Insectivorous bat roosts in road structures in Brisbane

VANESSA GORECKI

PROFESSOR STUART PARSONS

DR MONIKA RHODES

DR RAMONA MAGGINI

QUEENSLAND UNIVERSITY OF TECHNOLOGY

Research structure

Aim: understand the roosting ecology of insectivorous bats living in road structures in Brisbane to provide science-based recommendations for the management of bat roosts in road structures.

- Objective 1: To identify the factors that influence roost selection in road structures by insectivorous bats at a landscape scale;
- Objective 2: To identify the attributes of bat roost sites within road structures in Brisbane;
- Objective 3: To understand the habitat use and roosting ecology of the large-footed Myotis using road structures as roost sites;
- Objective 4: To examine the population structure of large-footed Myotis using mitochondrial DNA (mtDNA).

Bats in road structures

Globally

- 99 species from 8 families

Australia- 15 species

- Northern freetail bat (*Chaerephon jobnsis)*
- Large-eared pied bat (*Chalinolobus dwyeri*)
- Gould's wattle bat (*Chalinolobus gouldii*)
- Chocolate wattled bat (*Chalinolobus morio*)
- Diadem leaf-nosed bat (*Hipposideros diadema)*
- Northern leaf-nosed bat (*Hipposideros stenotis)*
- Little bent-wing bat (*Miniopterus australis*)
- Northern bent-wing bat (*Miniopterus orianae*)
- Southern bent-wing bat *(Miniopterus orianae bassanii)*
- Large-footed myotis (*Myotis macropus*)
- Lesser long-eared bat (*Nyctophilus geoffroyi*)
- Gould's long-eared bat (*Nyctophilus gouldi*)
- Eastern horseshoe bat (*Rhinolophus megaphyllus)*
- Northern cave bat (*Vespadelus caurinus)*
- Eastern cave bat (*Vespadelus troughtoni)*

Family	Count
Emballonuridae	3
Hipposideridae	5
Molossidae	5
Noctilionidae	2
Nycteridae	1
Phyllostomidae	13
Rhinolophidae	6
Vespertilionidae	64
Total	**99**

Road structures

- Structure specific
  - Girder/beam bridges
  - Arch bridges
  - Culverts >100m
- Construction fabric
  - Concrete
- Literature predominantly from the northern hemisphere

© Bancrete.com

© Bancrete.com

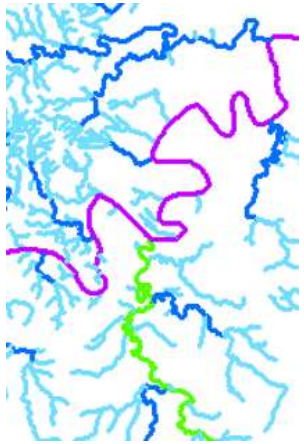
© Bat Conservation International

Experimental design

- Site selection – 2930 concrete culverts in Brisbane

- Random-stratified experimental design
  - Predictors:

land use

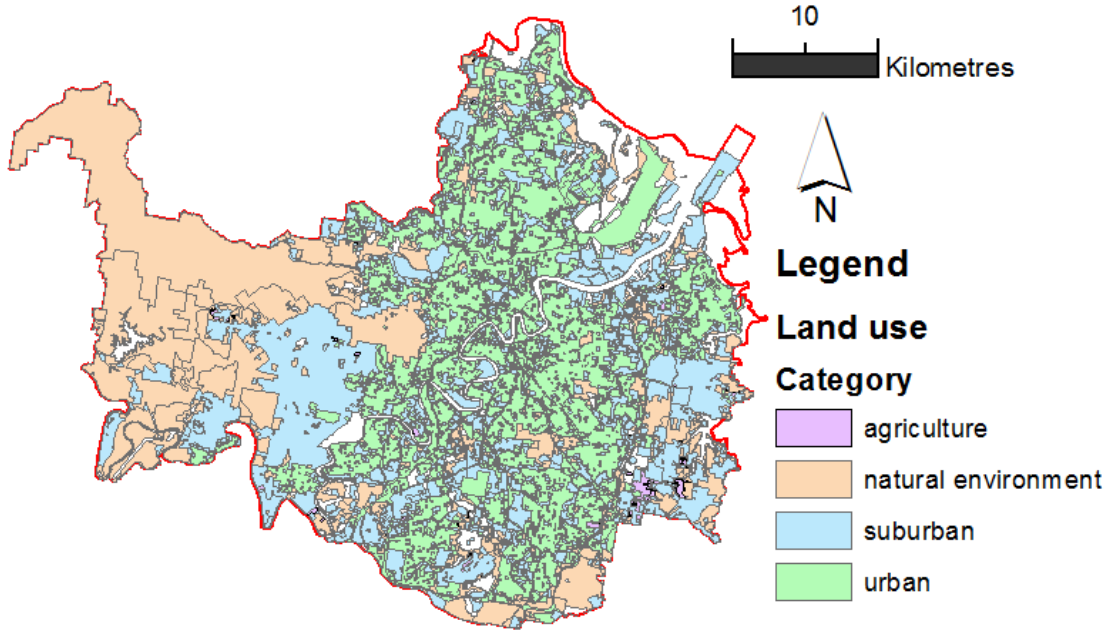


waterway permanency

structure design

Land use

- Land use based on Australian Land Use and Management Classification ArcGIS file from Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES, 2016)
- BCC- 68 categories
- This study- 4 categories



Natural environment

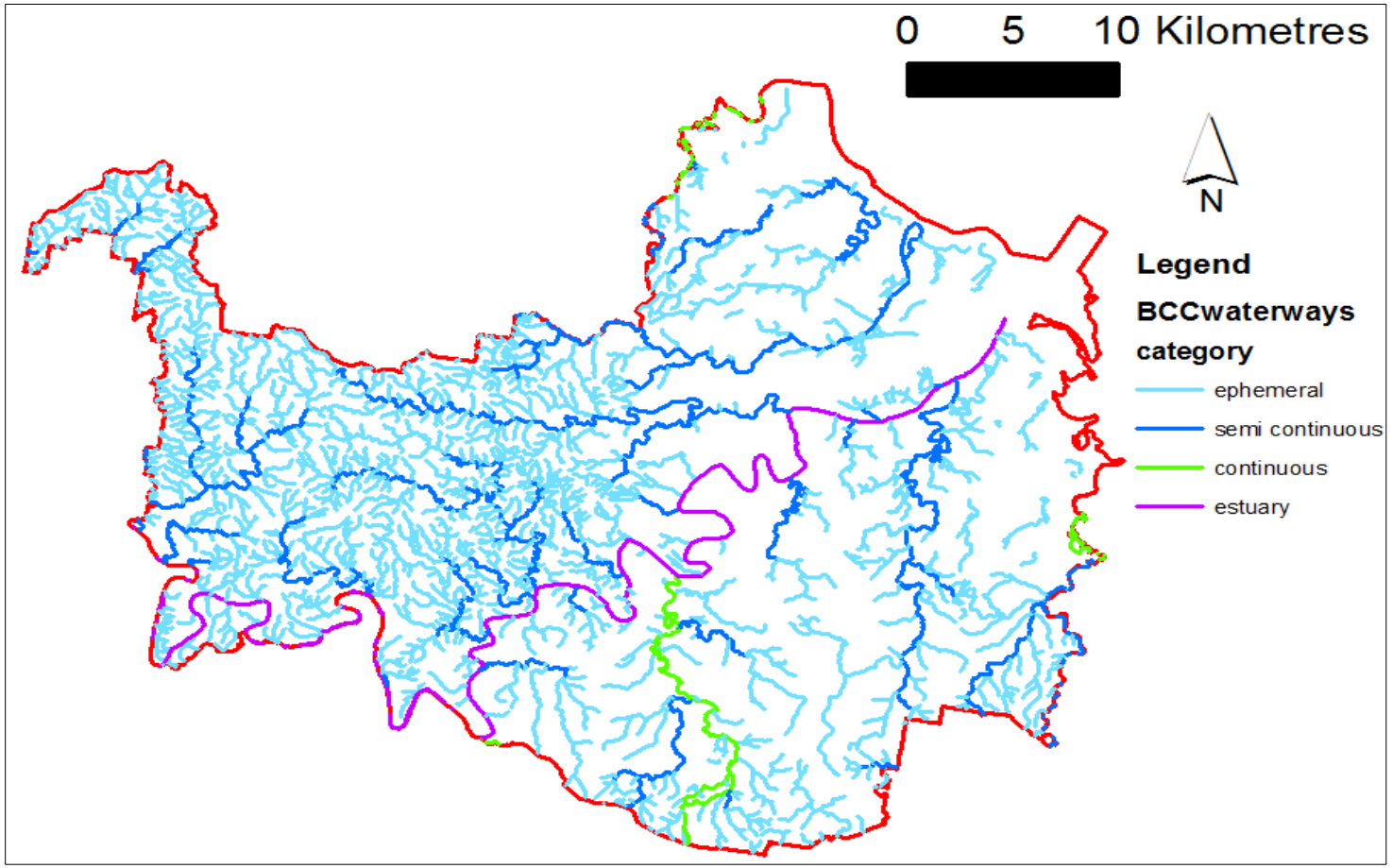
Suburban

Urban

Agriculture

Waterways

- Waterway permanency based on stream orders (Strahler, 1952)
  - Ephemeral (1-2)
  - Semi-continuous (3-4)
  - Continuous (5-6)



Road structures

- Structure design

Category	Definition
Box culvert small	<500 mm diameter
Box culvert med	500-1000 mm diameter
Box culvert large	1000-1500 mm diameter
Box culvert extra large	>1500 mm diameter
Pipe culvert small	<500 mm diameter
Pipe culvert med	500-1000 mm diameter
Pipe culvert large	1000-1500 mm diameter
Pipe culvert extra large	>1500 mm diameter

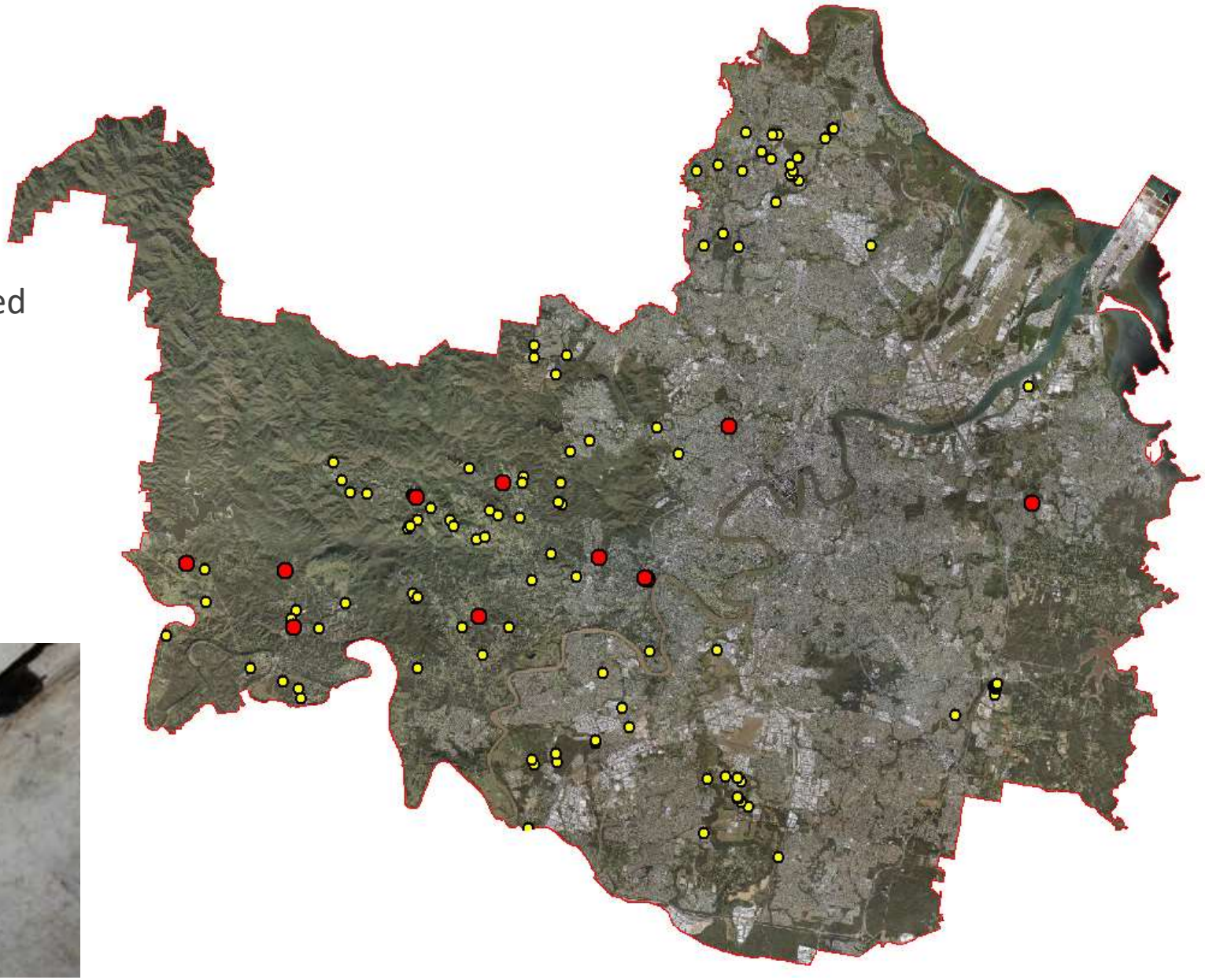
Brisbane City Council

Field Survey

- 303 structures to survey
- Walk-through, visual surveys
- Presence of bats
- Evidence of bats
- Water at time of survey
- Vegetation
- Weather
- Disturbance
- Roost suitability rating
- Structure orientation
- Distance to street light
- Other fauna

Results

- 126 sites inspected, 94 sites completed
- One species- Large-footed Myotis
- 11 roost sites identified
  - 3 day roosts identified
  - 6 maternity roosts identified
  - 2 roost sites without bats present identified



Roost sites

Roost	Land use type	Waterway	Culvert type
Chapel Hill	urban	semi continuous	box large
Tingalpa	natural environment	ephemeral	box large
Kenmore	urban	ephemeral	box large
Upper Brookfield	suburban	semi continuous	box large
Brookfield	suburban	semi continuous	box large
Pullenvale	urban	semi continuous	box xlarge
Indooroopilly	suburban	ephemeral	box xlarge
Red Hill	urban	semi continuous	box xlarge
Lake Manchester	suburban	semi continuous	pipe xlarge
Kholo	natural environment	ephemeral	pipe xlarge
Kholo	natural environment	semi continuous	pipe xlarge

Roost	Roost type	Number of bats	Culvert type	Culvert diameter (m)	Culvert width (m)	Culvert length (m)
Tingalpa	Bats absent	-	box	1.2	2.4	32.69
Lake Manchester	Bats absent	-	pipe	1.5	-	26.8
Kenmore	Day	2	box	1.5	3	27.6
Kholo	Day	37	pipe	2	-	19.8
Chapel Hill	Day	1	box	1.2	1.8	20
Upper Brookfield	Maternity	45+	box	1.8	2.1	8
Brookfield	Maternity	65+	box	1.8	2.7	13
Pullenvale	Maternity	21+	box	3	3	7
Indooroopilly	Maternity	11+	box	3	3	60
Red Hill	Maternity	2	box	2.7	3	12
Kholo	Maternity	10+	pipe	1.8	-	12.2

Modelling and outcomes

- Modelling
  - Generalised Linear Mixed-effects Model
    - Landscape variables
    - Surrounding habitat variables
    - Age of culvert
    - Dimensions of culvert- diameter, length, total area

- Outcomes
  - Road structure roost site preferences
  - Predictions on occupation
  - Quantitative description of predictors
  - Science based advice on bat roosts in culverts
  - Better conservation outcomes for urban bats

Thanks

Supervisors

- Professor Stuart Parsons
- Dr Monika Rhodes
- Dr Ramona Maggini

Brisbane City Council