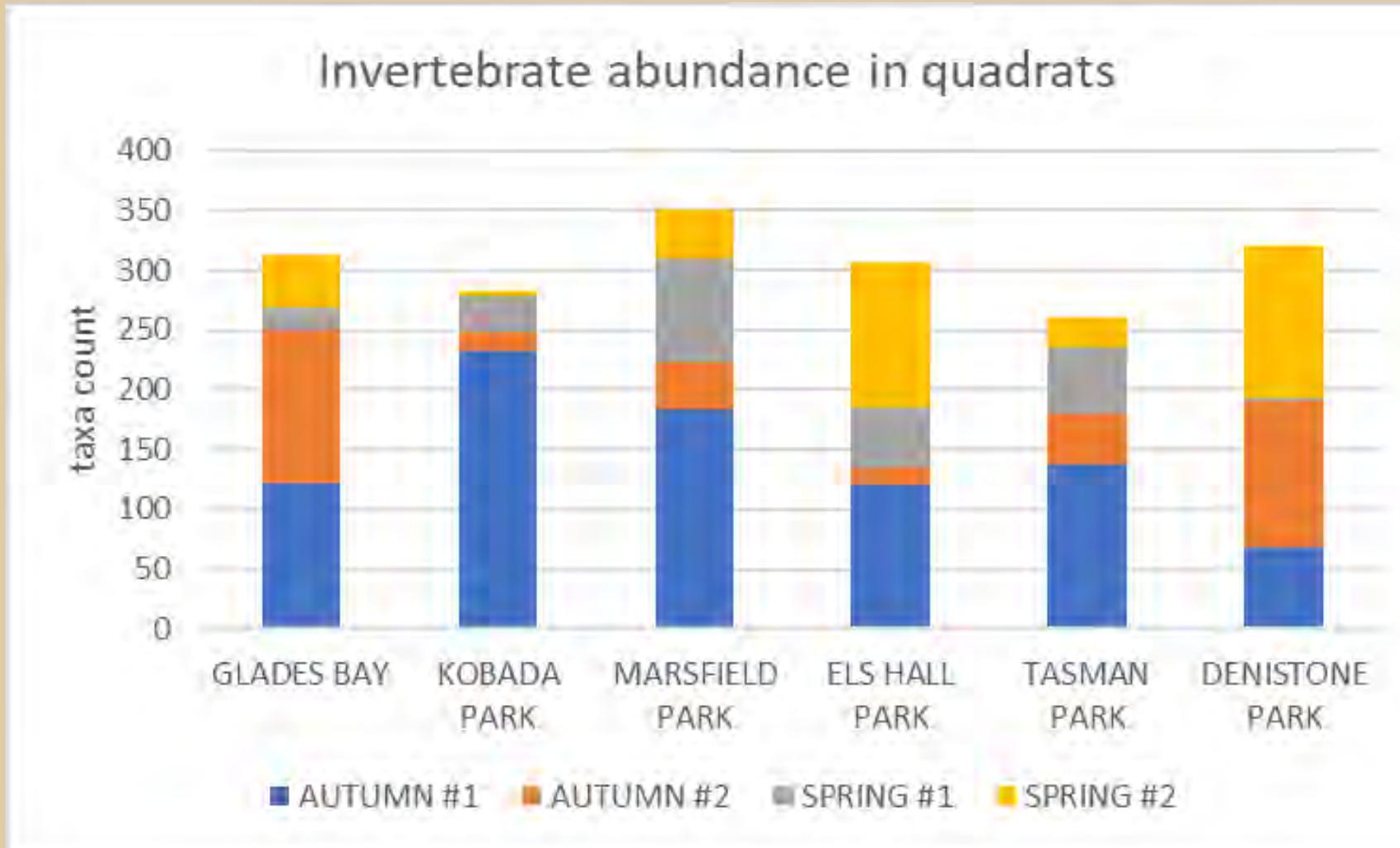
Total invertebrate species in quadrats



Invertebrate species abundance



Total invertebrate numbers in quadrats



Microbats in quadrats

Threatened species in red

Common name	Scientific Name	Parramatta River		Northern Reserves		Shrimptons Creek		Western Reserves	
		2008	2018	2008	2018	2008	2018	2008	2018
White-striped Free-tailed Bat	<i>Austronomus australis</i>		X		X		X		X
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	X	X	X	X	X	X	X	X
Chocolate Wattled Bat	<i>Chalinolobus morio</i>				X		X		
Eastern Bentwing-bat	<i>Miniopterus orianae oceanensis</i>		X		X		X		X
Ride's Free-tailed Bat	<i>Mormopterus ridei</i>		X		X		X		X
Large-footed Myotis	<i>Myotis macropus</i>				X				
a Long-eared Bat	<i>Nyctophilus sp</i>		X		X		X		X
Yellow-bellied Sheath-tailed Bat	<i>Saccolaimus flaviventris</i>		X		X				
Large Forest Bat	<i>Vespadelus darlingtoni</i>		X		X		X		
Little Forest Bat	<i>Vespadelus vulturnus</i>			X					X
Little Bentwing Bat	<i>Miniopterus australis</i>		X		X				X
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>				X				



More about microbats

- Microbats make up more than 30% of mammals in Sydney
- 11 species of microbats and 1 flying fox in 2018, compared with 3 species in 2008
- Includes 4 threatened microbat species and 1 threatened megabat species



Urban tolerant species

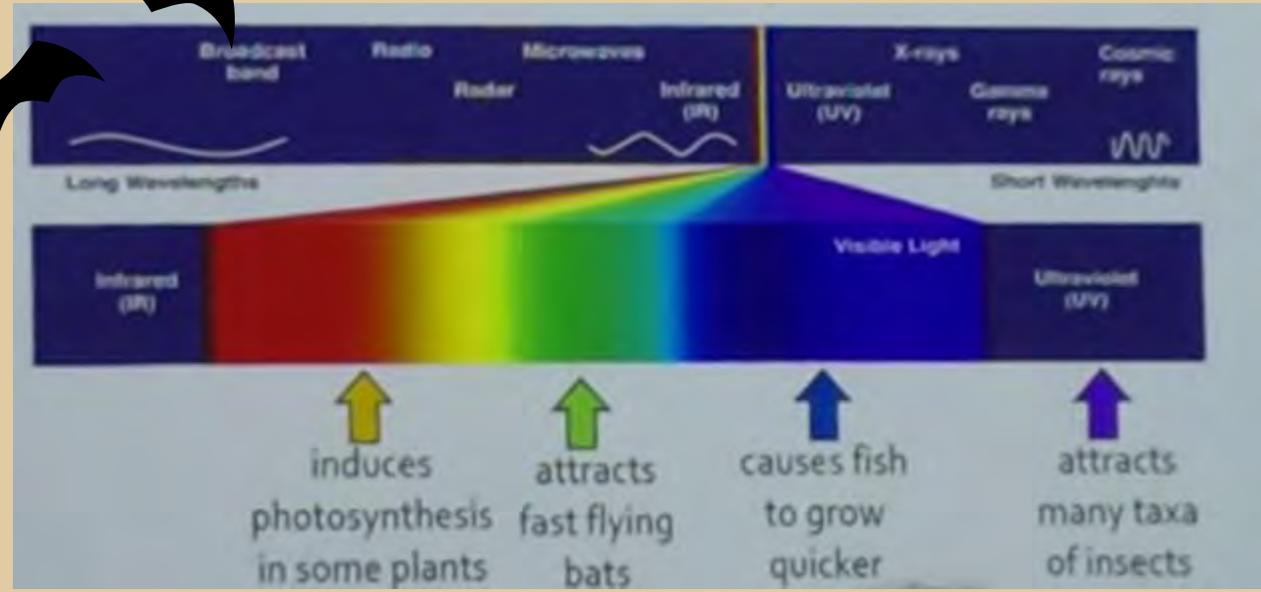
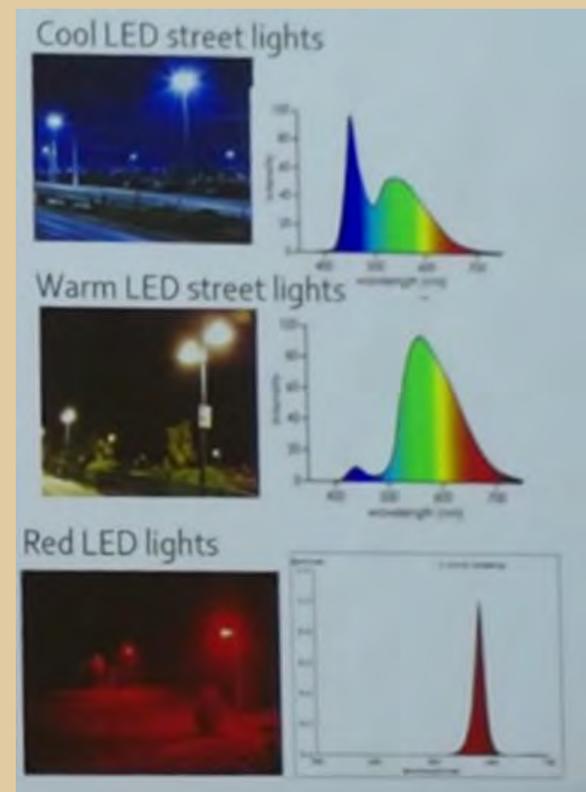
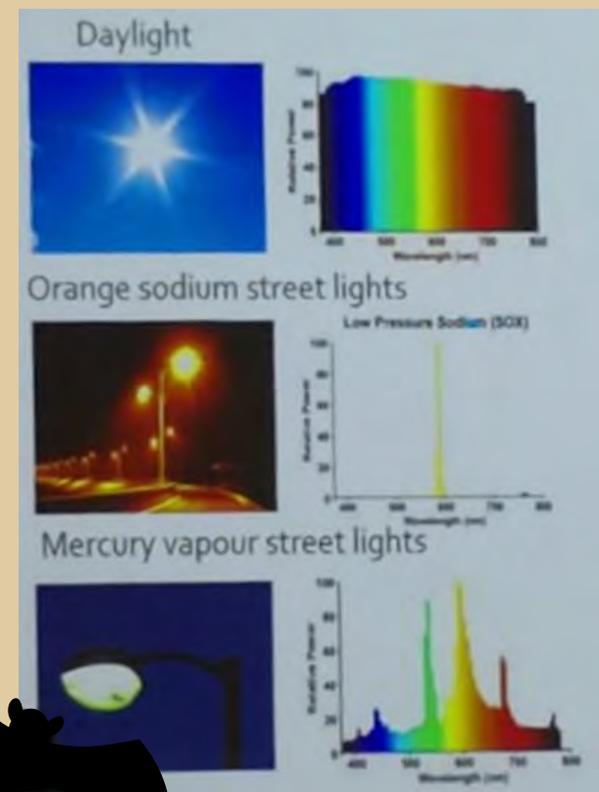
- Urban tolerant microbats are commonly recorded in areas with <10% vegetation cover
- Results of this survey included all 4 species deemed urban tolerant:
 - **Gould's Wattled Bat**
 - Eastern Bentwing Bat
 - **Ride's Freetail Bat**
 - **White-striped Mastiff Bat**

Species in red were recorded in this survey



Street lighting

- Street lights attract insects, providing food for some microbat species
- Fast flying, open space foragers benefit from street lights



Urban sensitive species

- Includes slow flying and clutter tolerant or clutter dependent species
- Most sensitive species include:
 - Little Bentwing Bat
 - Large and Little Forest Bats
 - Lesser and Gould's Long-eared Bats
 - Chocolate Wattled Bat
 - Eastern Horseshoe Bat
 - Large-footed Myotis

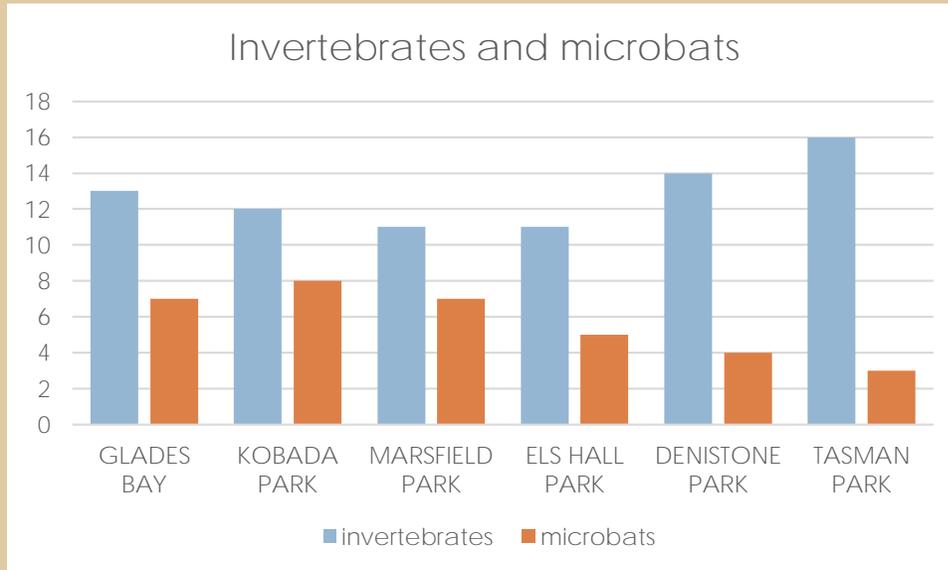
Species in red were recorded in this survey



Large-footed Myotis (*Myotis Macropus*)



Natural insecticides



- Microbats eat insects including moths, weevils, beetles, midges, flying termites, mosquitoes, and many more
- Microbats will eat around 50-75% of their body weight each night – sometimes this can be as much as 1200 mosquitoes every hour!

<http://www.allaboutbats.org.au/habitat/>





Overview of flora and vegetation

- Vegetation communities in reserves
- Results of spring surveys - changes in floristic composition in 42 reserves
- Relationships between flora and fauna, and the role of bioturbation in ecosystem health
- Realistic outcomes for vegetation management in these reserves



Vegetation communities present

- 12 vegetation communities in this survey
- Includes 4 Threatened Ecological Communities
- And 3 categories of non-native vegetation
 - Plant_n: Plantation (native and/or exotic)
 - Urban_E/N: Urban Exotic/Native
 - Weed_Ex: Weeds and Exotics



Vegetation communities

- Dry Sclerophyll communities
 - S_DSF04: Coastal Enriched Sandstone Dry Forest
 - S_DSF06: Coastal Sandstone Foreshores Forest
 - S_DSF09: Coastal Sandstone Gully Forest
 - S_DSF10: Hornsby Enriched Sandstone Exposed Woodland
- Wet Sclerophyll communities
 - S_WSF01: Blue Gum High Forest (BC/EPBC)
 - S_WSF06: Coastal Shale-Sandstone Forest
 - S_WSF08: Sydney Foreshores Shale Forest
 - S_WSF09: Sydney Turpentine-Ironbark Forest (BC/EPBC)



Vegetation communities (cont.)

- Estuarine communities
 - S_SW01: Estuarine Mangrove Forest
 - S_SW02: Estuarine Saltmarsh (BC)
- Other native vegetation
 - S_FoW08: Estuarine Swamp Oak Forest (BC)
 - S_RF02: Coastal Sandstone Gallery Rainforest

S_WSF01: Blue Gum High Forest

- Reported at
 - DENISTONE PARK
 - LYNN PARK
 - MIRIAM PARK
 - SYMON'S RESERVE
- Described as
 - Tall wet sclerophyll forest found on fertile shale soils
 - Dominated by Sydney blue gum (*Eucalyptus saligna*), blackbutt (*Eucalyptus pilularis*) and turpentine (*Syncarpia glomulifera*)
 - Ground layer is variable in composition and cover. It may be ferny, grassy or herbaceous



Blue Gum High Forest at Denistone Park

S_WSF09: Sydney Turpentine-Ironbark Forest

- Reported at
 - BOOTH RESERVE
 - BUNDARA RESERVE
 - ELS HALL PARK
 - GREENWOOD PARK
 - MARSFIELD PARK
 - STEWART PARK
- Described as
 - On the north shore these forests are found on shale-enriched sheltered sandstone slopes where ironbarks are less common and blackbutt (*Eucalyptus pilularis*) is prevalent.
 - Canopy dominated by turpentine (*Syncarpia glomulifera*) and red mahogany (*Eucalyptus resinifera*)



Sydney Turpentine Ironbark Forest
at Marsfield Park

S_SW02: Estuarine Saltmarsh

- Reported at
 - GLADES BAY PARK
 - KOONADAN RESERVE
 - MELROSE PARK
 - MEMORIAL PARK
 - SETTLERS PARK
- Described as
 - Consists of low succulent herbs and rushes on tidally inundated land
 - Salinity varies greatly according to tidal influence, evaporation and fresh water accumulation.
 - Some of the areas are flooded regularly, while at slightly higher elevations flooding is rare



Estuarine Saltmarsh at Melrose Park

Wilsonia backhousia

Recorded in
Meadowbank Park
and Looking Glass Bay
Park/Banjo Paterson
Reserve

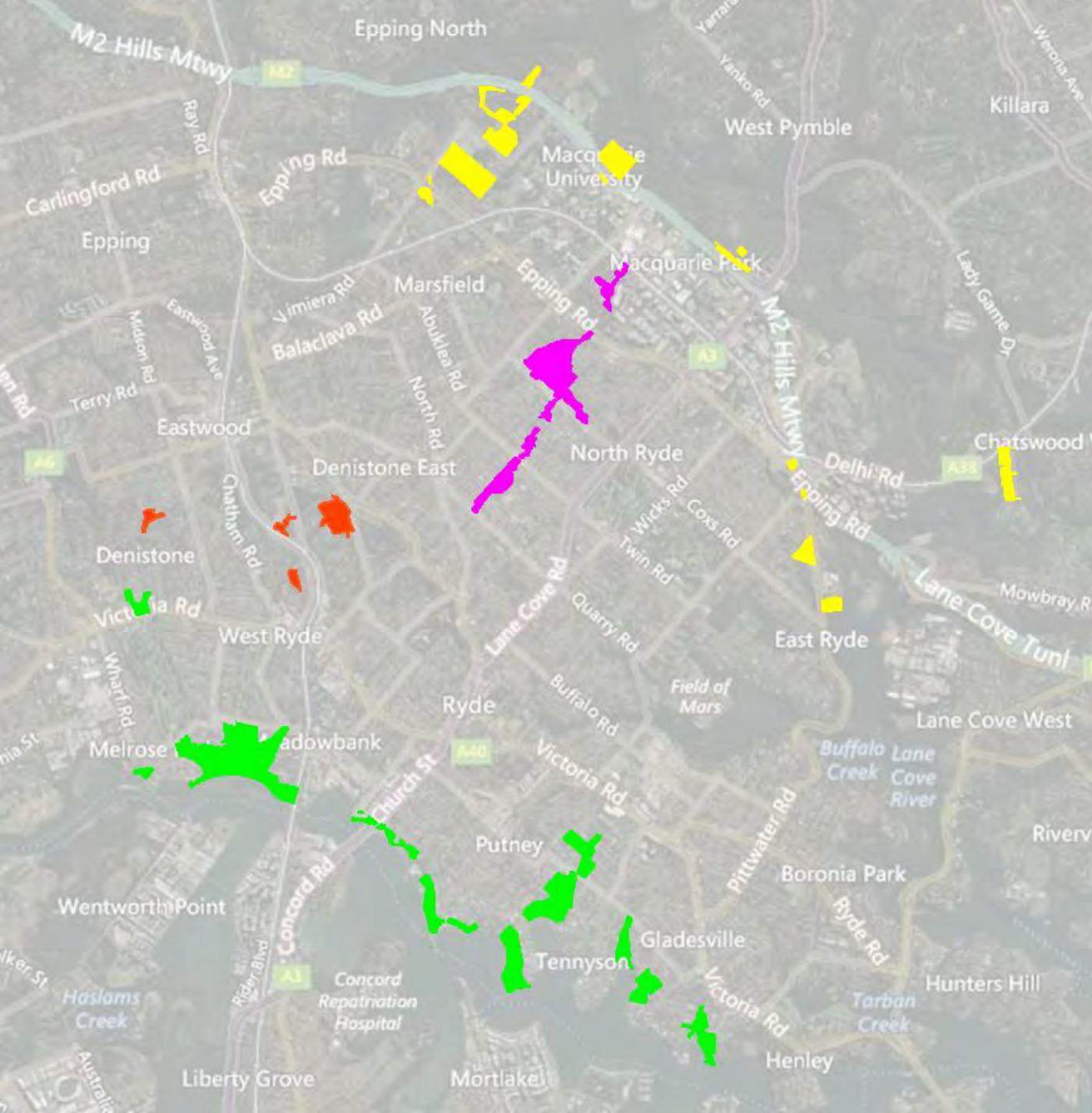


S_FoW08: Estuarine Swamp Oak Forest

- Reported at
 - SETTLERS PARK
 - Other parks?
- Described as
 - Occurs immediately above tidal influence
 - Fringes the margins of saline waterbodies
 - Swamp oak (*Casuarina glauca*) forms dense monospecific stands above a thick ground cover of salt tolerant herbs, rushes and sedges



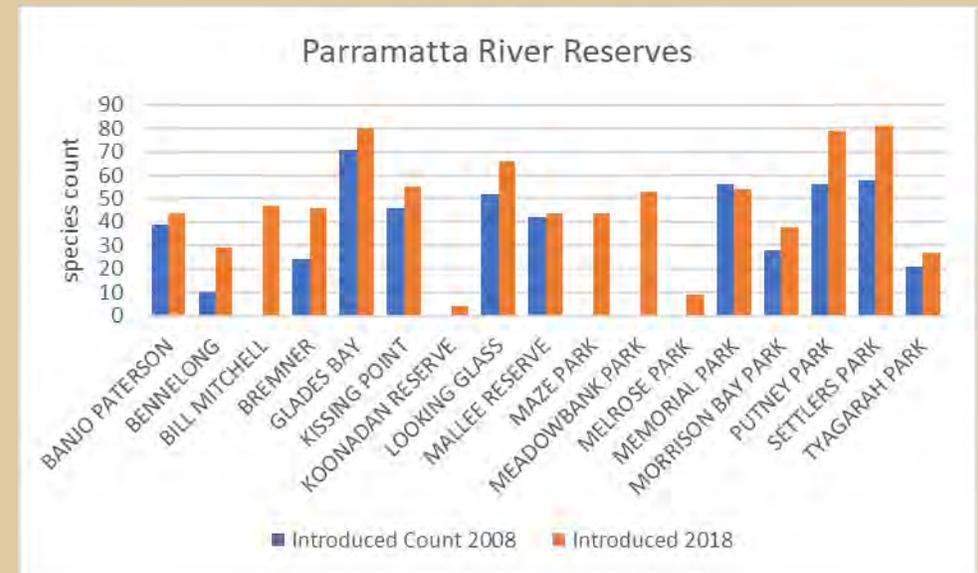
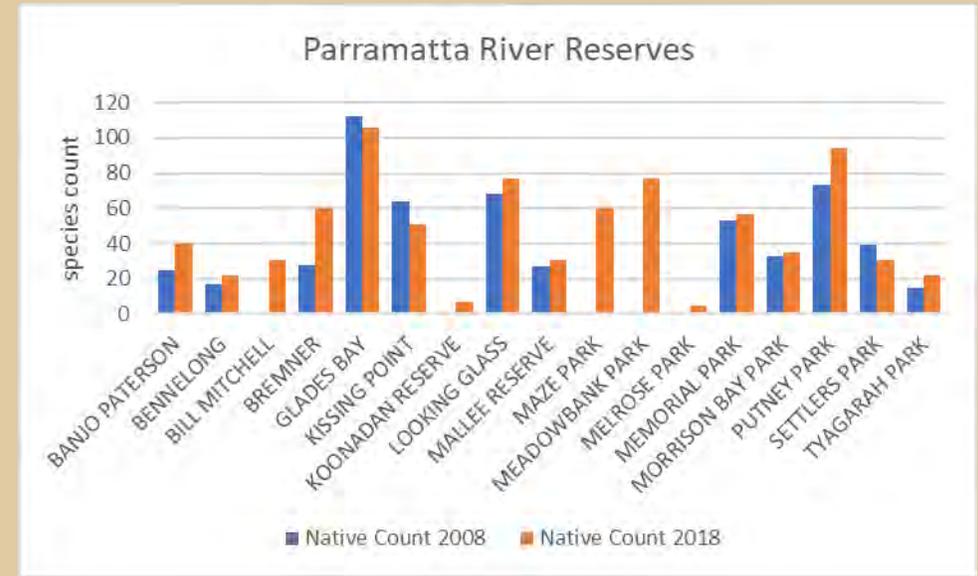
Recreating Estuarine Swamp Oak Forest
at Bennelong Park



Area	Park Name	Area	Park Name
Parramatta River Reserves	BANJO PATERSON RESERVE	Northern Reserves	BOOBAJOOL RESERVE
	BENNELONG PARK		BUNDARA RESERVE
	BILL MITCHELL PARK		CHRISTIE PARK
	BREMNER PARK		FIELDER PARK
	GLADES BAY PARK		KOBADA PARK
	KISSING POINT PARK		MARSHFIELD PARK
	KOONADAN RESERVE		MYALL RESERVE
	LOOKING GLASS BAY PARK		NORTH RYDE PARK
	MALLEE RESERVE		STEWART PARK
	MAZE PARK		TASMAN PARK
	MEADOWBANK PARK		TRAFALGAR PARK
	MELROSE PARK		WATERLOO PARK
	MEMORIAL PARK		YURRAH RESERVE
	MORRISON BAY PARK		Western Reserves
PUTNEY PARK	LYNN PARK		
SETTLERS PARK	MIRIAM PARK		
TYAGARAH PARK	SYMON'S RESERVE		
Shrimptons Creek Reserves	BOOTH RESERVE		
	ELS HALL PARK		
	FLINDERS PARK		
	GREENWOOD PARK		
	QUANDONG RESERVE		
	SANTA ROSA PARK		
	TINDARRA RESERVE		
	WILGA RESERVE		

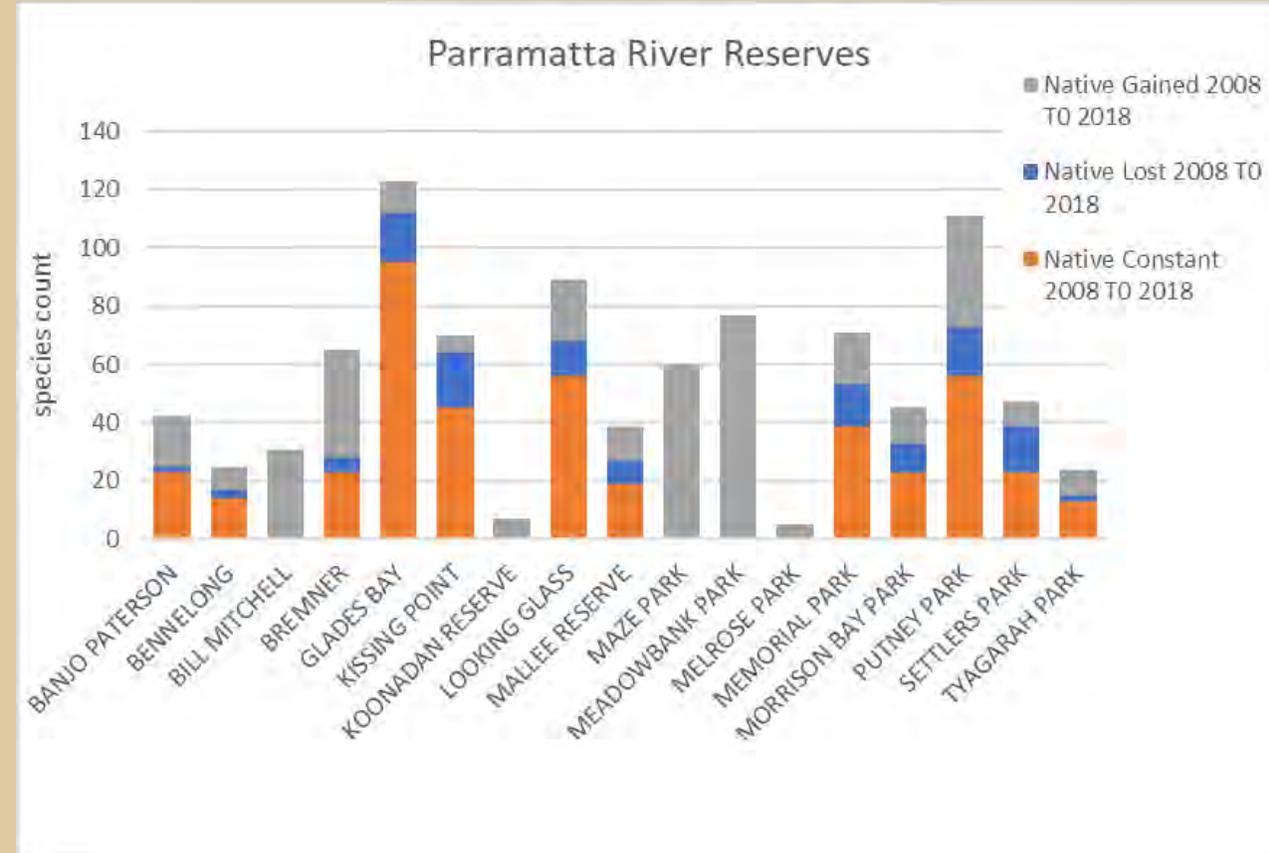
Parramatta River foreshore reserves

- 17 reserves, 12 surveyed in 2008, 5 new reserves
- More native flora species in 9 reserves, less in 3 reserves
- More weed species in 11 reserves, less in 1 reserve



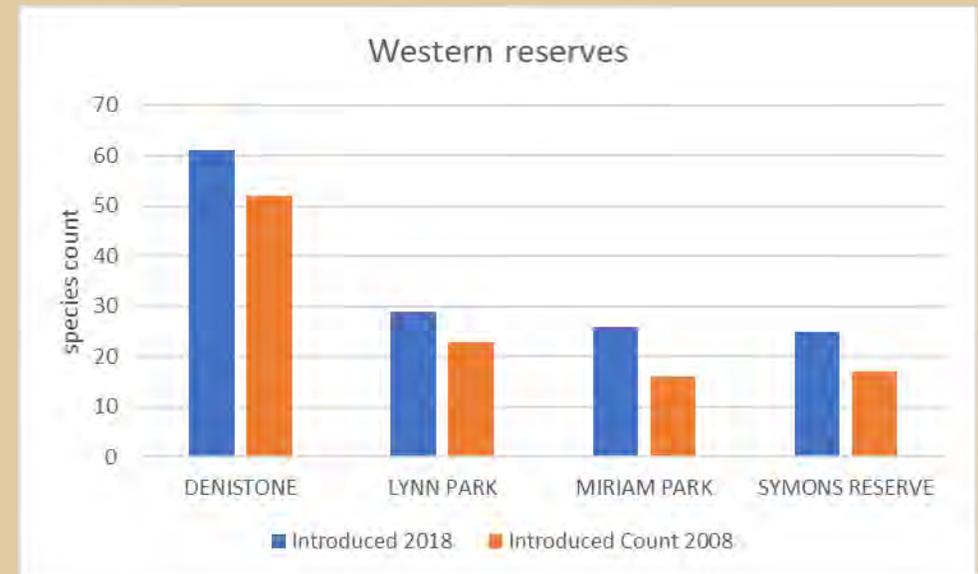
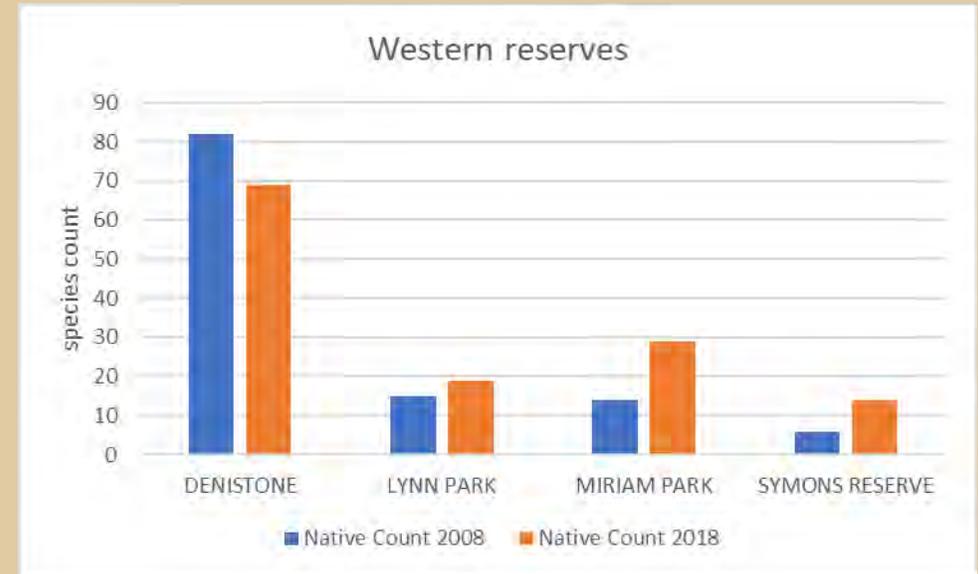
Change in floristic composition

- 'Losses' from 2008 to 2018 ranged from 2 to 19 native species
- 'Gains' from 2008 to 2018 ranged from 5 to 38 native species
- Revegetation planting?



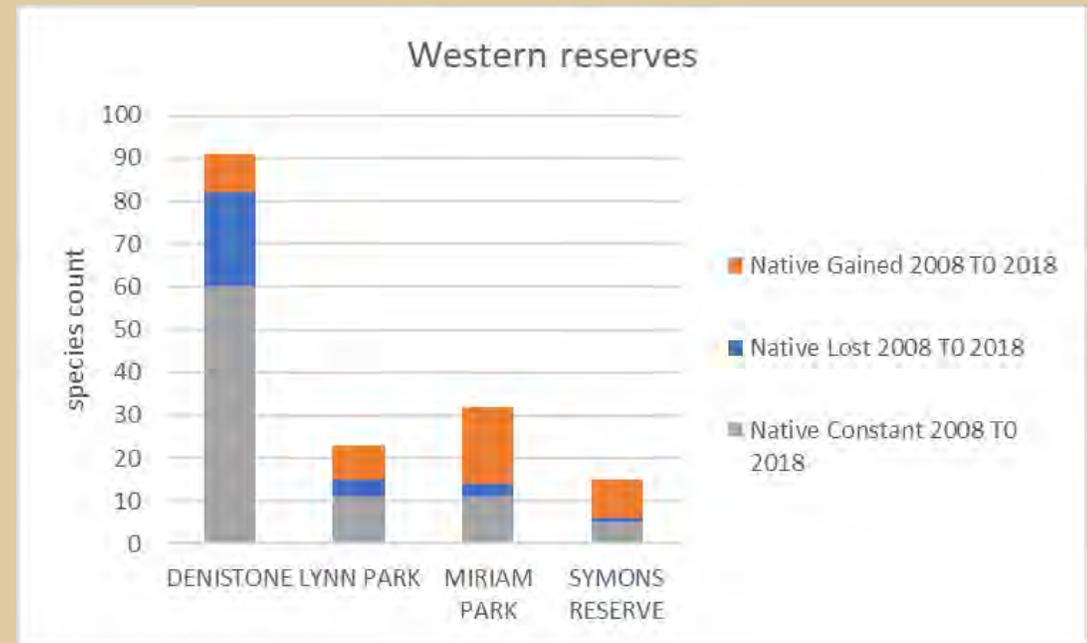
Western reserves

- 4 reserves, 4 surveyed in 2008, no new reserves
- More native flora species in 3 reserves, less in 1 reserve
- Less weed species in 4 reserves



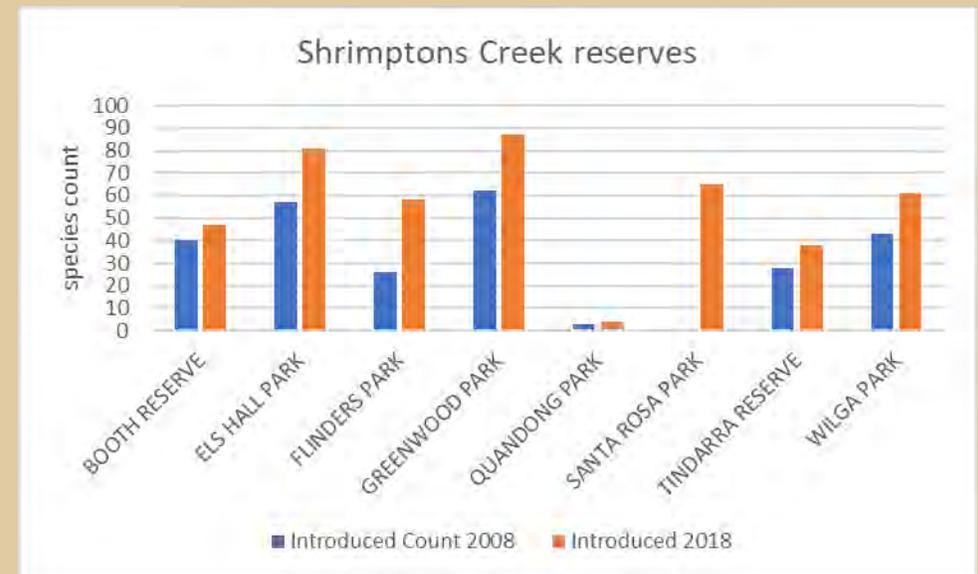
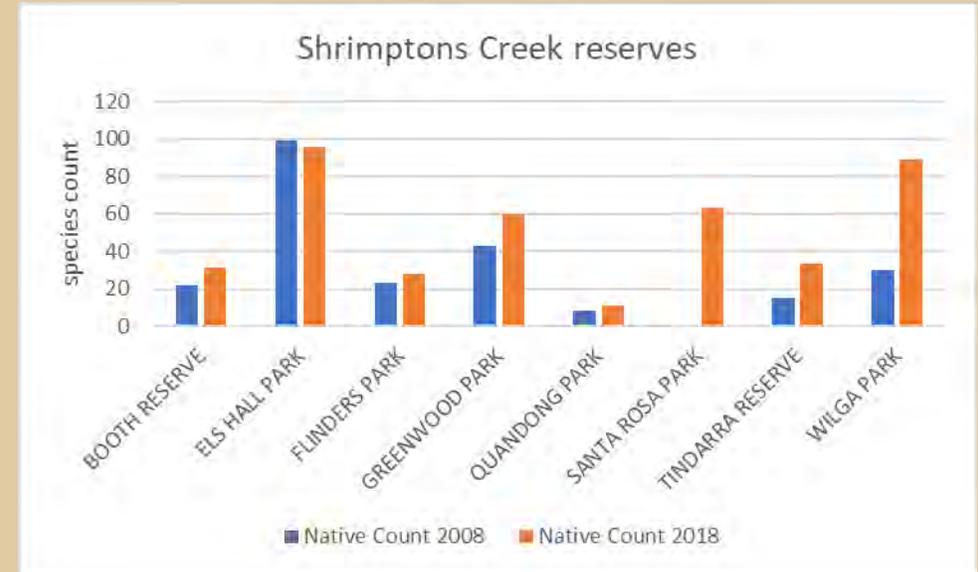
Change in floristic composition

- 'Losses' from 2008 to 2018 ranged from 1 to 22 native species
- 'Gains' from 2008 to 2018 ranged from 8 to 18 native species
- Revegetation planting?



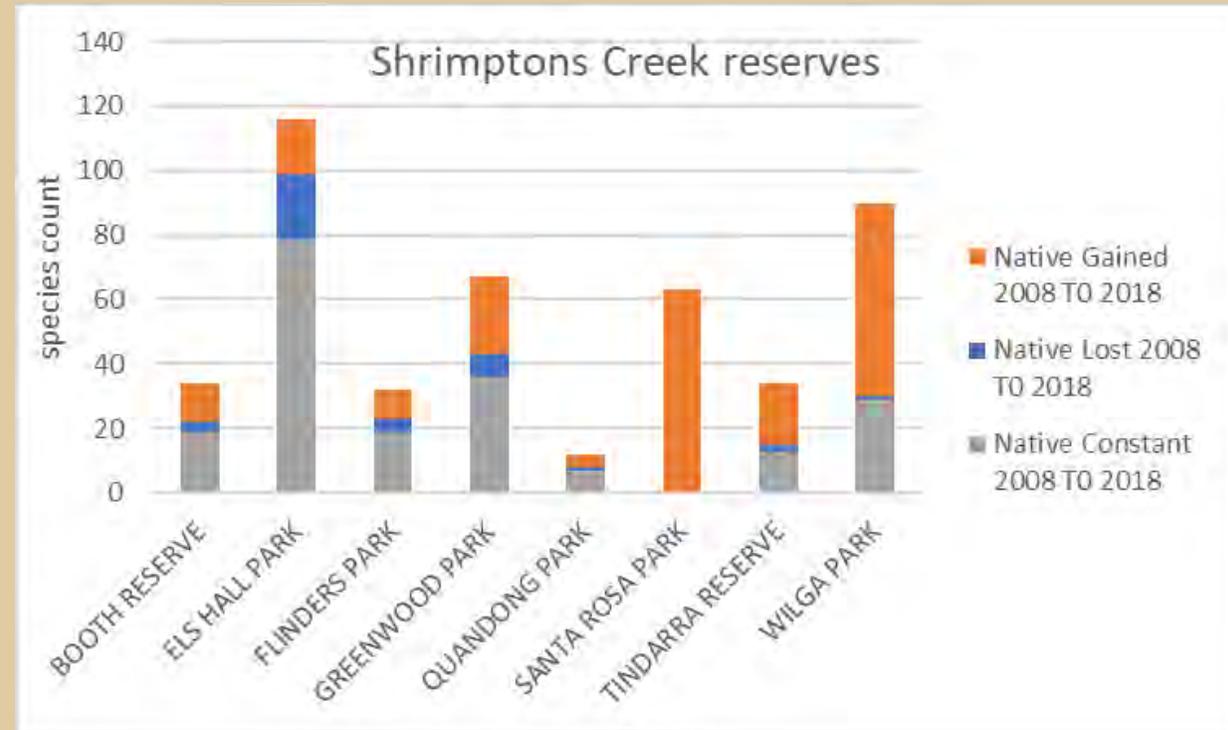
Shrimptons Creek corridor reserves

- 8 reserves, 7 surveyed in 2008, 1 new reserve
- More native flora species in 7 reserves, less in 0 reserves
- More weed species in 7 reserves, less in 0 reserves



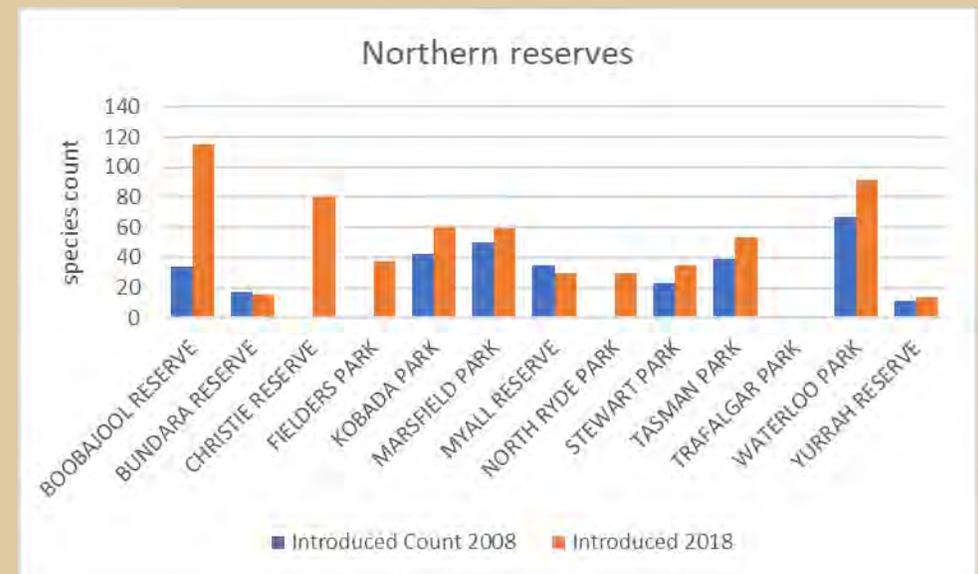
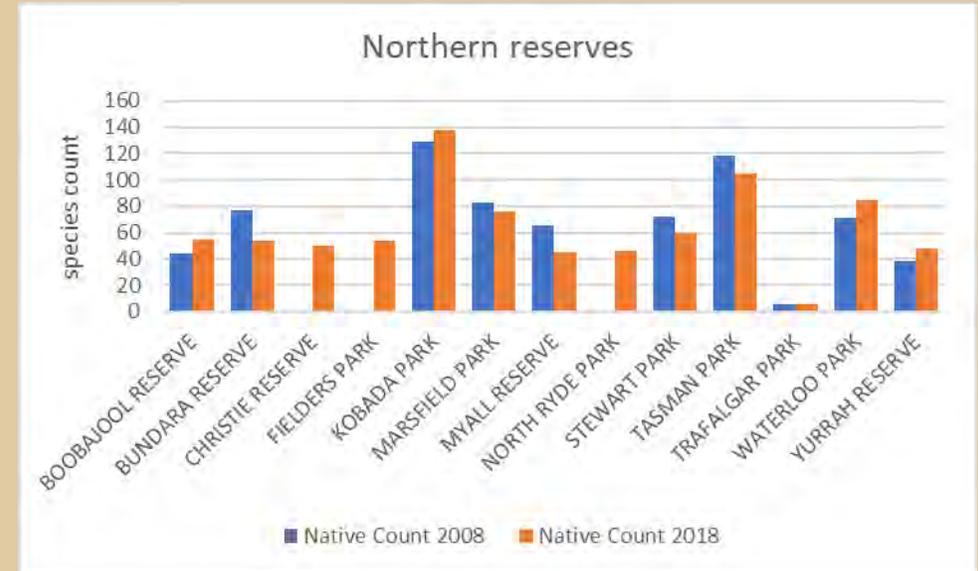
Changes in floristic composition

- 'Losses' from 2008 to 2018 ranged from 1 to 20 native species
- 'Gains' from 2008 to 2018 ranged from 4 to 60 native species
- Changed survey area?



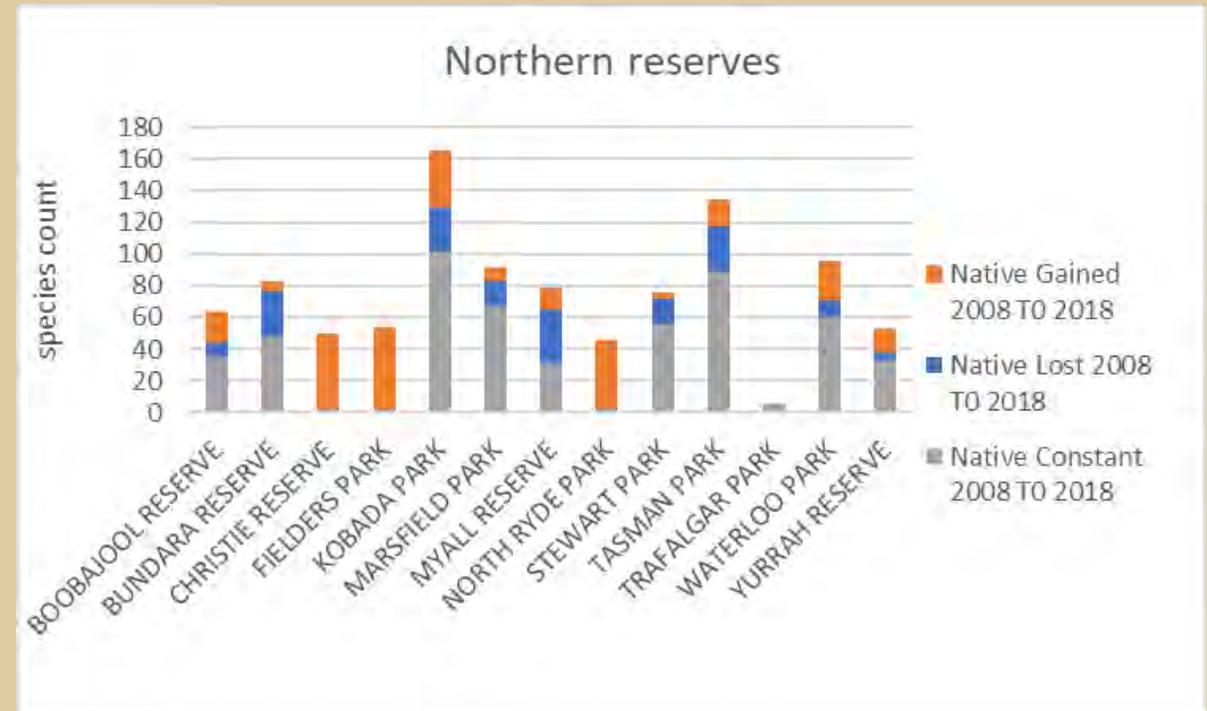
Northern (Lane Cove River) reserves

- 13 reserves, 10 surveyed in 2008, 3 new reserves
- More native flora species in 5 reserves, less in 5 reserves
- More weed species in 7 reserves, less in 3 reserves



Changes in floristic composition

- 'Losses' from 2008 to 2018 ranged from 5 to 34 native species
- 'Gains' from 2008 to 2018 ranged from 4 to 36 native species
- Increased survey effort?



Mechanisms for species turnover

- Changes in native flora species diversity from:
 - Increased survey effort
 - Changes in survey extent
 - Seasonal variation
 - Revegetation planting
 - Immigration from nearby bushland
- Changes in weed species diversity from
 - Change in survey extent or effort
 - Bush regeneration weed control
 - Invasion from elsewhere
 - Seasonal variation



Ground truthing vegetation communities



The Native Vegetation of the Sydney Metropolitan Area

Volume 2: Vegetation Community Profiles

Version 3.0



Catchment Management Authority



Office of Environment & Heritage

- Quadrats were surveyed for native flora species
- Lists of species present were compared with criteria for mapped veg communities
- Must have minimum number of species to test
- Must have minimum number of diagnostic species to satisfy identification criteria (= pass)

Species **Map Unit Code**

This list comprises species that fall into one of three fidelity classes: positive diagnostic, constant and uninformative (see section 2.7.3 and section 4.12 of *The Native Vegetation of the Sydney Metropolitan Area Volume 1: Technical Report*). Fidelity classes are a measure of the relative likelihood that a species will be recorded in a 0.04 hectare systematic floristic sample site that is randomly located in the vegetation community. Obtaining such a sample is a pre-requisite for the use of the positive diagnostic species list. The number of positive diagnostic species present in a sample site can be used to identify the vegetation community by ruling out all but a few feasible alternatives. The presence of the minimum number of positive diagnostic species in a sample site is strong evidence that the sample belongs to the vegetation community. This assumes that all vascular plant species occurring in the sample site area were correctly identified and that the total number of native species recorded in the sample site exceeds the specified minimum (species-poor sites can not be tested).

Species Name	Group Score (50 percentile)	Group Frequency	Non-group Score (50 Percentile)	Non-group Frequency	Fidelity Class
<i>Acacia imraya</i>	1	25%	1	2%	Uninformative
<i>Acmena smithii</i>	3	100%	2	6%	Positive diagnostic
<i>Adiantum formosum</i>	2	75%	2	1%	Positive diagnostic
<i>Alecryon subcinereus</i>	2	25%	1	1%	Positive diagnostic
<i>Aphanopetalum resinosum</i>	2	25%	2	0%	Positive diagnostic
<i>Arthrodictyon tenella</i>	2	50%	2	0%	Positive diagnostic
<i>Asplenium australasicum</i>	3	50%	1	2%	Positive diagnostic
<i>Asplenium flabellatum</i>	2	25%	1	4%	Uninformative
<i>Baloghia inophylla</i>	3	25%	0	0%	Positive diagnostic
<i>Ceratopetalum apetalum</i>	3	75%	2	0%	Positive diagnostic
<i>Cissampelos</i>	2	25%	2	2%	Uninformative
<i>Cissampelos</i>	2	25%	2	0%	Uninformative
<i>Claytonia australis</i>	2	25%	1	1%	Positive diagnostic
<i>Claytonia aristata</i>	2	50%	1	7%	Constant
<i>Clematis rectum latissimum</i>	2	25%	1	0%	Uninformative

Group Frequency
Indicates how often the species occurs within the sites used to define this community. In this case, the species has been found at 75 per cent of sites.

Group Score
The group score is the median cover score recorded for the species within sites used to define this community. In this case, a median score of 3 = greater than five and less than 20 per cent cover.

Non-group Frequency
Indicates how often the species occurs in sites in other vegetation communities. In this case, the species occurs in five per cent of sites in other communities.

Non-group Score
The non-group score is the median cover score for the species within sites in all other communities in the study area. In this case a score of 2 = common and less than five per cent cover.

See volume one of this report for definition of the fidelity classes and how they have been derived.

Positive diagnostic species occur more frequently in this community than in all sample sites combined.

Constant species occur frequently in this community as well as other communities and are therefore characteristic rather than diagnostic of this community.

Uninformative species are included to present a more comprehensive species list, they are not diagnostic or necessarily characteristic. All species with 10 per cent group frequency or greater are included.

The Native Vegetation of the Sydney Metropolitan Area

Quadrat surveys

- Six quadrats surveyed in 2008, repeat surveys in autumn and spring 2018
- Surveys recorded species present and amount of cover estimated using Braun-Blanquet cover classes

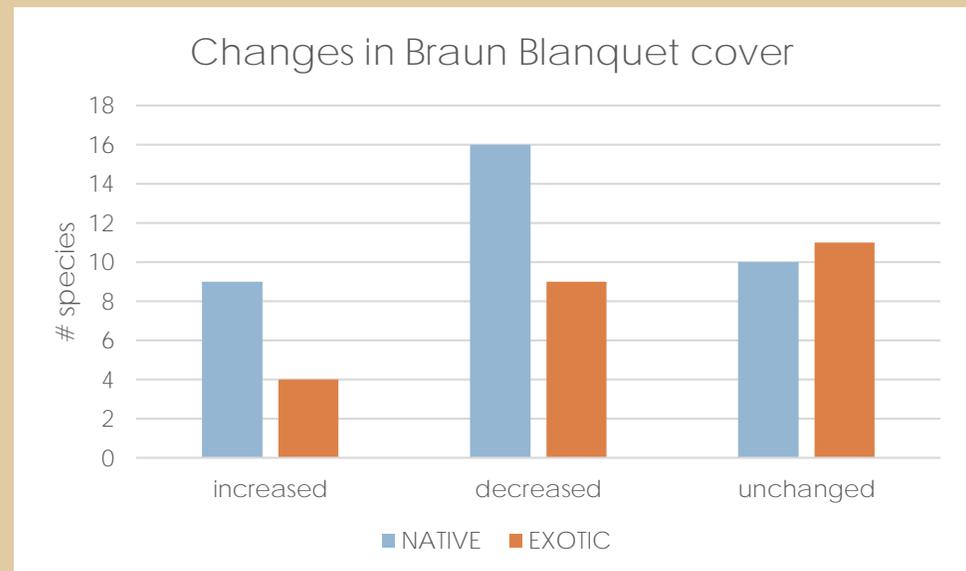
Braun Blanquet Cover Class	Cover Abundance
1	Rare, few individuals (three or less) and cover <5%
2	Uncommon, (more than three but not consistently throughout the plot) and cover <5%
3	Common (consistent throughout the plot) and cover <5%
4	Very abundant and cover <5% or cover >5% but <20%
5	Cover >20% but <50%
6	Cover >50% but <75%
7	Cover >75% but < 100%

Denistone Park quadrat



MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_WSF01: Blue Gum High Forest	YES

SUMMARY DATA NATIVE FLORA	
# native species 2008	32
# native species 2018	25 (+3, -10)
total native species recorded	35
SUMMARY DATA WEED SPECIES	
# weed species 2008	23
# weed species 2018	19 (+1, -5)
total weed species recorded	24

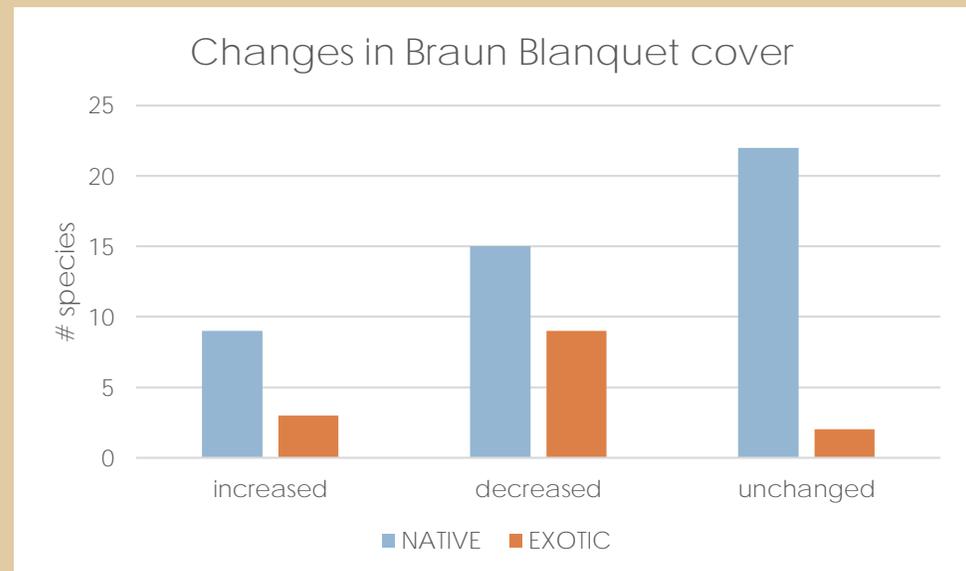


ELS Hall Park quadrat



SUMMARY DATA NATIVE FLORA	
# native species 2008	43
# native species 2018	38 (+3, -8)
total native species recorded	46
SUMMARY DATA WEED SPECIES	
# weed species 2008	11
# weed species 2018	6 (+3, -8)
total weed species recorded	14

MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_DSF04: Coastal Enriched Sandstone Dry Forest	YES

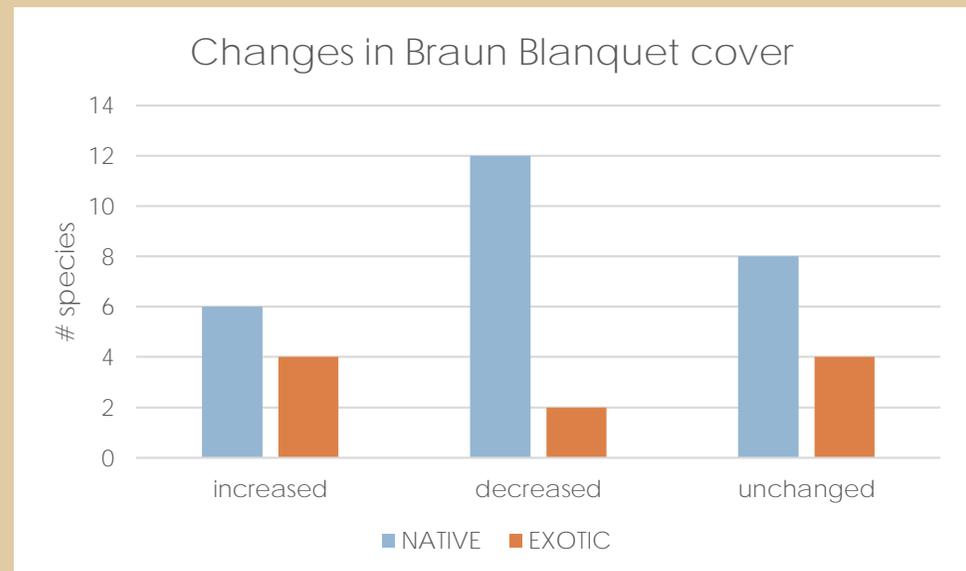


Glades Bay Park quadrat



MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_DSF06: Coastal Sandstone Foreshores Forest	YES

SUMMARY DATA NATIVE FLORA	
# native species 2008	24
# native species 2018	24 (+2, -2)
total native species recorded	26
SUMMARY DATA WEED SPECIES	
# weed species 2008	7
# weed species 2018	9 (+3, -1)
total weed species recorded	10

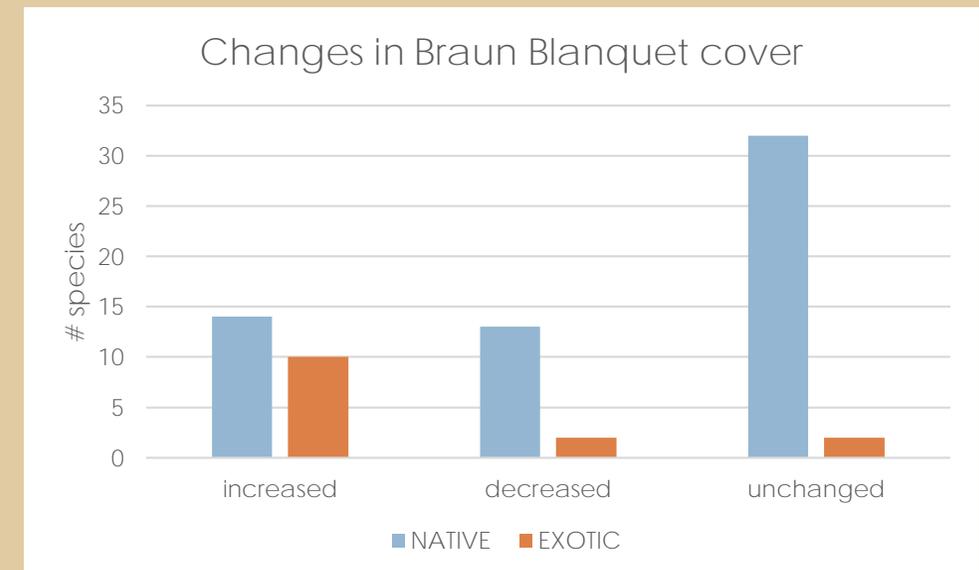


Kobada Park quadrat



MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_DSF04: Coastal Enriched Sandstone Dry Forest	YES

SUMMARY DATA NATIVE FLORA	
# native species 2008	51
# native species 2018	50 (+8, -9)
total native species recorded	59
SUMMARY DATA WEED SPECIES	
# weed species 2008	5
# weed species 2018	13 (+9, -1)
total weed species recorded	14

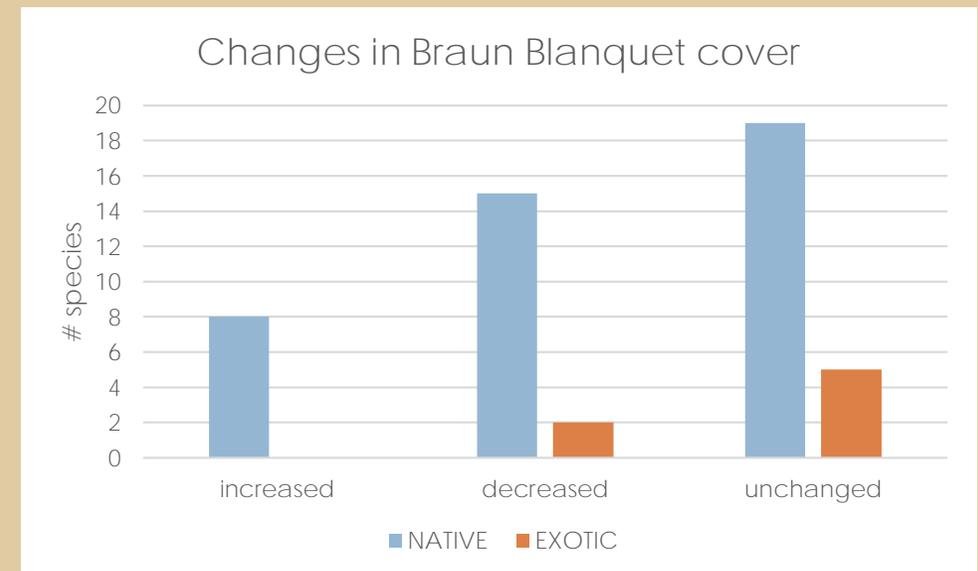


Marsfield Park quadrat



MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_WSF09: Sydney Turpentine-Ironbark Forest	YES

SUMMARY DATA NATIVE FLORA	
# native species 2008	42
# native species 2018	34 (+0, -8)
total native species recorded	42
SUMMARY DATA WEED SPECIES	
# weed species 2008	7
# weed species 2018	5 (+0, -2)
total weed species recorded	7

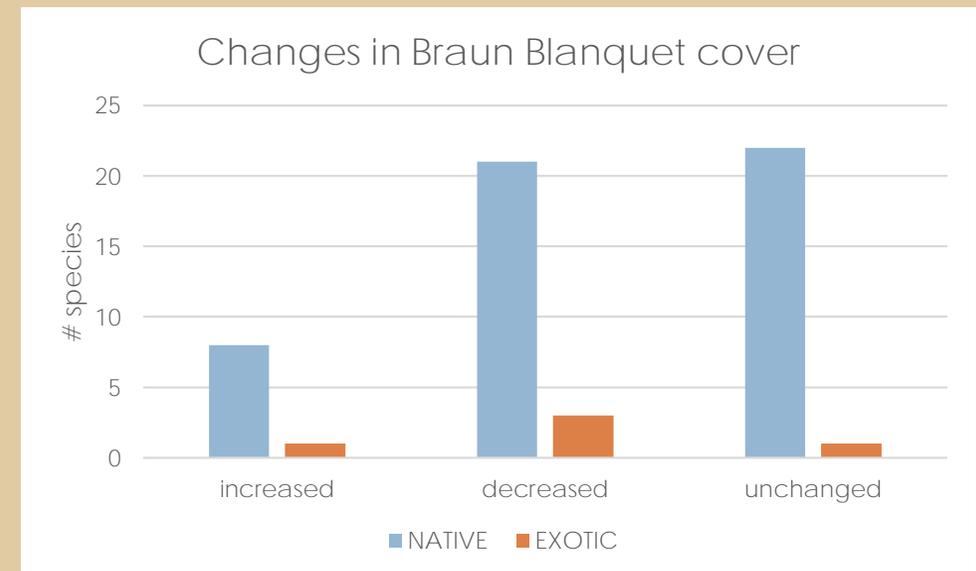


Tasman Park quadrat



MAPPED VEGETATION COMMUNITY	CONFIRMED?
S_WSF06: Coastal Shale-Sandstone Forest	YES

SUMMARY DATA NATIVE FLORA	
# native species 2008	51
# native species 2018	39 (+0, -12)
total native species recorded	51
SUMMARY DATA WEED SPECIES	
# weed species 2008	4
# weed species 2018	2 (+1, -3)
total weed species recorded	5



Some things to consider

- FOR 20m x 20m QUADRATS
- Where is the greatest native diversity?
- Where are the most weed species?
- Where has there been the most change? Why?
- Which quadrats have improved? Deteriorated?

QUADRAT	# NATIVE SPECIES	# WEED SPECIES	COMMENTS
DENISTONE	35	24	most weed species, 10 native species "lost"
ELS HALL	46	14	many weed species
GLADES BAY	26	10	fewest native species
KOBADA	59	14	most native species, many weed species, dead large shrubs
MARSFIELD	42	7	few weed species
TASMAN	51	5	many native species, fewest weed species, 12 native species "lost"



Trajectories in vegetation changes

- Development of an estimate for a vegetation health trajectory for each quadrat

TRAJECTORY	DEFINING CHARACTERISTICS
DEGRADING	decrease in numbers and cover extent for native species with increase in numbers or cover extent for introduced species
MINOR DEGRADING	decrease in numbers or cover extent for native species with unchanged numbers or cover extent for introduced species OR
	unchanged numbers or cover extent for native species with increased numbers or cover extent for introduced species
STABLE	little or no change in numbers or cover extent for native species with no change in numbers or cover extent for introduced species
IMPROVING	no change or increase in numbers or cover extent for native species with no change or decrease in numbers or cover extent for introduced species



Possible trajectories for quadrats

QUADRAT	# NATIVE SPECIES	NATIVE COVER	# WEED SPECIES	WEED COVER	TRAJECTORY
DENISTONE	decreased	decreased	decreased	unchanged/decreased	MINOR DEGRADING
ELS HALL	decreased	unchanged	decreased	decreased	STABLE?
GLADES BAY	unchanged	decreased	increased	unchanged/increased	STABLE?
KOBADA	unchanged	unchanged	increased	increased	MINOR DEGRADING
MARSHFIELD	decreased	unchanged	decreased	unchanged	STABLE?
TASMAN	decreased	unchanged/decreased	decreased	decreased	STABLE?

- Processes causing change can be abrupt or gradual, and may include:
 - Extreme wind and weather conditions eg drought
 - Active management eg weed control, revegetation planting
 - Changes in adjoining land use – impacts on quadrat veg

A primary driver of biodiversity

- “Bioturbation is defined as the reworking of soils and sediments by animals or plants”
- Changes to chemical and structural properties of soils
- Greater water infiltration, increased soil moisture, decreased surface runoff and erosion
- Digging stimulates germination, disperses fungi, provides habitat for microscopic organisms, leading to increased nutrient cycling



Bioturbators in City of Ryde

- The overall effect of bioturbation is therefore increased plant vigour and resilience, increased biodiversity and consequently improved ecosystem functioning.
- Bioturbators seen in City of Ryde include Brush Turkeys, Bandicoots, Swamp Wallabies, and Lyre Birds



Bandicoots were seen on camera in Marsfield Park – also good bioturbators!



Working towards a realistic goal

- Weed control
- Revegetation
- Recreate bushland?

- Restore previously existing vegetation community/ecosystem

- Habitat for fauna

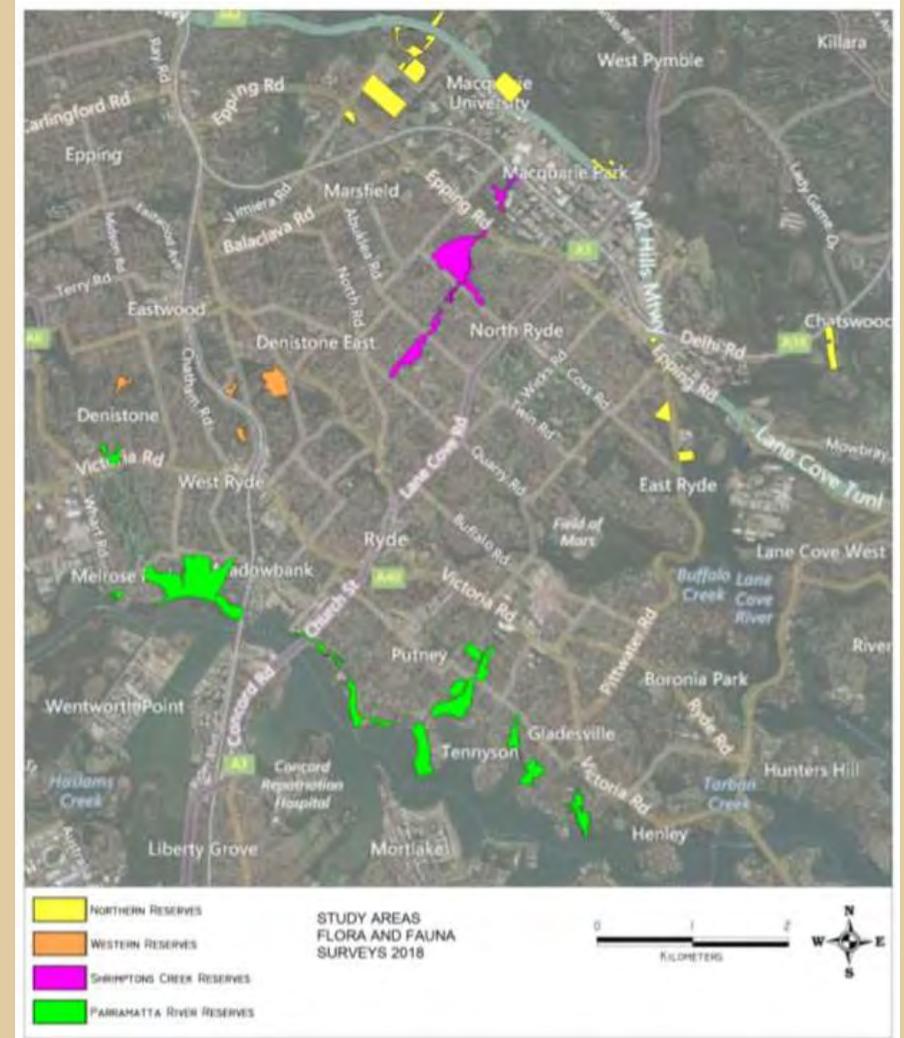
- Manage as a wildlife corridor

- Something else?

- Revegetate as a passive recreation park or veg corridor within a park

Realistic outcomes for reserves

- Parramatta River foreshore reserves
- Reserves linked with Lane Cove National Park
- Small and/or isolated reserves
- Long linear reserves



Working towards a realistic goal

- What vegetation community is present? Or was present? Use this to guide native flora species selection
- What animals use the reserve? Or might use the reserve, especially if they are in an adjoining reserve! Use this to guide development of habitat resources (food, nesting, roosting, refugia habitat requirements)
- What degrading factors are operating? Use this to develop a realistic set of sustainable management goals for the reserve





Finishing off...

- Final report to be completed and issued to council
- Recommendations for the way forward from here – continue these surveys, make some modifications?
- Any questions, suggestions?