BIODIVERSITY SURVEYS, AUTUMN 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…

RYDE
FLORA and FAUNA
STUDY
2008

RYDE BUSHLAND
RESERVES
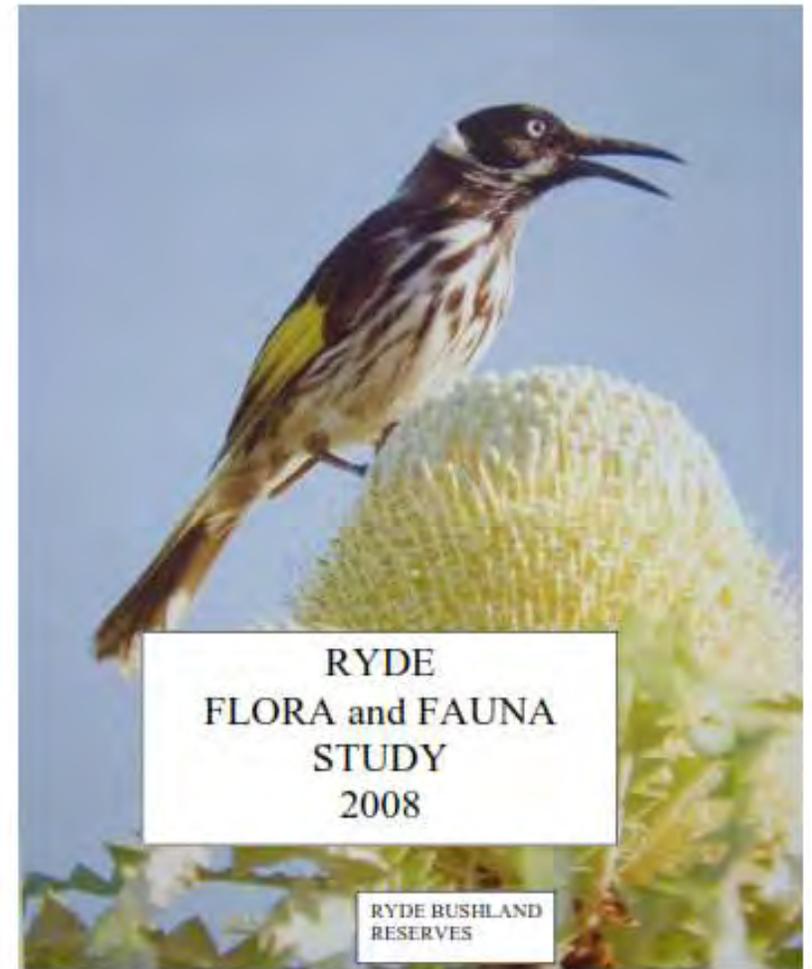
Biosphere Environmental Consultants Pty Ltd

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
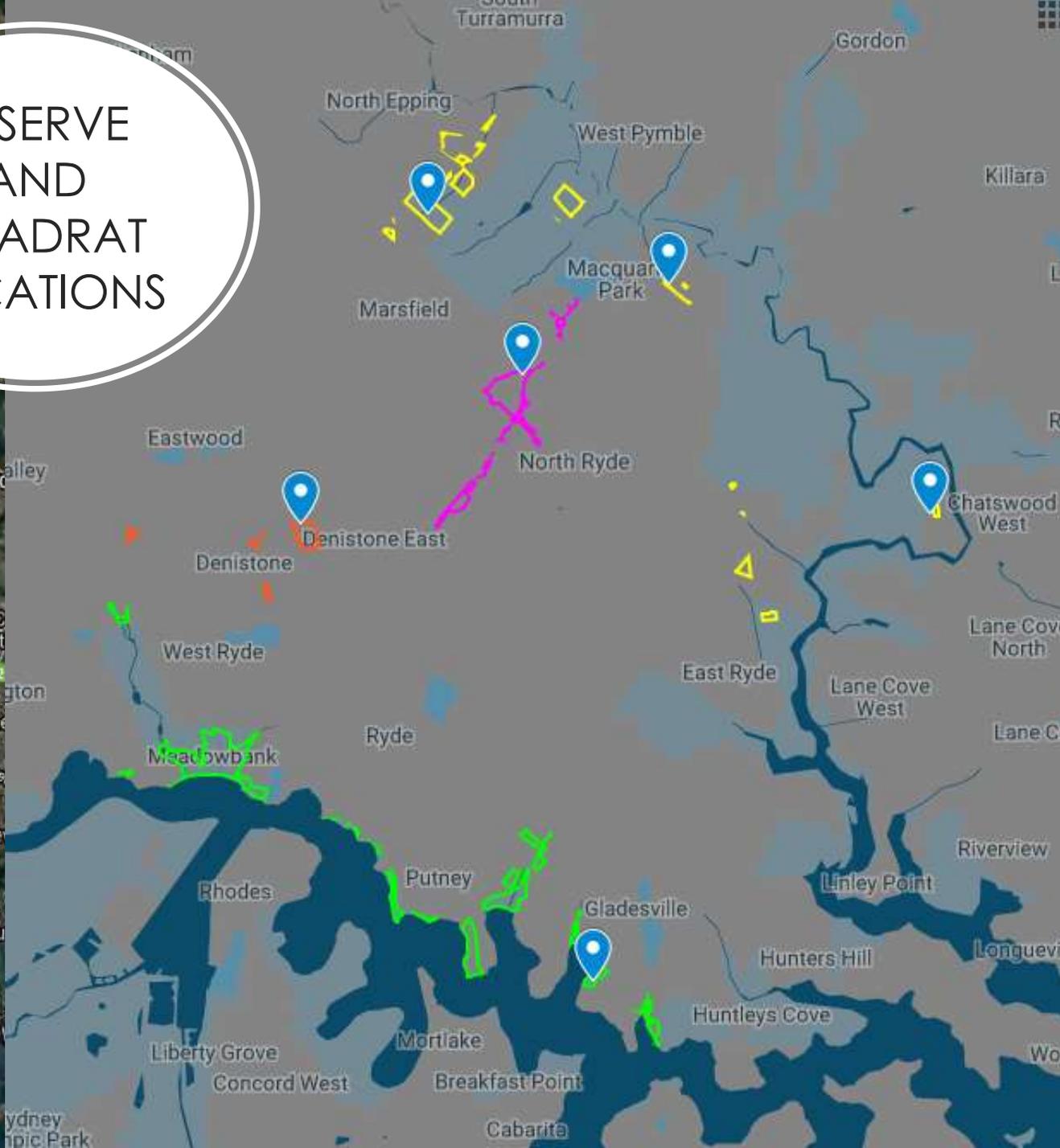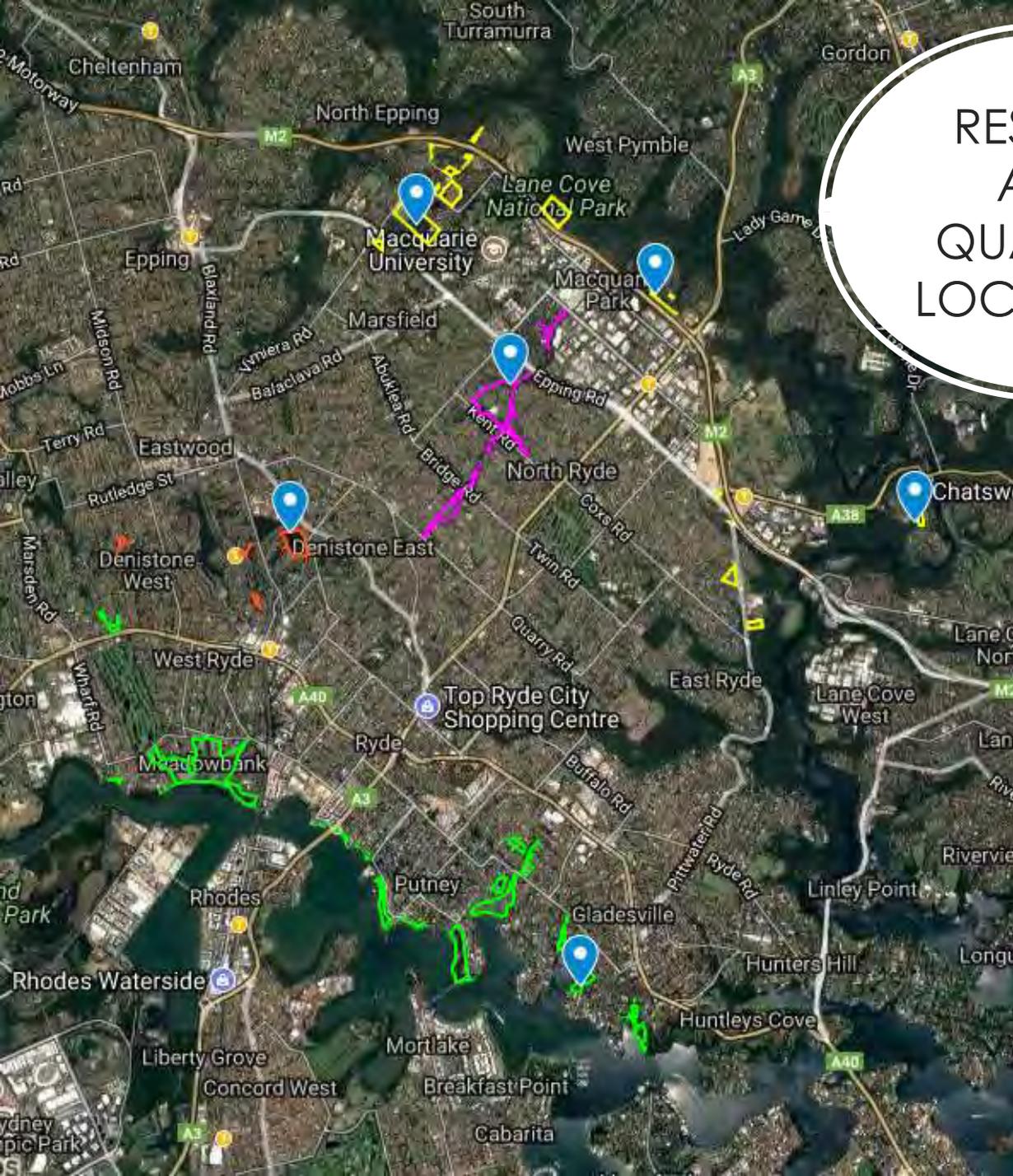
- APPLIED ECOLOGY 2018
  - Other bushland reserves

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

DIURNAL BIRDS
Listening, direct observation

RESERVE GROUPING	20 MINUTE QUADRAT SESSIONS PER SEASON	ADDITIONAL BIRDING SESSIONS
NORTHERN	6	5
WESTERN	2	2
SHRIMPTONS CK	2	3
PARRAMATTA RIVER	2	15

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*)

OTHER METHODS - HAIRTUBES

- **MAMMAL SPECIFIC**

MAJOR CORRIDOR NAME	MINIMUM EFFORT HAIRTUBES PER SEASON	TOTAL EFFORT HAIRTUBE NIGHTS AUTUMN
NORTHERN	100	126
WESTERN	50	75
SHRIMPTONS CK	100	166
PARRAMATTA RIVER	150	168

Common Brushtail Possum

Bush rat
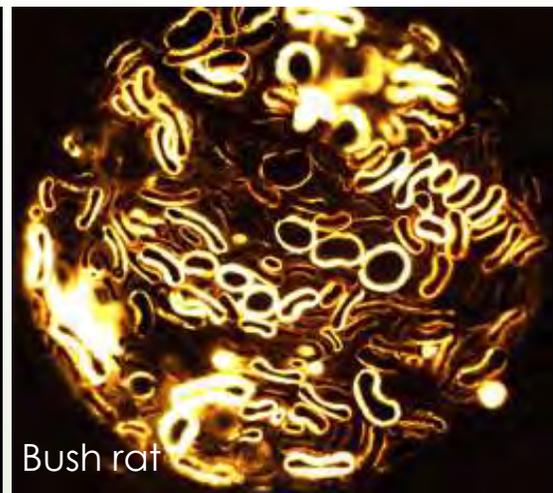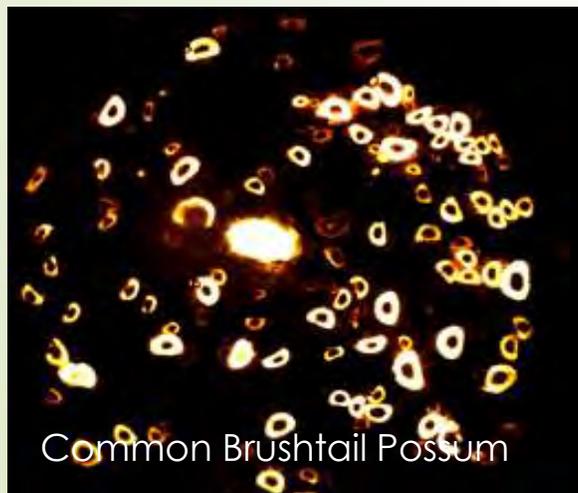
CAMERA TRAPPING ▶ PRIMARILY MAMMALS

MAJOR CORRIDOR NAME	PROPOSED EFFORT REMOTE CAMERA NIGHTS PER SEASON	TOTAL EFFORT REMOTE CAMERA NIGHTS AUTUMN
NORTHERN	40	145
WESTERN	40	40
SHRIMPTONS CK	40	49
PARRAMATTA RIVER	40	32

MICROBATS – SURVEY METHODS

MAJOR CORRIDOR NAME	MINIMUM ANABAT NIGHTS PER SEASON	ANABAT NIGHTS AUTUMN
NORTHERN	7	14
WESTERN	7	20
SHRIMPTONS CK	7	16
PARRAMATTA RIVER	7	7

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

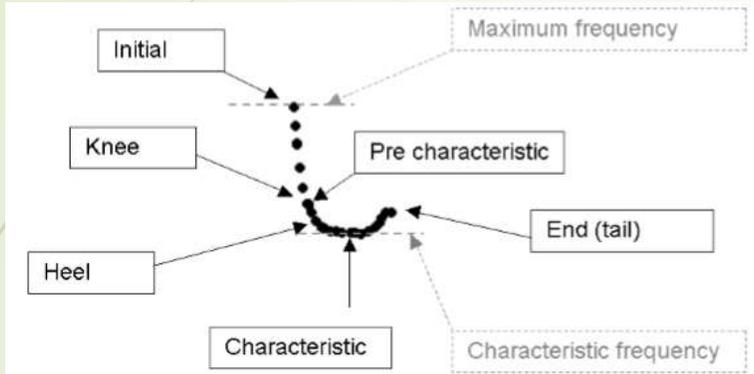- Record and/or real time monitor

MICROBAT CALLS
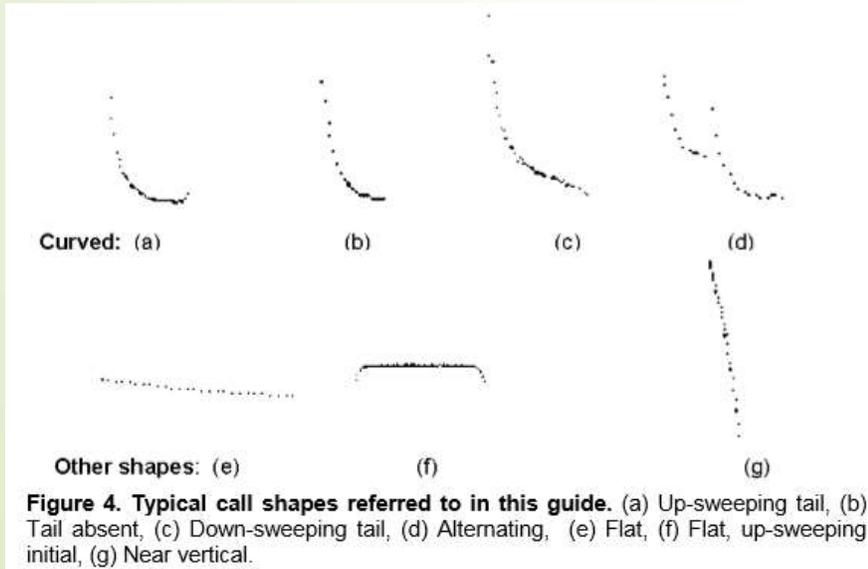
Figure 3. Features of a generic call pulse.

Figure 4. Typical call shapes referred to in this guide. (a) Up-sweeping tail, (b) Tail absent, (c) Down-sweeping tail, (d) Alternating, (e) Flat, (f) Flat, up-sweeping initial, (g) Near vertical.
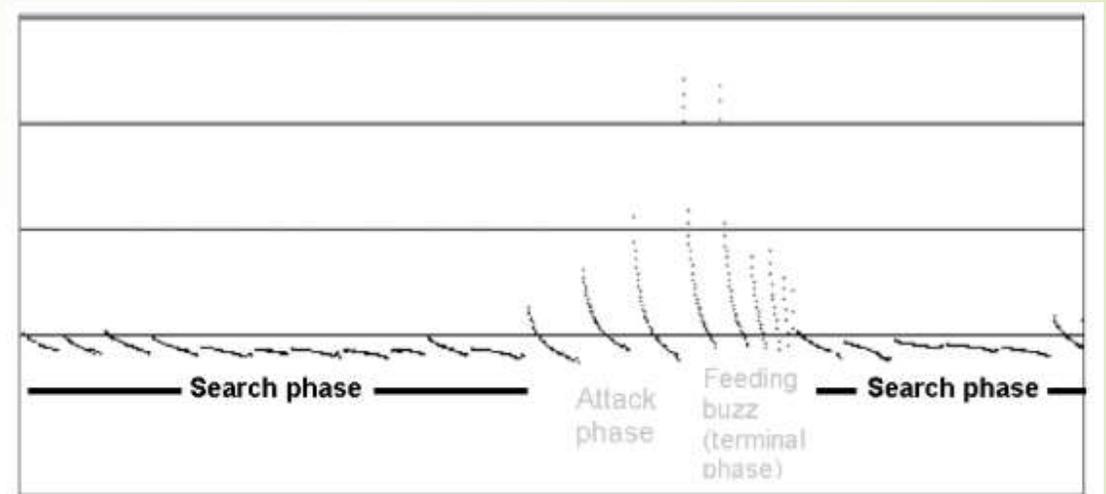

Figure 5. Phases of a *Mormopterus* species 4 call sequence, illustrating search phase pulses used for identification in this guide.
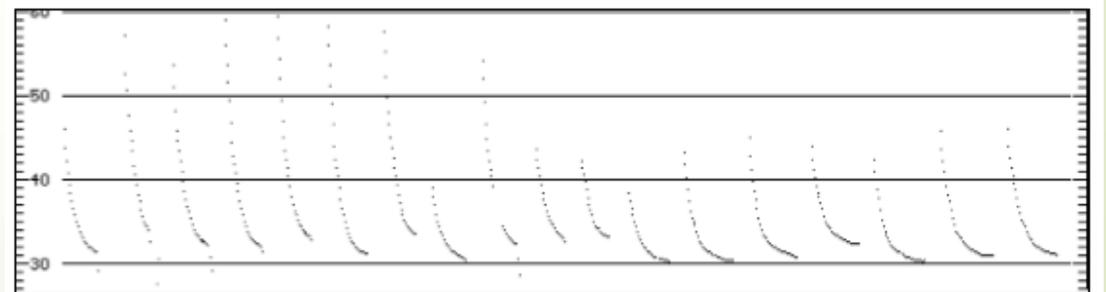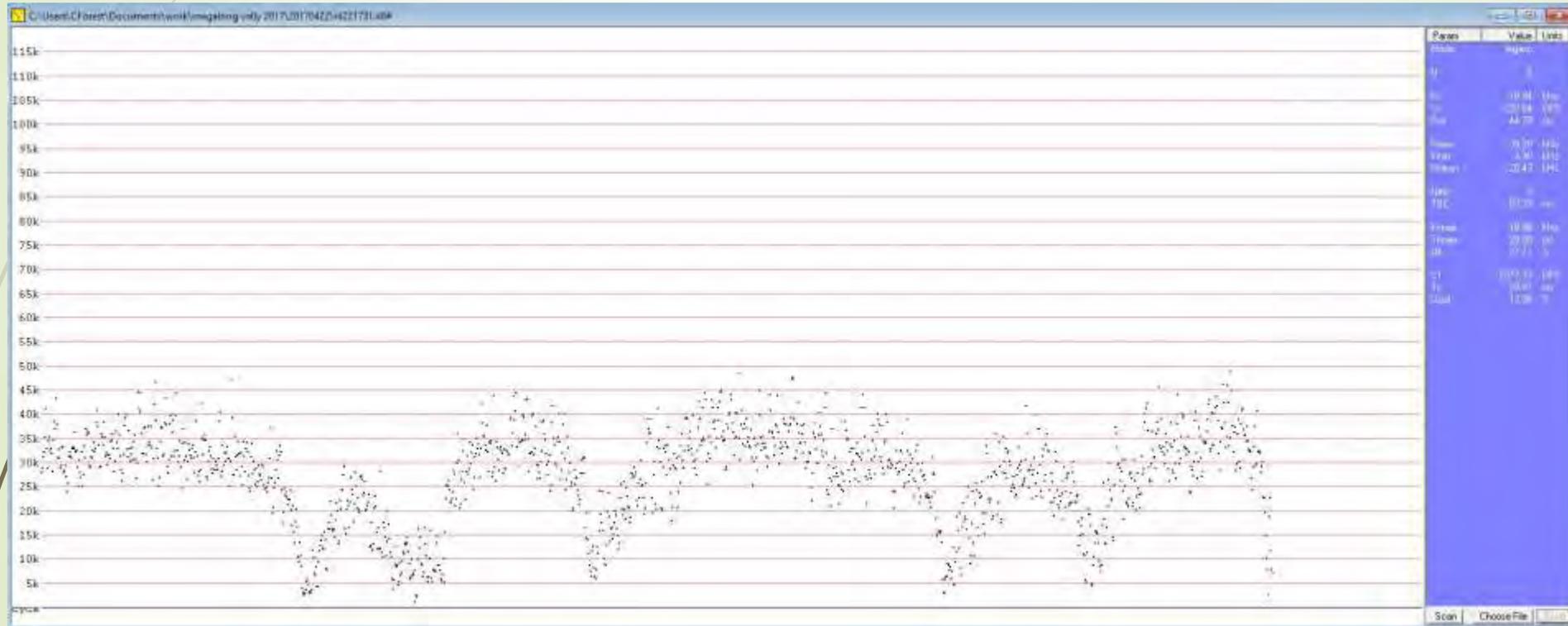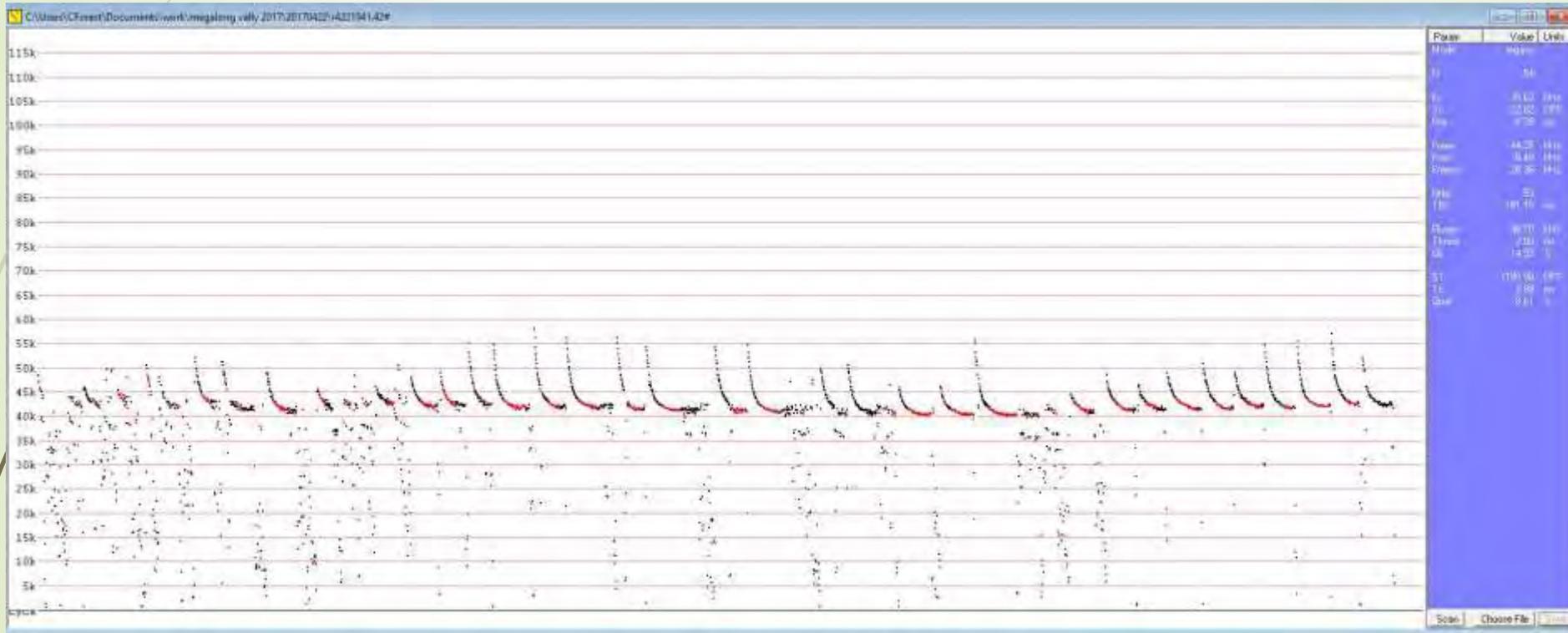

Figure 6. 'Excited' release call of *Chalinolobus gouldii*, showing several higher steeper pulses before producing normal pulses.

INSECT NOISE
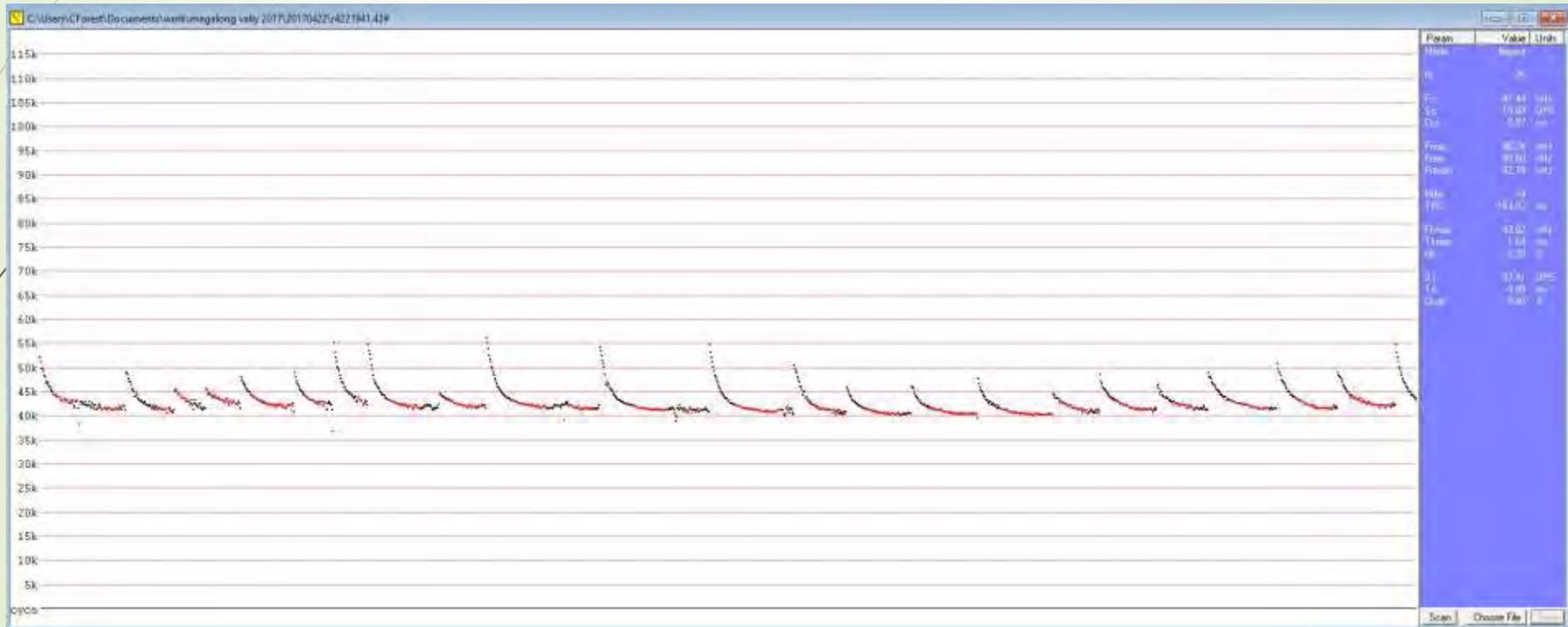
CHOCOLATE WATTLED BAT - CALL WITH INSECT NOISE

REAL TIME CALL

INSECT NOISE FILTERED OUT – READY FOR IDENTIFICATION

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.

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**

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

RESULTS FAUNA

- BIRDS = 44 species (inc. 4 exotic species)
- 2008 = 59 species over both seasons

MAJOR CORRIDOR NAME	No of SPECIES
NORTHERN	21
WESTERN	11
SHRIMPTONS CK	14
PARRAMATTA RIVER	26

Australian Brush-turkey
Australian King-Parrot
Australian Magpie
Australian Pelican
Australian Raven
Australian White Ibis
Black-faced Cuckoo-shrike
Brown Goshawk
Brown Thornbill
Chestnut Teal
Crested Pigeon
Crested Tern
Eastern Rosella
Eastern Spinebill
Eastern Whipbird
Golden Whistler
Grey Butcherbird
Laughing Kookaburra
Lewins Honeyeater
Little Corella

Little Pied Cormorant
Little Wattlebird
Magpie-lark
Masked Lapwing
Noisy Miner
Pacific Black Duck
Pied Currawong
Rainbow Lorikeet
Red Wattlebird
Rufous Fantail
Satin Bowerbird
Silver Gull
Spotted Pardalote
Sulphur-crested Cockatoo
Superb Fairy-wren
Welcome Swallow
White-browed Scrubwren
White-cheeked Honeyeater
White-faced Heron
Willie Wagtail

MAMMALS EXCLUDING BATS 2018=9 2008 = 9

GROUP	WESTERN		NORTHERN		SHRIMPTONS		PARRAMATTA RIVER	
	2008	**2018**	**2008**	**2018**	**2008**	**2018**	**2008**	**2018**
Arboreal Mammals	2	0	3	3	2	2	2	2
Terrestrial Mammals	0	0	1	2	0	0	0	0
Introduced	3	1	5	4	4	2	5	3
Bats (Micro & FF)	2	4	3	12	2	5	2	7

2018	WESTERN	NORTHERN	SHRIMPTONS	PARRAMATTA RIVER
TERRESTRIAL MAMMALS				
Red Fox		camera	camera	camera
Cat		camera		
Black Rat	camera, hairtube	camera	camera, hairtube	camera
Long-nosed Bandicoot		camera		
Swamp Wallaby		scats		
Rabbit		camera, scats		camera, scats, observed
ARBOREAL MAMMALS				
Common Ringtail		camera, hairtube, observed	camera, hairtube, observed	
Common Brushtail		camera, hairtube, observed	camera, observed	camera, hairtube
Sugar Glider		camera		
BATS	call recording	call recording, observed	call recording, observed	call recording

HERPETOFAUNA

2018 = 10 SPECIES   2008 = 8 SPECIES

|	WESTERN		NORTHERN		SHRIMPTONS		PARRAMATTA RIVER	
REPTILES	2008	2018	2008	2018	2008	2018	2008	2018
Delicate Skink	x	x	x	x	x	x	x	x
Eastern Blue-tongue Lizard						x		
Eastern Water Dragon		x		x		x		
Eastern Water Skink	x	x	x	x	x	x	x	x
Grass Skink	x	x	x	x	x	x	x	
Weasal Skink			x		x		x	
Swamp Snake			x					
Golden Crown Snake			Tasman					
Bar-sided Forest Skink		x						
FROGS								
Common Eastern Frogle	x		x	x	x		x	
Brown Marsh Frog	x			x	x	x		
Perons Tree frog		x						
Green Stream Frog				x				

Invertebrate surveys

- Timed surveys in 6 quadrats – 20 minutes each
- Repeated in March, April, and May 2018
- Species identified to morphotypes, and abundance estimated for larger populations
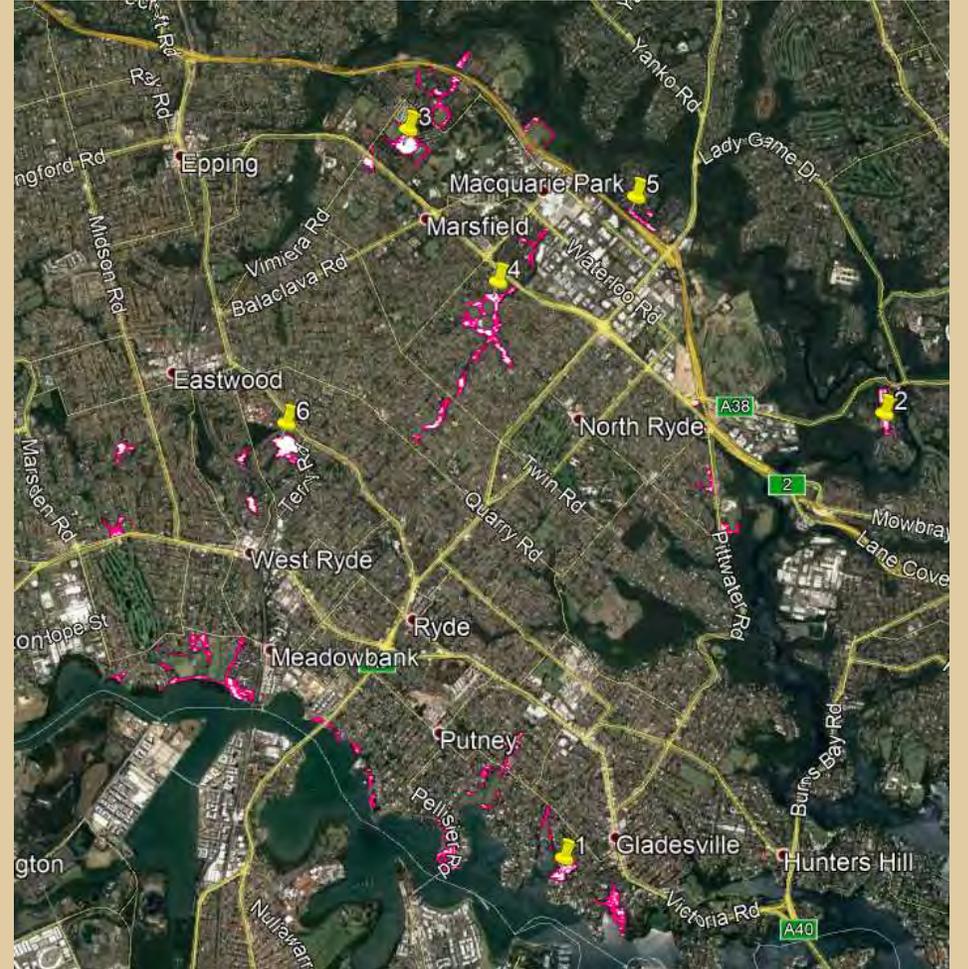
Invertebrate species richness

Invertebrate species richness in quadrats
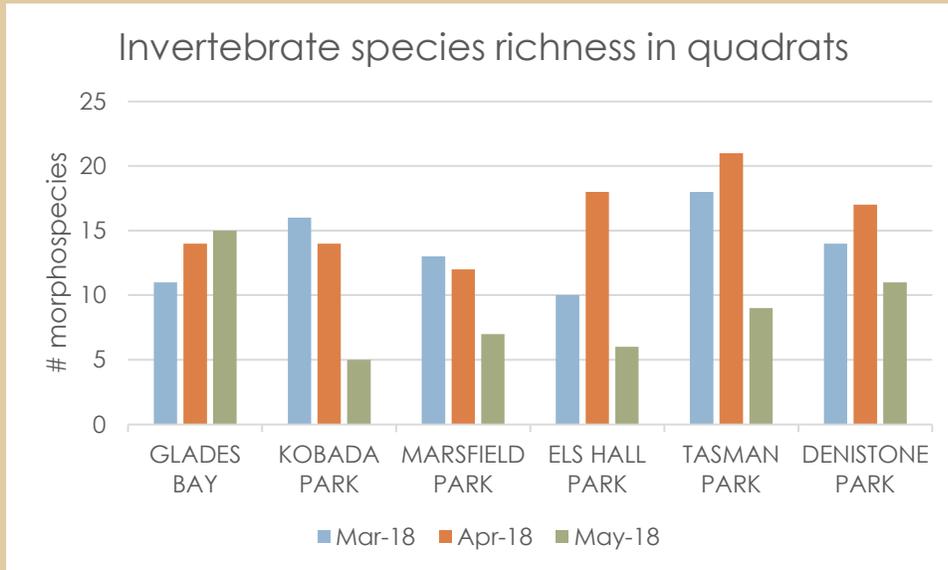
Invertebrate species abundance
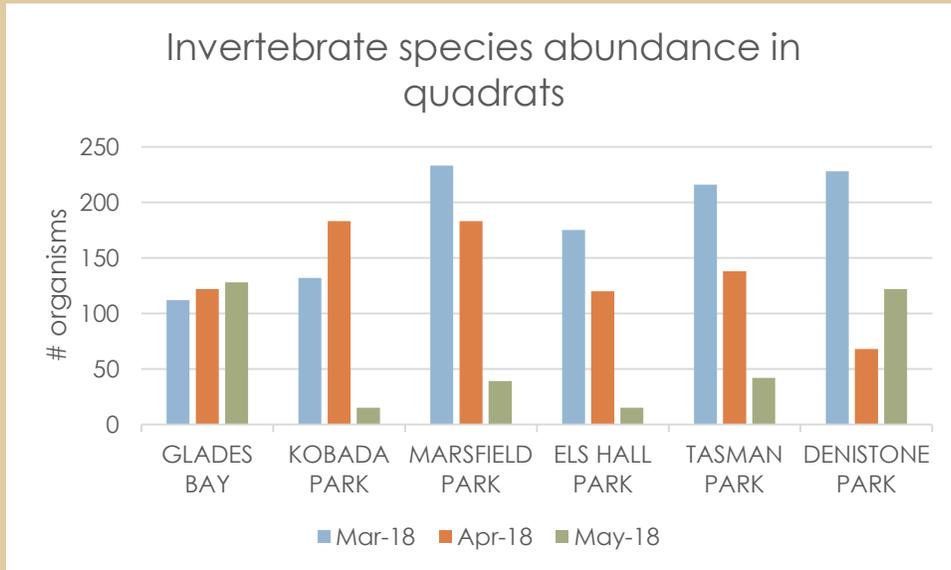
Microbats in quadrats

Threatened species in red

COMMON NAME	SCIENTIFIC NAME	DENISTONE PARK	ELS HALL	GLADES BAY	KOBADA PARK	MARSFIELD	TASMAN
Gould's Wattled Bat	*Chalinolobus gouldi*	x	x	x	x	x	x
Eastern Bentwing Bat	*Miniopterus orianae oceanensis*	x	x	x		x	
White-striped Free-tailed Bat	*Austronomus australis*	x	x	x	x	x	x
Little Bentwing Bat	*Miniopterus australis*	x				x	x
Chocolate Wattled Bat	*Chalinolobus morio*		x		x		
Long-eared Bat	*Nyctophilus sp.*			x	x	x	
Ride's Free-tailed Bat	*Mormopterus ridei*			x	x		
Large Forest Bat	*Vespadelus darlintoni*			x		x	
Yellow-bellied Sheathtailed Bat	*Saccolaimus flaviventris*			P	P		
Large-footed Myotis	*Myotis macropus*				x		
Eastern Broad-nosed Bat	*Scotorepens orion*				x		
Grey-headed Flying-fox	*Pteropus poliocephalus*		x			x	
TOTAL SPECIES RECORDED		4	5	7	8	7	3

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
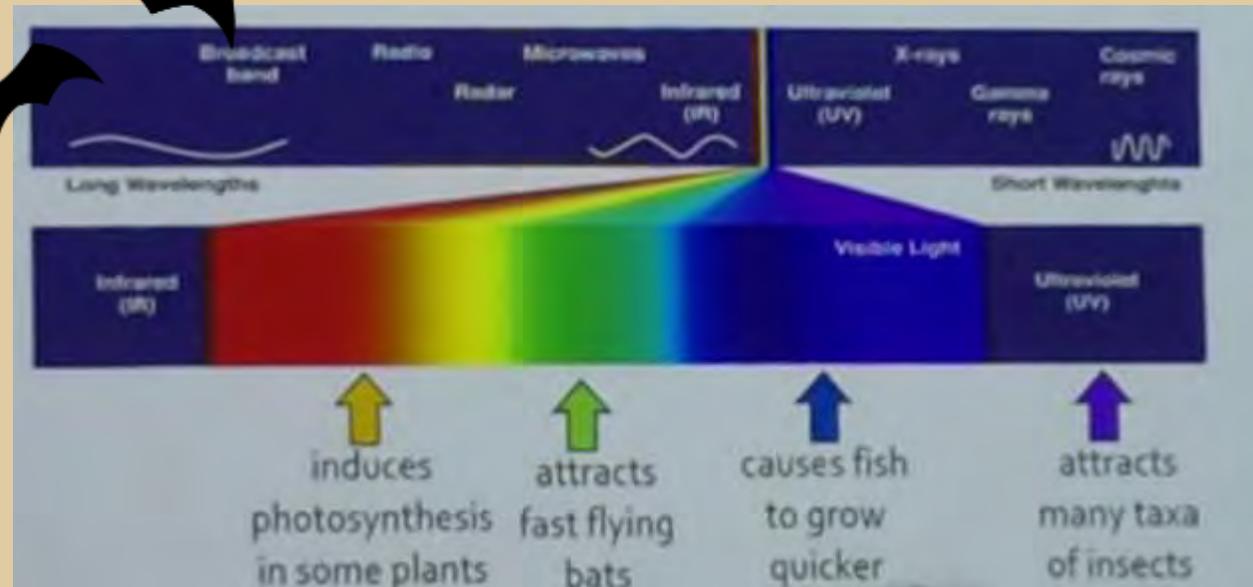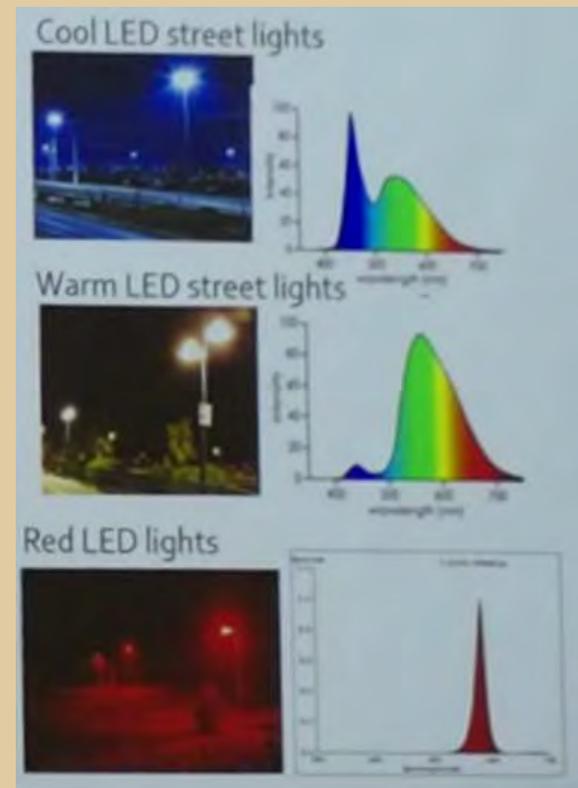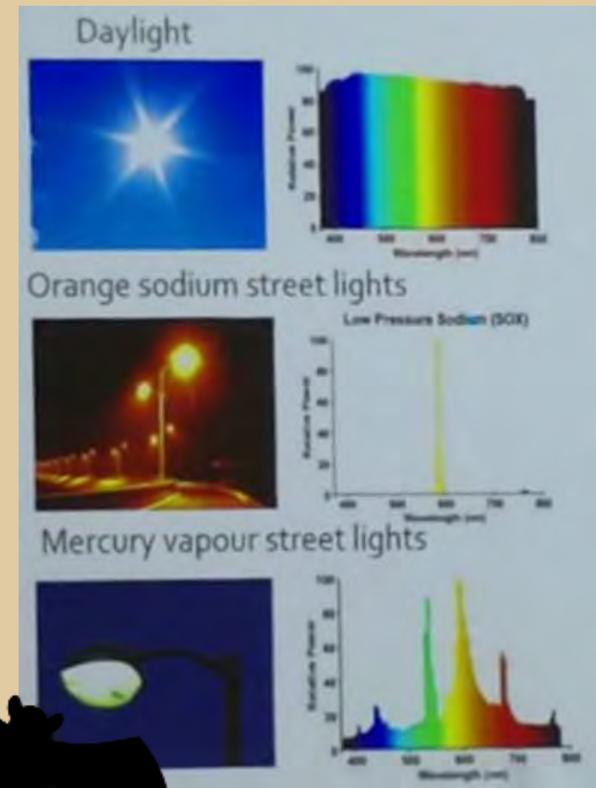
Urban tolerant species

- 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
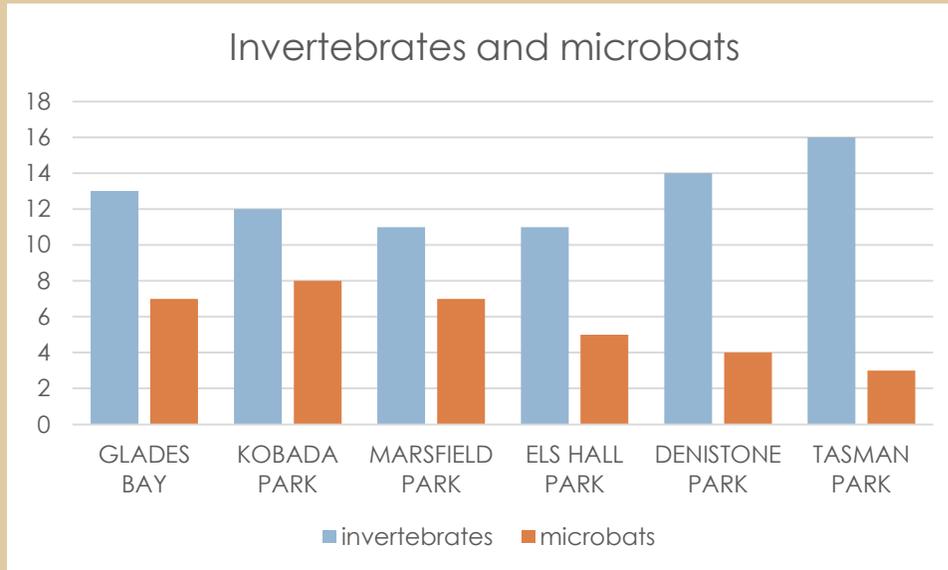 - Eastern Horseshoe Bat
  - Large-footed Myotis

Species in red were recorded in this survey

Large-footed Myotis (*Myotis Macropus*)

Natural insecticides

Invertebrates and microbats

- 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 autumn surveys - changes in quadrat cover
- 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

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

Quadrat surveys

- Six quadrats surveyed in 2008, repeat surveys in autumn 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%

Ground truthing vegetation communities

- 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)

The Native Vegetation of the Sydney Metropolitan Area

Volume 2: Vegetation Community Profiles

Version 3.0

Catchment Management Authority

Office of Environment & Heritage

Denistone Park quadrat

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

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

Changes in Braun Blanquet cover

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

Changes in Braun Blanquet cover
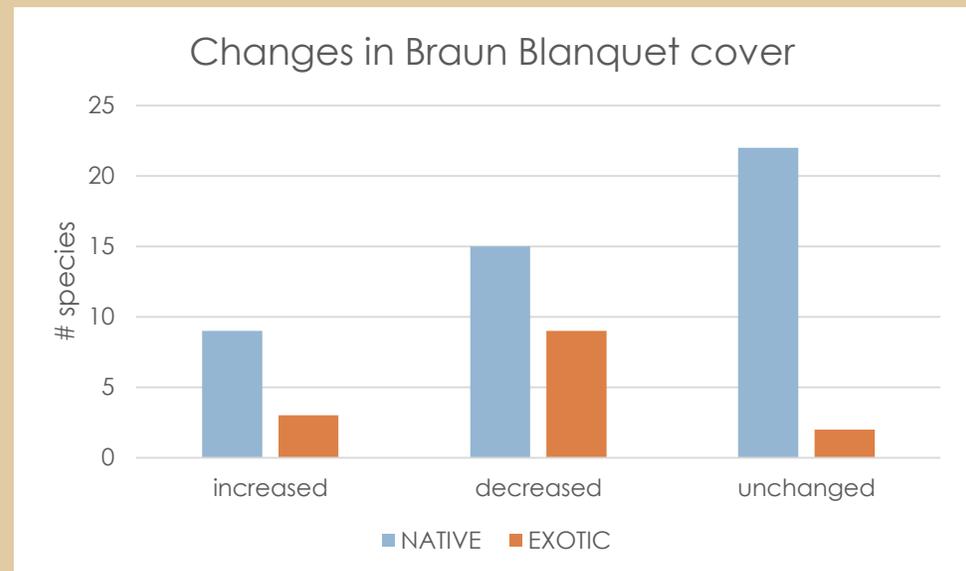
Glades Bay Park quadrat

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

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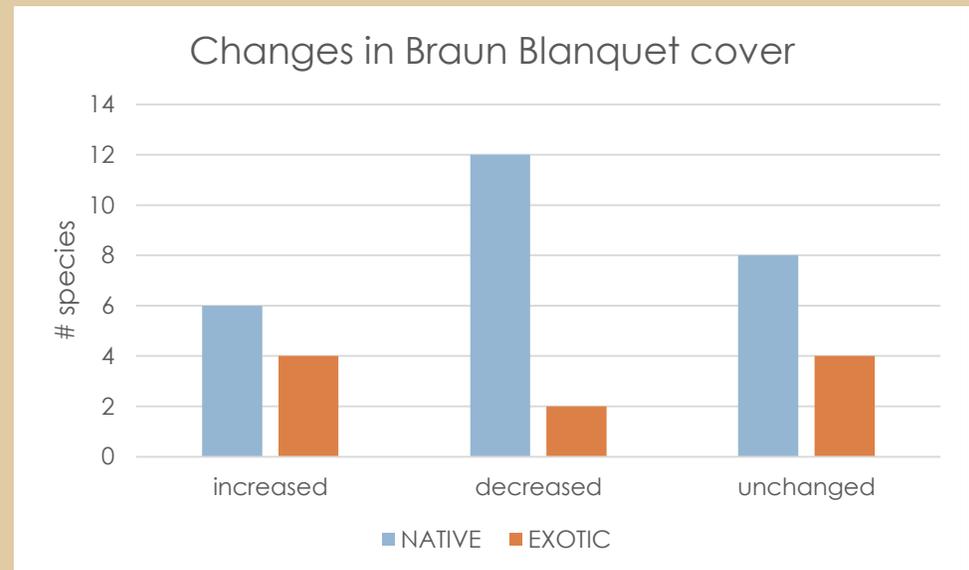
Kobada Park quadrat

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

Changes in Braun Blanquet cover

Marsfield Park quadrat

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

Changes in Braun Blanquet cover

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

Tasman Park quadrat

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

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

Changes in Braun Blanquet cover
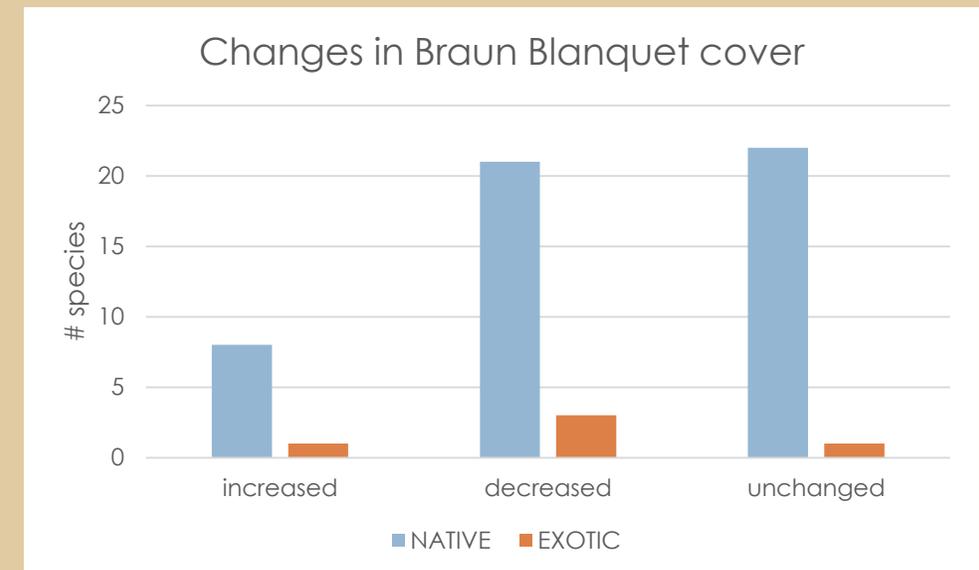
Some things to consider

- Where is the greatest native diversity?
- Where is the most weed species?

- Where has there been the most change?
- Which quadrats have improved? Deteriorated?

- What might cause changes?

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
MARSFIELD	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

Bioturbation in the ecosystem

- "Bioturbation is defined as the reworking of soils and sediments by animals or plants. These include burrowing, ingestion and defecation of sediment grains. Bioturbating activities have a profound effect on the environment and are **thought to be a primary driver of biodiversity**." (Wikipedia)

Brush Turkeys were seen in Waterloo Park drinking from water bowls

Bioturbation changes soil properties

- Increased soil turnover
- Changes to chemical and structural properties of soils
- Greater water infiltration, increased soil moisture
- Decreased surface runoff and erosion
- All of which is great for plants and animals!

Bioturbation and mycorrhizae

- Digging provides habitat for microscopic and macroscopic organisms
- These are actively involved in nutrient cycling, which increases
- Fungi are dispersed by digging, which also creates sites for fungal growth
- Diggings capture plant seeds
- Digging stimulates germination

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

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

Outcomes for Veg Management

- 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
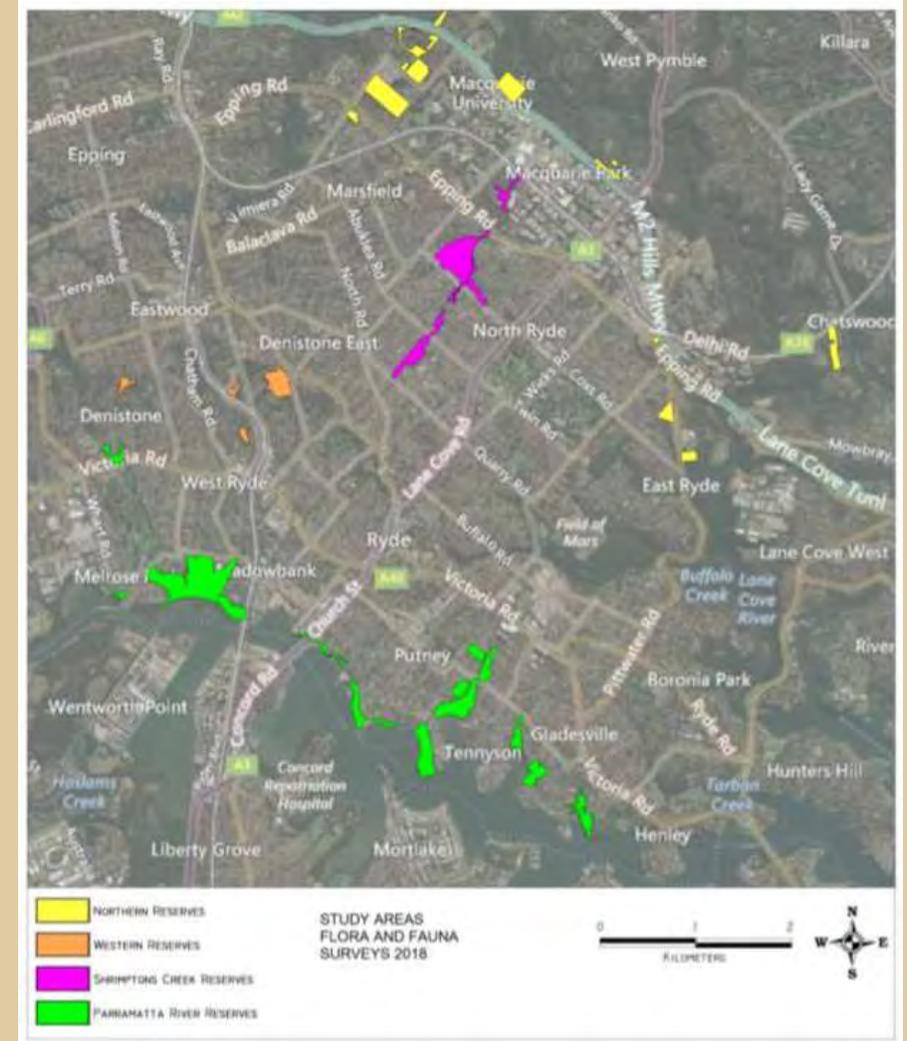
WHERE TO FROM HERE…

- Spring surveys to repeat autumn (and 2008) surveys

- Extensive vegetation surveys

- Ground truthing vegetation communities mapped in patches in all reserves

- Convert 2008 results

- Compile results for 2018 (autumn and spring surveys) and compare with 2008 surveys