



Albury
Conservation
Company



Squirrel Glider Monitoring Program – Thurgoona / Wirlinga (NSW)

Autumn 2019 Report

For Albury Conservation Company

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Table of Contents

Disclaimer	2
Document Control.....	3
1. Introduction	6
1.1 Survey Area	6
1.2 Experimental Design.....	6
1.3 Personnel	8
1.4 Methodology	8
1.5 Limitations	9
1.6 Timing.....	12
2. Results	13
2.1 Squirrel Glider detections.....	13
2.2 Observations and Trends	17
2.2.1 Habitat Type & Land Use Type.....	17
2.2.2 Camera Height.....	19
2.2.3 Tree Species.....	20
2.2.4 Detection Tracking.....	22
2.3 Other Fauna Species.....	24
2.4 Monitoring Site Tracker.....	24
2.5 Targeted Bird Survey.....	24
3. Discussion and Recommendations	23
4. Acknowledgments	25
5. References.....	26
Appendix A –Detection Images (Autumn 2019) by Site ID	29

List of Figures

Figure 1: Squirrel Glider Monitoring Program (SGMP) potential survey sites by classification.

Figure 2: Camera installed in River Red Gum (*Eucalyptus camaldulensis*) with target area in adjacent tree.

Figure 3: Sites not able to be monitored – Autumn 2019.

Figure 4: Image of partial eye and ear - species not identified

Figure 5: Image of whiskers - species not identified

Figure 6: Partial head/face – species not identified

Figure 7: Deployed camera locations

Figure 8: Squirrel Glider detections (with Site ID)

Figure 9: Squirrel Glider detection rates according to each vegetation type across the Winter and Spring 2018 and Autumn 2019 monitoring periods.

Figure 10: Squirrel Glider detection rates of each habitat type according to land use type for Autumn 2019 monitoring period.

Figure 11: Squirrel Gliders detected across three monitoring periods according to habitat type and land use type.

Figure 12: Squirrel Glider detection rates (%) at each height (m) across the three monitoring periods.

Figure 13: Average Squirrel Glider detection rate (%) at each height (m) across the three monitoring periods.

Figure 14: Squirrel Glider detections according to tree species in Winter 2018.

Figure 15: Squirrel Glider detections according to tree species in Spring 2018.

Figure 16: Squirrel Glider detections according to tree species in Autumn 2019.

Figure 17: Average Squirrel Glider detection rates according to tree species across the three monitoring periods.

Figure 18: Number of Squirrel Glider detection nights at each site across all three surveys to date.

Figure 19: Site 56 - White-bellied Sea-Eagle location (Google Earth Pro, 2018).

Figure 20: Site 14 cleared prior to Autumn 2019 monitoring period. Insert: Squirrel Glider recorded at this site during Winter 2018 monitoring period.

Table 1: Species list compiled from targeted bird surveys across the SGMP area in Autumn 2019.

Abbreviations

Abbreviation	Description
ACC	Albury Conservation Company
AEL	Albury Environmental Lands
CEnvP	Certified Environmental Practitioner
GPS	Global Positioning System
DMEco	DM Ecological
MEIANZ	Member of the Environmental Institute of Australia and New Zealand
SGMP	Squirrel Glider Monitoring Program

1. Introduction

DM Ecological (DMEco) was engaged by Albury Conservation Company (ACC) in April 2019 to implement Year 2 of a Squirrel Glider Monitoring Program (SGMP) in the greater Thurgoona / Wirringa area of New South Wales (NSW), after implementing Year 1 of the SGMP throughout 2018. The SGMP has the following aims:

- To determine the impact of urbanisation on Squirrel Glider (*Petaurus norfolcensis*) populations within key 'stronghold' patches (as indicated in previous studies).
- To evaluate the effectiveness of management actions designed to improve the persistence of Squirrel Glider populations in 'lower quality' patches.
- Engage the community in the protection and enhancement of Squirrel Glider populations by providing avenues to participate in monitoring and restoration works.
- Maintain a strong base program but be amenable to incorporating complementary research projects as funding and opportunities become available.

The wildlife surveys were carried out in April – May 2019 using motion sensing cameras as the primary method. Thirty motion sensing cameras were provided by ACC to undertake the SGMP.

Post each monitoring period, data conveying the locations of detected Squirrel Gliders and other threatened species will be uploaded to the Atlas of Living Australia where it will become publicly accessible and hopefully contribute to sound decision making in managing threatened species in the region.

A total of 68 sites have now been monitored at least once across the three SGMP monitoring periods so far; Winter 2018, Spring 2018 and Autumn 2019. Squirrel Gliders have been detected at 45 of these sites – 66% of sites monitored. The overall detection rate has remained steady at 32% for the Autumn 2019 survey, down from 33% in Spring 2018.

1.1 Survey Area

Thurgoona is an outer suburb of the regional city of Albury in southern NSW, Australia. Wirringa is a rural area which borders Thurgoona in the west and Lake Hume in the east. The SGMP was implemented across the greater Thurgoona / Wirringa area from the Murray River at the south to Ettamogah at the north.

1.2 Experimental Design

ACC identified 85 potential survey sites for the SGMP in the survey area and classified these according to the broad habitat type at each site. This was done via a mix of desktop and site assessments. The 85 potential sites are a mix of public and private land and zoned as one of urban, rural or proposed development. Figure 1 (page 7) shows the identified sites of each habitat type and land use type. The three sites east of the Hume Freeway were not a part of any zone overlays.

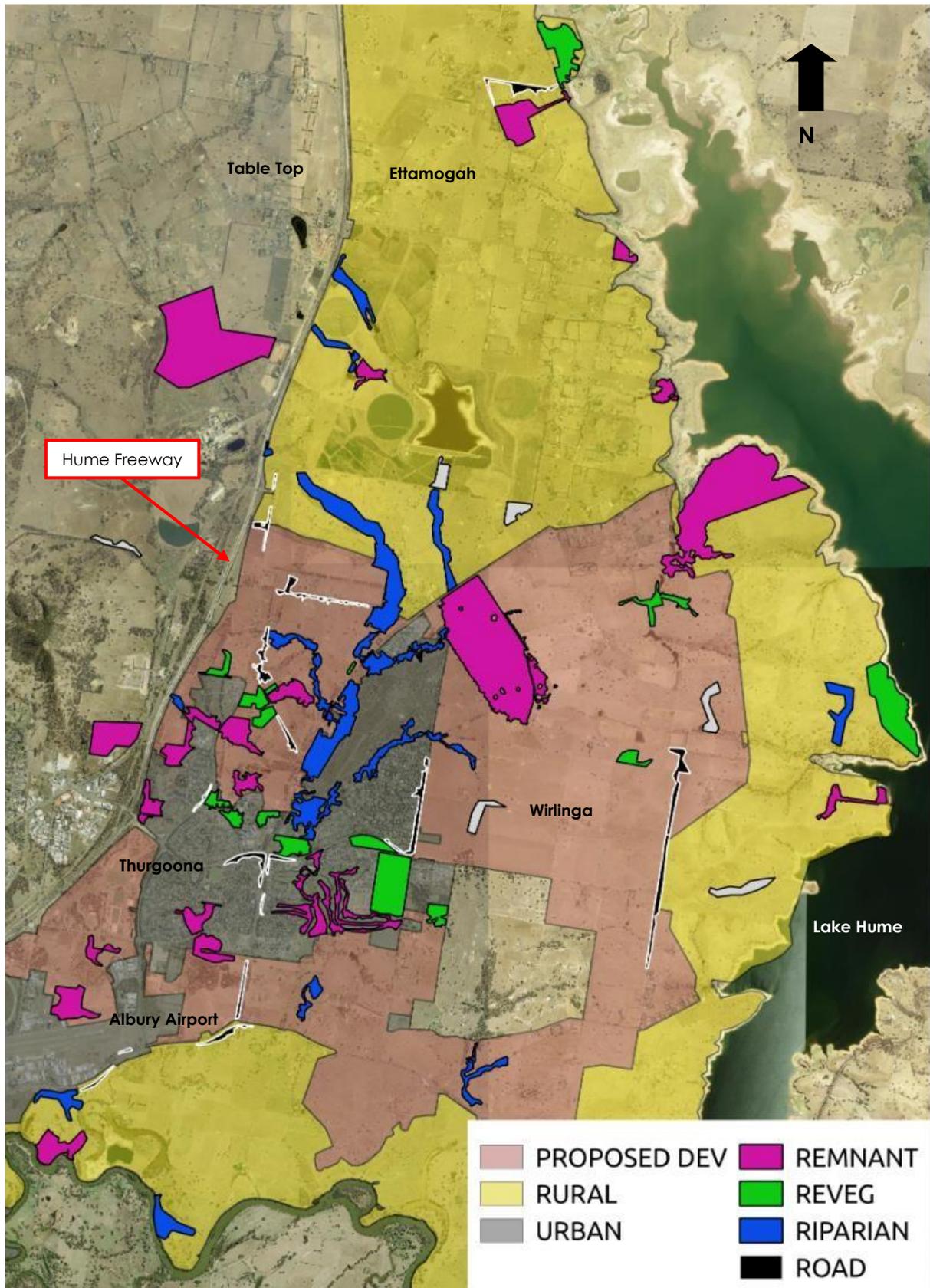


Figure 1: Squirrel Glider Monitoring Program (SGMP) potential survey sites by classification

1.3 Personnel

The assessment was undertaken by Ecologist Dylan McWhinney. Dylan is an experienced wildlife ecologist with expertise in the development and implementation of flora and fauna surveys throughout Eastern Australia. Dylan has worked on threatened species projects in Victoria, Queensland and New South Wales and specifically targeted Squirrel Gliders in all three states. He has performed capture and relocation roles on the clearing fronts of multiple large-scale development projects and is a licensed wildlife controller. Dylan holds a Bachelor of Environmental Science (Wildlife and Conservation Biology), is a Member of the Environmental Institute of Australia and New Zealand (MEIANZ) and is a Certified Environmental Practitioner (CEnvP) as administered by the Institute.

1.4 Methodology

The primary method of survey for the SGMP was the use of 30 motion sensing wildlife cameras as provided by ACC. The cameras utilised are the Little Acorn LTL-5610 Series. They can take 12MP High Definition images and store up to 12GB of data. The zero-glow technology makes them ideally suited for monitoring nocturnal species. The cameras were deployed arboreally at a height range of 3-10m depending on tree suitability, target area, reach, safety and potential for theft of cameras.

Cameras were typically placed on an auxiliary branch/ limb facing a target area on the main trunk or another branch/ limb with significant surface area. Distance from camera to target area varied from 0.5-2m. Care was taken to minimise the likelihood of leaves triggering images, however this is a common occurrence when utilising motion sensing cameras in an arboreal survey.

With the camera installed, the target area on the tree was sprayed with an attractant mix comprised of water, honey and sugar to provide a scent lure and improve the likelihood of detecting the target species at each location. Figure 2 (page 9) demonstrates a typical camera installation.

Basic data was captured at each initial site visit, including Site ID, Camera ID, Tree Species, Approximate Height (meters), Tree Circumference (cm) and a waypoint taken using Garmin Etrex 10 Global Positioning System (GPS).

During the Autumn 2019 monitoring period, DM Eco also undertook bird surveys at 35 monitoring sites, as directed by ACC. The bird surveys provide an opportunity to identify and record other threatened species in the Thurgoona / Wirringa region and contribute the data to publicly accessible data bases (Atlas of Living Australia), where it will provide value in planning assessments or other population monitoring/ distribution research. Bird surveys were carried out from a static point upon arrival at each site for a duration of 20 minutes using binoculars. Birds were recorded after being directly observed or identified via their call.



Figure 2: Camera installed in River Red Gum (*Eucalyptus camaldulensis*) with target being adjacent limb.

In addition to the use of motion sensing cameras, nearby nest boxes were physically inspected for use/ occupation where it was feasible from a time and accessibility perspective. The three nest boxes monitored were unoccupied but showed evidence of recent occupation (leaf nest – still green). These boxes were located between sites 23 and 24 (refer Figure 8 – page 16) in Thurgoona.

1.5 Limitations

The two monitoring periods implemented during 2018 (Winter and Spring) both produced excessive amounts of images, due to the settings implemented on the cameras and some localised weather events. For this initial monitoring period (Year 1) the cameras were set to capture images 24hrs a day, to minimise the risk of malfunction or recording a false absence. The Winter 2018 and Spring 2018 monitoring periods produced over 100,000 & 500,000 images respectively which required processing. This of course greatly increases the time and resources required to process the data.

Having revised the methodology heading into Year 2 of the SGMP, the cameras have been set to operate on a timer from 7am – 7pm, excluding daytime images from the survey without any risk to the detection rate of the (nocturnal) target species. This simple change has seen the images produced for the Autumn 2019 monitoring period reduce to just under 10,000 images.

The target number of sites for monitoring in each period was set at 68. In Autumn 2019 only 62 sites were monitored. This was due the remaining sites being inaccessible for one of the following reasons:

- Landholders not contactable for access permissions (11 Sites)
- Landholders contactable but not willing to participate in the SGMP on their property (4 Sites)
- Site already cleared of habitat and an active construction development site (2 Sites)

Seventeen sites that were not able to be monitored during Autumn 2019 are identified in Figure 3 (page 11).

An original aim of the SGMP was to utilise local community members in the analysing of captured images. It was originally intended to be done online via citizen science website Zooniverse (<https://www.zooniverse.org>) however it proved problematic uploading hundreds of thousands of 12MP images due mainly to internet speeds. During the Autumn 2019 monitoring period, DM Eco used a network of volunteers to review images from various sites which they received via an online large file transfer service (<https://wettransfer.com/>). They recorded image numbers where fauna was detected on a spreadsheet and returned for each site. These detections were reviewed and verified by DM Eco, providing the data for this report. The volunteers are recognised in Section 4, Acknowledgments.

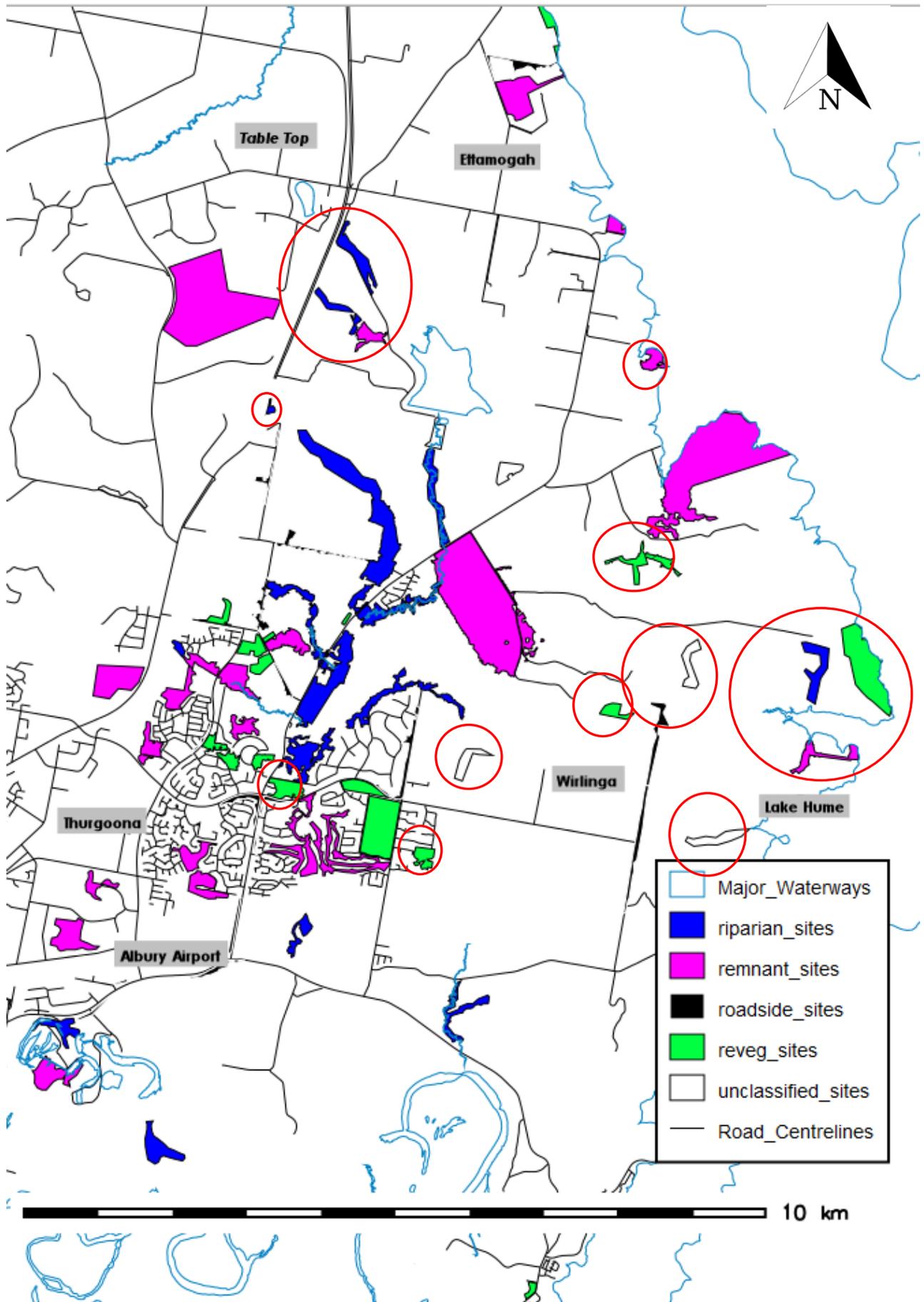


Figure 3: Sites not able to be monitored in Autumn 2019 are circled in red.

1.6 Timing

The monitoring occurred over three separate periods during April – May 2019. They were:

- Monitoring Period 1: 19th April to 4th May
- Monitoring Period 2: 5th May – 18th May
- Monitoring Period 3: 19th May – 1st June

Analysis of captured images occurred throughout June and July 2019.

2. Results

2.1 Squirrel Glider detections

Of the 62 sites monitored during Autumn 2019, Squirrel Gliders were positively identified at 20 of those sites, with a detection rate of 32%. This detection rate is lower than that of the previous monitoring periods (33% in Spring 2018 and 41.5% in Winter 2018). This is not to say that Squirrel Gliders were not present at the remaining sites, just that they were not detected during this monitoring period. It should also be noted that some of the cameras at these sites captured images of arboreal mammals, but it was not possible from the features identifiable in the images to determine whether the animal was indeed a Squirrel Glider or another species. As such, these sites were not deemed to have detected Squirrel Gliders as there was not enough evidence to support an entry into the Atlas of Living Australia database. Some examples of these images are provided in Figures 4 – 6 (pages 13/14).



Figure 4: Image of partial eye and ear - species not identified.



Figure 5: Image of whiskers - species not identified



Figure 6: Partial head/face – species not identified

A map displaying the location of the 62 deployed cameras is shown in Figure 7, below.

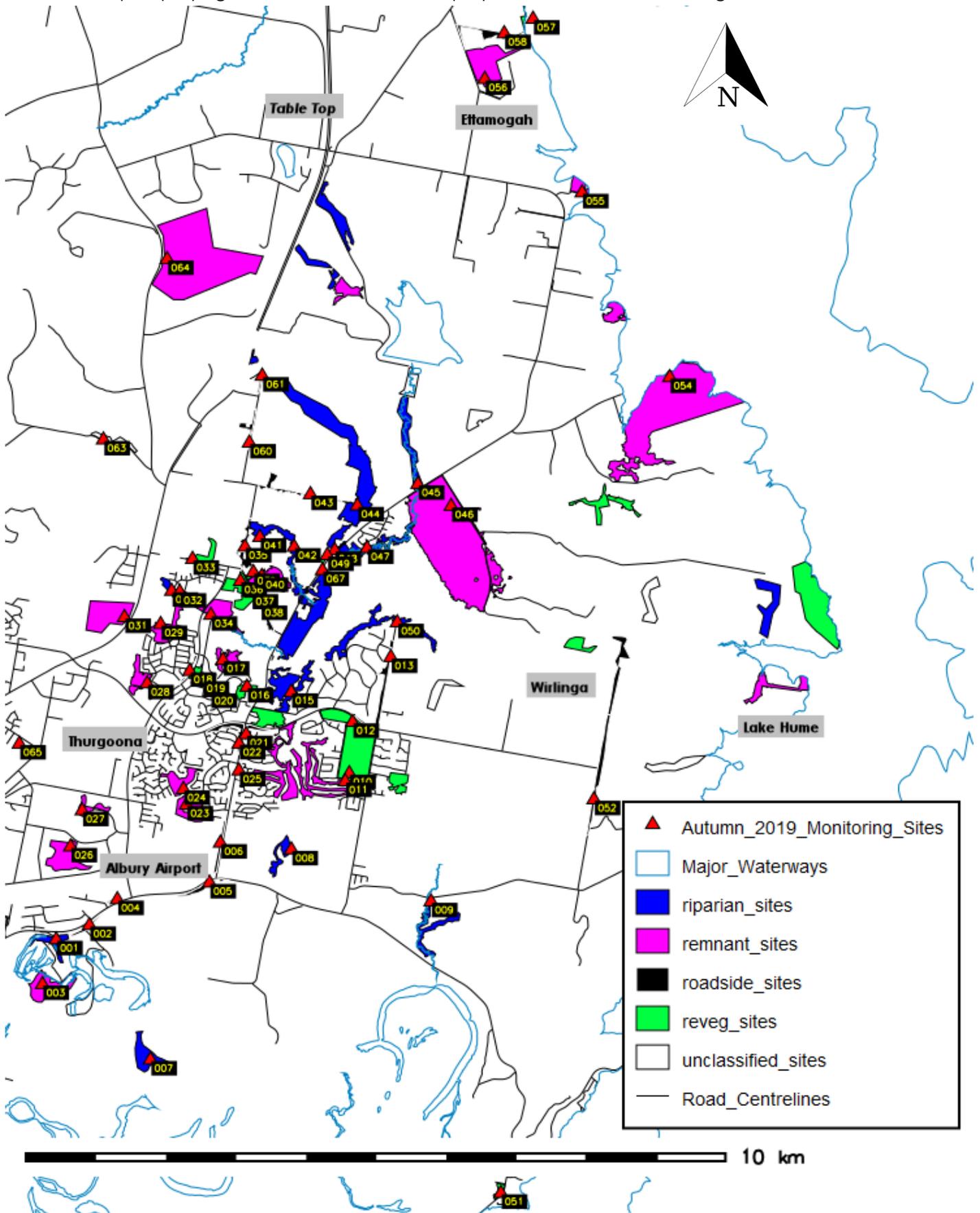


Figure 7: Deployed camera locations

A map displaying 20 sites with Squirrel Glider detections is shown in Figure 8, below.

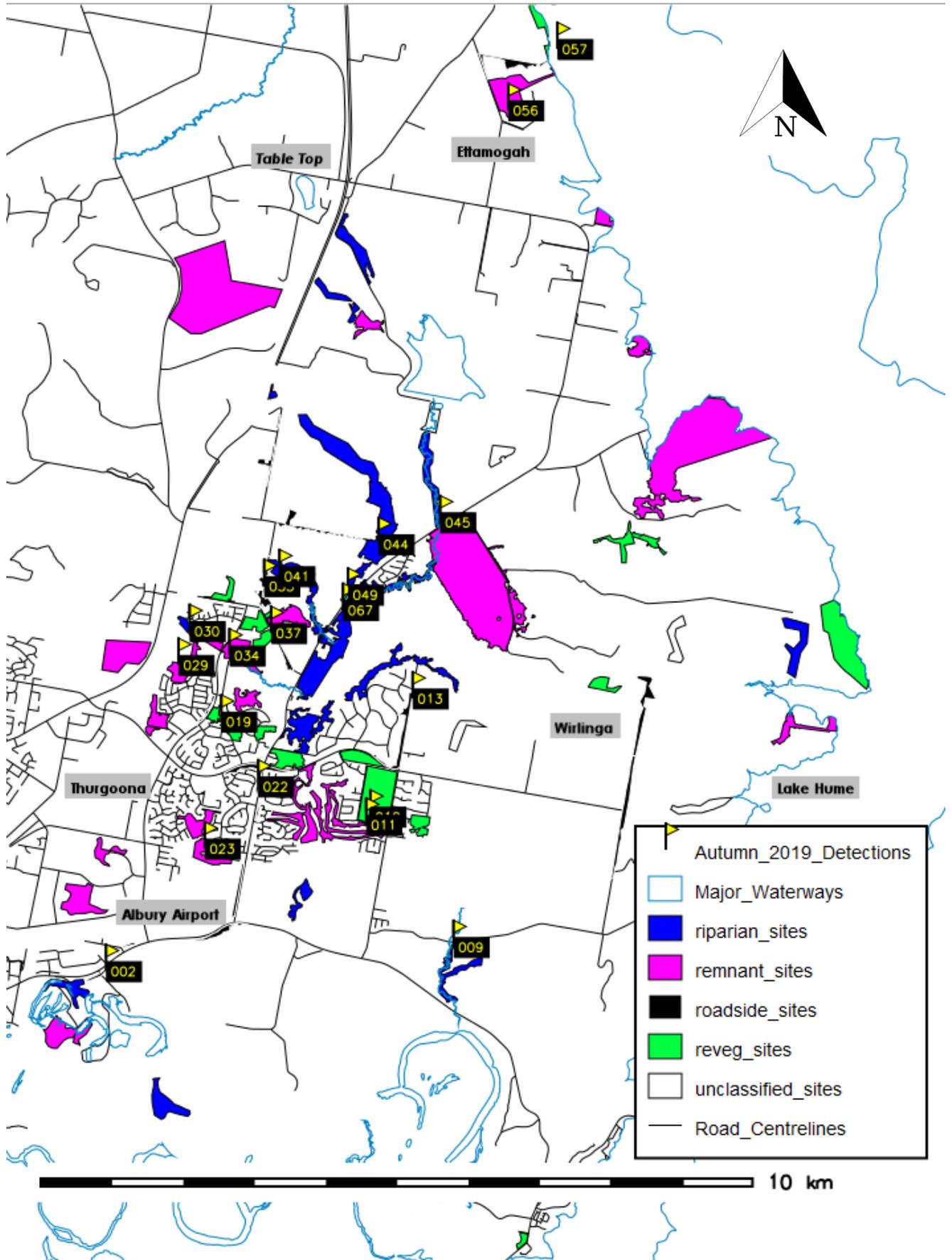


Figure 8: Squirrel Glider detections (with Site ID)

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2.2 Observations and Trends

2.2.1 Habitat Type & Land Use Type

Over the course of the three monitoring periods (Winter 2018, Spring 2018 and Autumn 2019) there has been a downward trend in detection rates in each habitat type, except for riparian sites, which have had a sharp increase in detection rates (a 6% increase to 43%) from Spring 2018 to Autumn 2019 (see Figure 9 below).

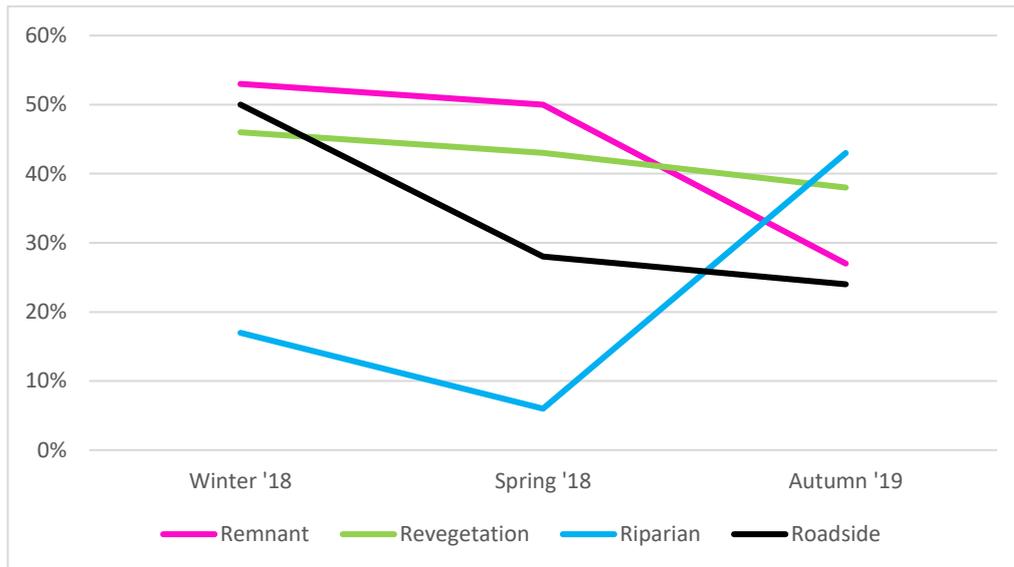


Figure 9: Squirrel Glider detection rates according to each vegetation type across the Winter and Spring 2018 and Autumn 2019 monitoring periods.

Of note is that the spike in riparian site detections has come predominantly from riparian sites within the proposed development land use type (5 Squirrel Glider detections from 8 sites monitored). Riparian sites within the urban land use type have yet to register a detection across the three monitoring periods (0 detections from 3 sites monitored in Autumn 2019). Figure 10 below displays the detection rates of each habitat type against their land use type for the Autumn 2019 monitoring period.

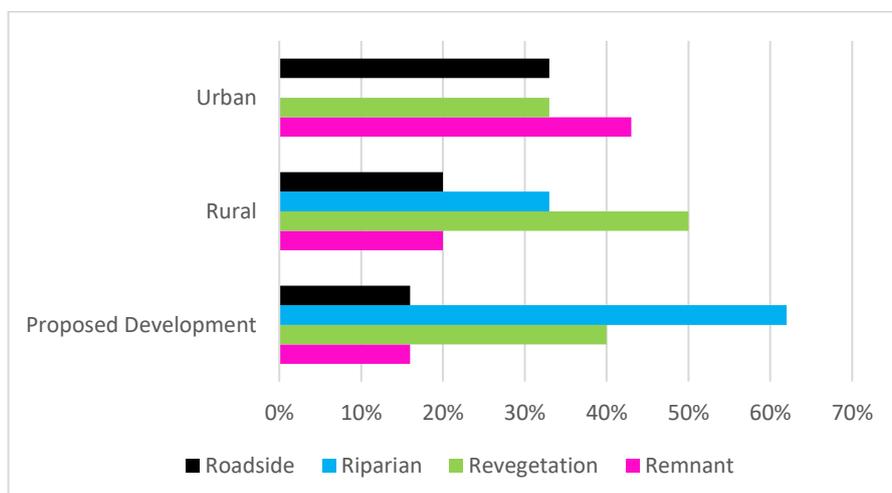


Figure 10: Squirrel Glider detection rates of each habitat type according to land use type for Autumn 2019 monitoring period.

This information shows that Squirrel Glider detections in the proposed development area were most frequent at riparian sites, in rural areas revegetation sites provided the most detections and in the urban area remnant sites had the highest rate of detections.

The actual number of Squirrel Glider detections has been tracked over each of the monitoring periods to give a visual representation of the habitat type in each land use area where Squirrel Gliders are recorded (see Figure 11, below)

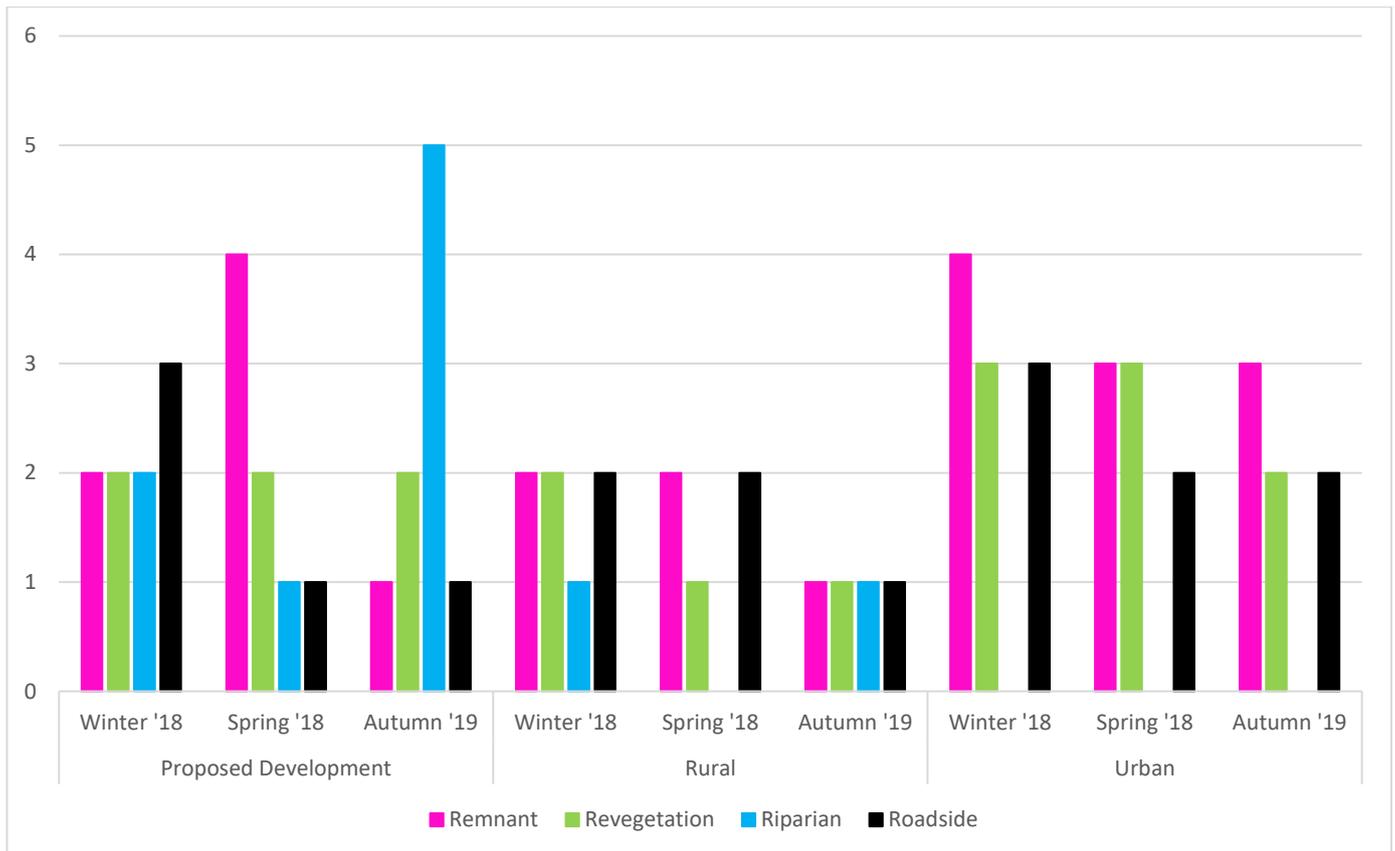


Figure 11: Squirrel Gliders detected across three monitoring periods according to habitat type and land use type.

2.2.2 Camera Height

Squirrel Gliders have been detected at every height throughout the range monitored from 3m to 10m high during each monitoring period so far. There has been a general upward trend in glider detection rates when the camera is placed higher in the tree and in particular, above 8m in height. This trend has been similar across the three monitoring periods as shown in Figure 12, below.

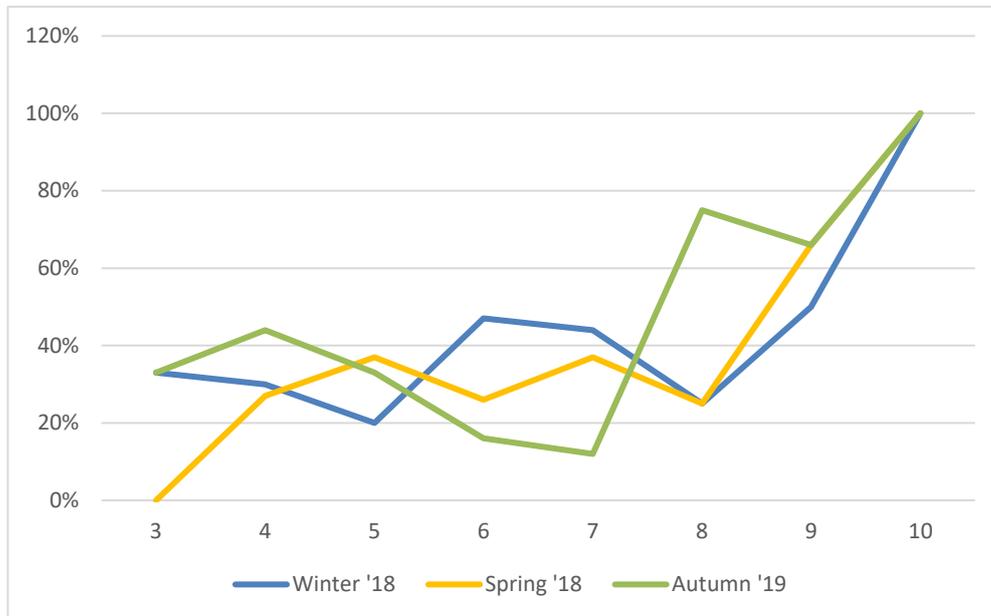


Figure 12: Squirrel Glider detection rates (%) at each height (m) across the three monitoring periods.

It should be noted that fewer trees have been monitored in the 8+ meter height range due to availability and accessibility of suitable target areas within specified sites. Only one tree has been monitored at 10m high (Site 30), which has had a positive Squirrel Glider detection in each monitoring period, hence the 100% detection rate at the 10m height range. The trend of increased detection rates above 8m in height is noticeable when the average detection rate at each height across the three monitoring periods is displayed as per Figure 13 below.

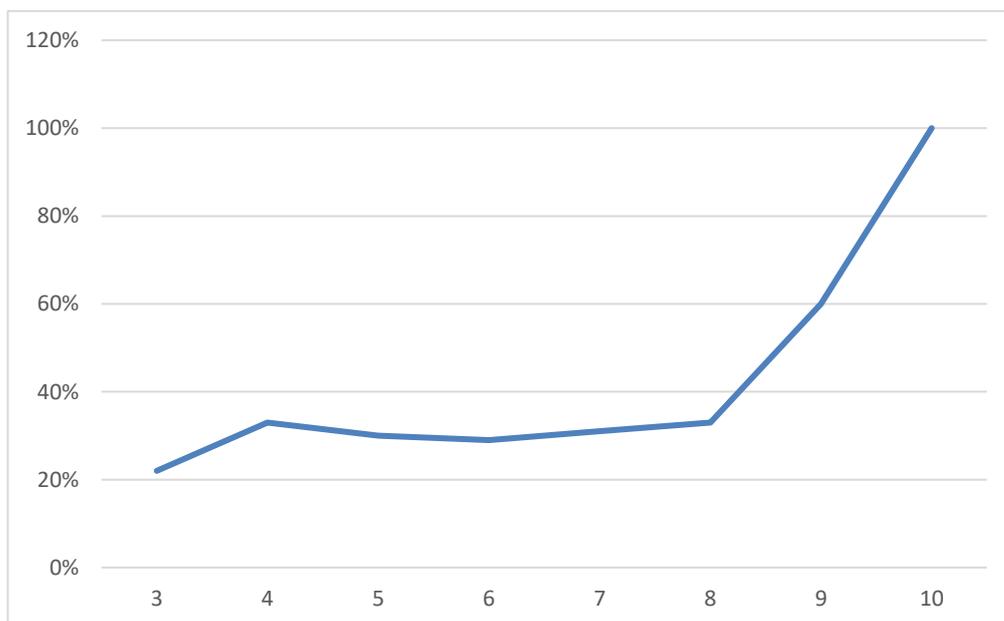


Figure 13: Average Squirrel Glider detection rate (%) at each height (m) across the three monitoring periods.

2.2.3 Tree Species

There were 13 different tree species monitored in Winter 2018 with Squirrel Gliders being detected in all but two species; Red Ironbark (*Eucalyptus sideroxylon*) and Manna Gum (*Eucalyptus viminalis*). Figure 14 (below) demonstrates which tree species had better detection rates than others during that period.

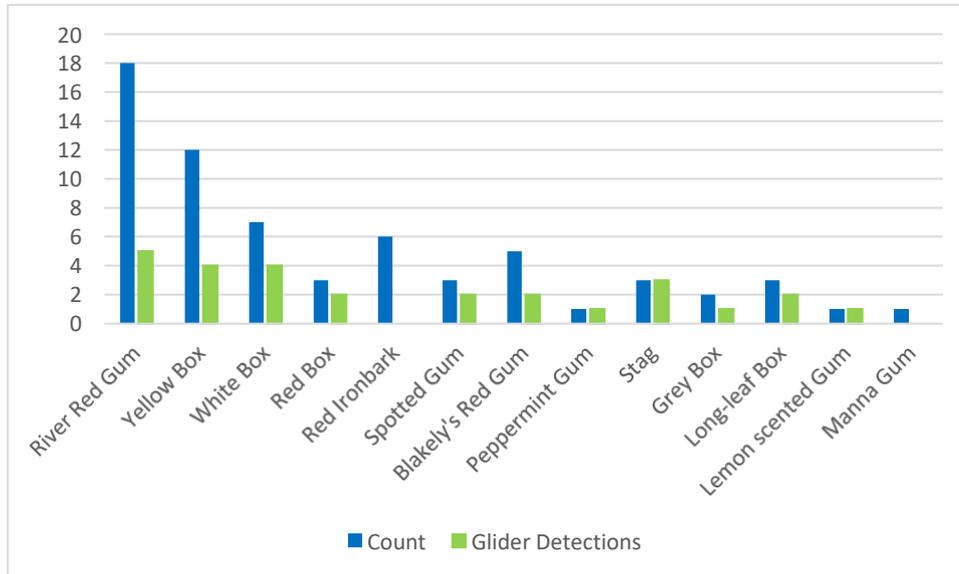


Figure 14: Squirrel Glider detections according to tree species in Winter 2018

During Spring 2018, 12 species of tree were included in the monitoring program and Squirrel Gliders were detected in nine of them. They were not detected in any Grey Box (*Eucalyptus microcarpa*), Lemon-scented Gum (*Corymbia citriodora*) or Peppermint Gum (*Eucalyptus nicholii*) trees during this period, having been detected in them in the previous monitoring period. Conversely, gliders were detected in Red Ironbark (*Eucalyptus sideroxylon*) trees this period, having not been detected in the Winter 2018 monitoring period. Figure 15 (below) demonstrates which tree species had better detection rates than others during the Spring period.

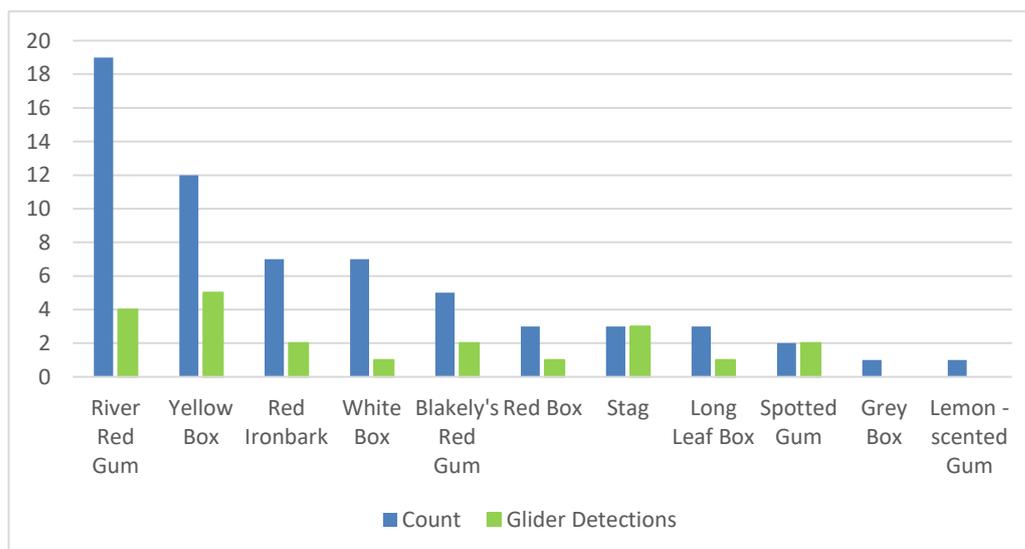


Figure 15: Squirrel Glider detections according to tree species in Spring 2018

In the Autumn 2019 monitoring period 11 different tree species were monitored and Squirrel Gliders were detected in 10 of them. They were not detected in the Lemon – scented Gum (*Corymbia citriodora*) (of which there is only one, at Site 51). There had been one Peppermint Gum (*Eucalyptus nicholii*) surveyed on the previous two monitoring rounds however its associated site (Site 14) was cleared prior to this monitoring round. It recorded a Squirrel Glider detection during the Winter 2018 monitoring period. There was also one Manna Gum (*Eucalyptus viminalis*) monitored during Winter 2018, however it has not been a part of the survey area since due to landholder access constraints. It had not recorded any Squirrel Glider detections. Detection rates for each tree species during the Autumn 2019 monitoring period are displayed in Figure 16, below.

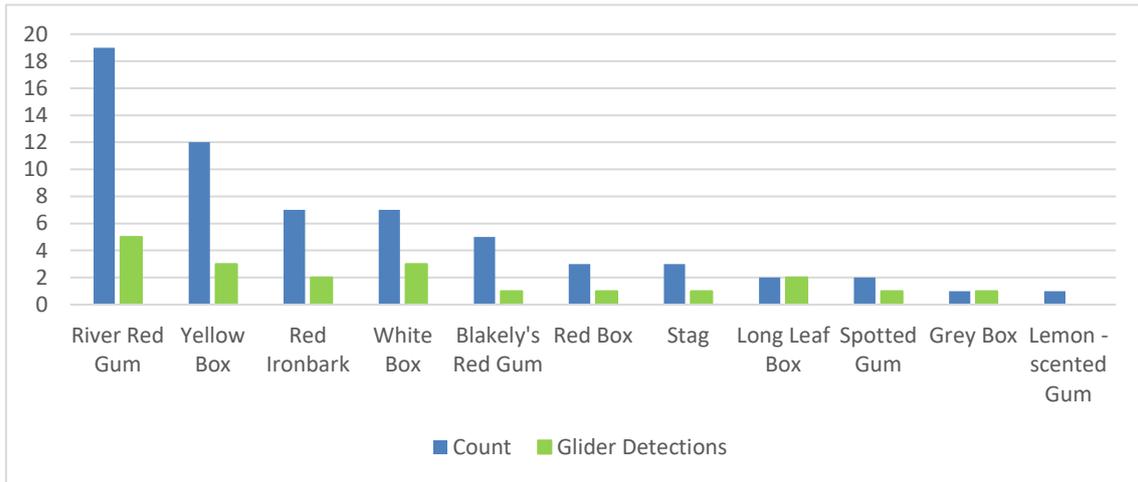


Figure 16: Squirrel Glider detections according to tree species in Autumn 2019

Average detection rates per tree species across the three monitoring periods is shown in Figure 17, below:

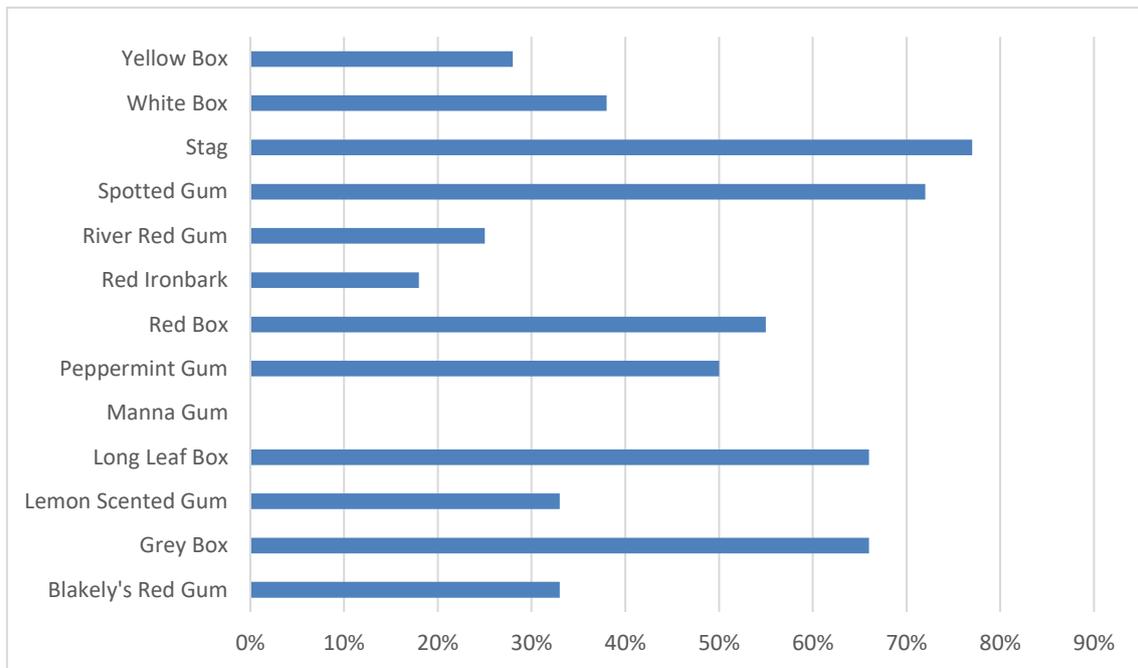


Figure 17: Average Squirrel Glider detection rates per tree species across the three monitoring periods.

2.2.4 Detection Tracking

Positive identifications were recorded at 27 of the 65 sites monitored during Winter 2018, 21 of the 64 sites in Spring 2018 and 20 of 62 sites in Autumn 2019. Images from each of the sites detecting Squirrel Gliders in Autumn 2019 can be seen in Appendix A.

The number of detection nights per site from across each of the three monitoring periods so far is displayed in Figure 18. Squirrel Gliders were detected up to eight of the ten monitoring nights at some sites and as few as one night at others. So far, only 8 of the 68 total sites monitored have detected Squirrel gliders across all three survey efforts (Winter and Spring 2018 and Autumn 2019). This data may enable future monitoring at these sites to identify changes in population density, distribution and other characteristics.

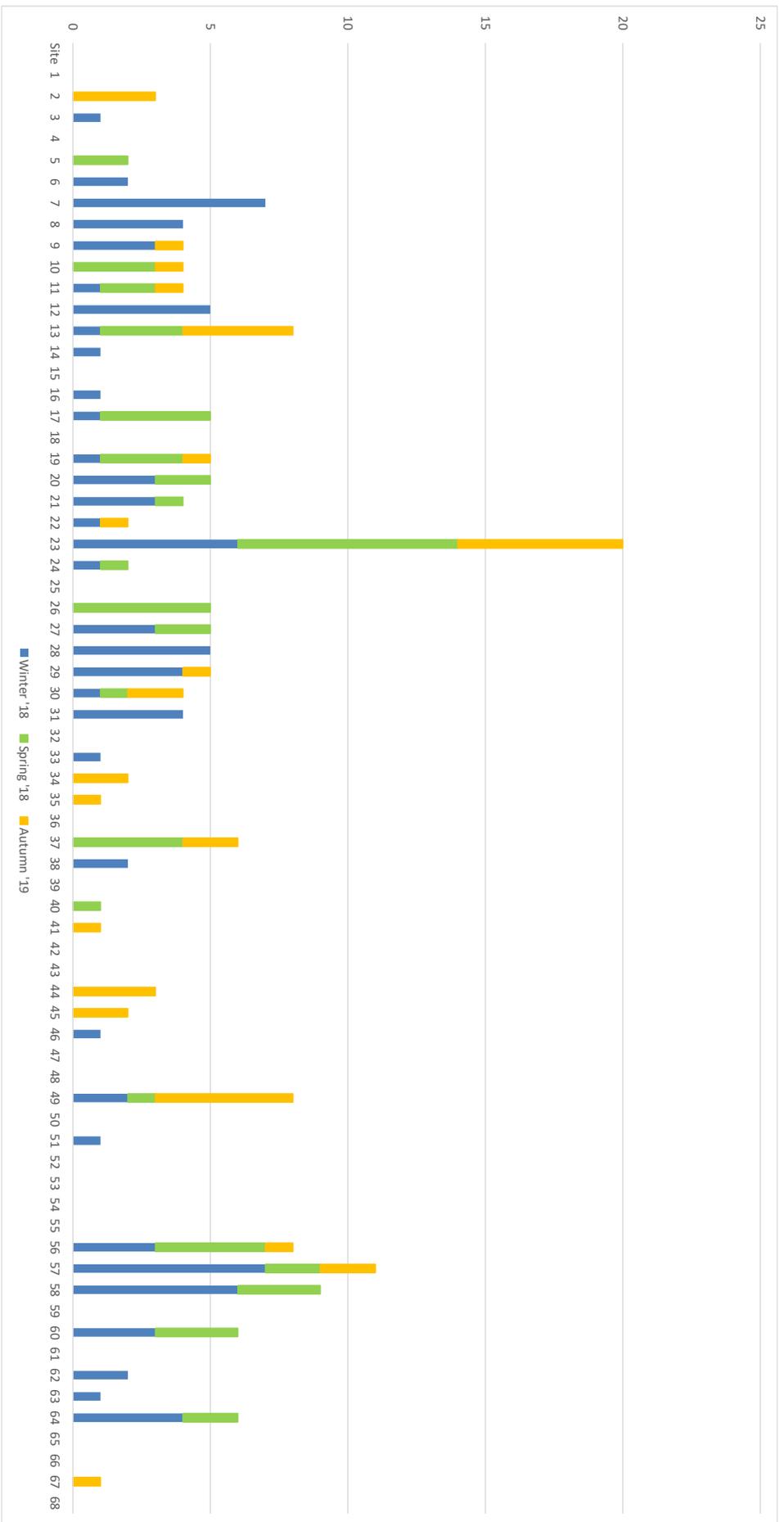


Figure 18: Number of squirrel Glider detection nights at each site across all three surveys to date.

2.3 Other Fauna Species

Several other non-target fauna species were detected using the motion sensing cameras during the monitoring period, none of which are listed under Commonwealth or State conservation legislations. Non-target species detected included:

- Common Brushtail Possum (*Trichosurus vulpecula*)
- Common Ringtail Possum (*Pseudocheirus peregrinus*)
- Tawny Frogmouth (*Podargus strigoides*)

2.4 Monitoring Site Tracker

A site monitoring tracker has been developed to show which sites have been monitored during each monitoring period. So far, 68 sites have been monitored across the three monitoring periods and there are another 13 potential sites which have been identified but not yet monitored (Section 1.4 – Limitations). The sites which have not been monitored have not yet been assigned a Site ID and as such are not included in the tracker. It is the objective of the SGMP to include these sites in future where possible.

The following omissions have occurred in each monitoring period due to the limitations discussed in Section 1.5.

- Omitted Winter 2018 – Sites 67, 68
- Omitted Spring 2018 – Sites 4, 53, 59, 62
- Omitted Autumn 2019 – Sites 14, 53, 59, 62, 66, 68

2.5 Targeted Bird Surveys

Targeted bird surveys were conducted at 35 of the SGMP sites as described in Section 1.4 Methodology. The bird surveys produced common species at all sites monitored, as per the species list in Table 1 (page 25).

Bird Species	
Common Name	Scientific Name
Australian Magpie	<i>Cracticus tibicen</i>
Australian Raven	<i>Corvus coronoides</i>
Australian Reed Warbler	<i>Acrocephalus australis</i>
Australian Wood Duck	<i>Chenonetta jubata</i>
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
Crested Pigeon	<i>Ocyphaps lophotes</i>
Crimson Rosella	<i>Platycercus elegans</i>
Common Starling	<i>Sturnus vulgaris</i>
Eastern Rosella	<i>Platycercus eximius</i>
Galah	<i>Eolophus roseicapillus</i>
Grey Shrike-thrush	<i>Colluricincla harmonica</i>
Grey Teal	<i>Anas gracilis</i>
House Sparrow	<i>Passer domesticus</i>
Laughing Kookaburra	<i>Dacelo novaeguineae</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Masked Lapwing	<i>Vanellus miles</i>
Noisy miner	<i>Manorina melanocephala</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Peaceful Dove	<i>Geopelia striata</i>
Pied Currawong	<i>Strepera graculina</i>
Red Wattlebird	<i>Anthochaera carunculata</i>
Red-rumped Parrot	<i>Psephotus haematonotus</i>
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
Superb Fairy-wren	<i>Malurus cyaneus</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Whistling Kite	<i>Haliastur sphenurus</i>
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>
White-browed Woodswallow	<i>Artamus superciliosus</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
White-naped Honeyeater	<i>Melithreptus lunatus</i>
White-plumed Honeyeater	<i>Lichenostomus penicillatus</i>
White-throated Treecreeper	<i>Cormobates leucophaea</i>
White-winged Chough	<i>Corcorax melanorhamphos</i>
Willie Wagtail	<i>Rhipidura leucophrys</i>
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>

Table 1: Species list compiled from targeted bird surveys across the SGMP area in Autumn 2019.

The notable species identified in the list above is the White-bellied Sea-Eagle which is listed as vulnerable in NSW under the Biodiversity Conservation Act 2016. This species was recorded in the North of the SGMP at Site 56, a remnant patch located in the rural land use area. The site is adjacent to a system of tributaries upstream of Lake Hume. This site is displayed in Figure 19 (page 26).

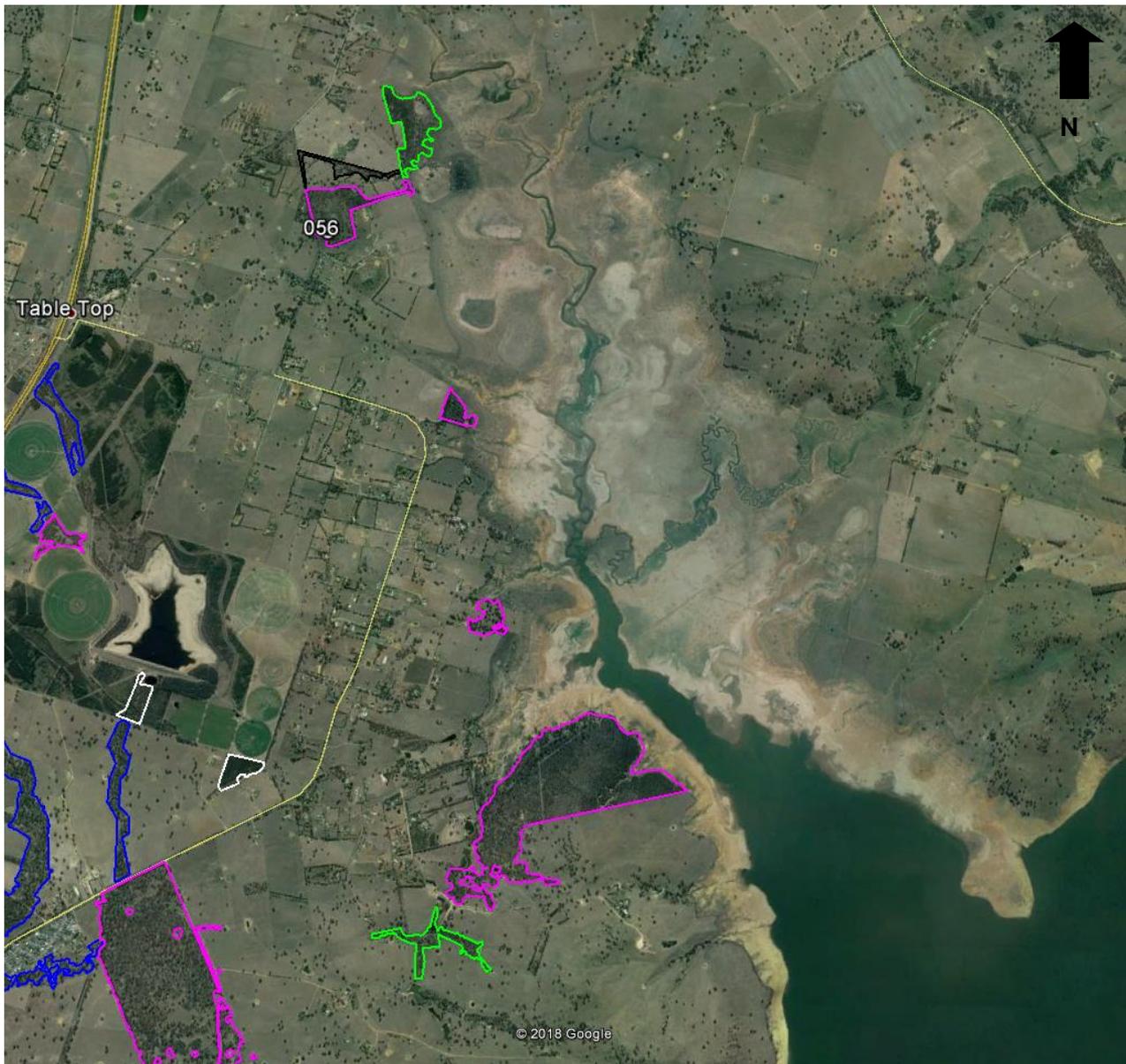


Figure 19: Site 56 - White-bellied Sea-Eagle location (Google Earth Pro, 2018)

3. Discussion and Recommendations

A total of 68 sites have now been monitored at least once across the three SGMP monitoring periods so far; Winter 2018, Spring 2018 and Autumn 2019. Squirrel Gliders have been detected at 45 of these sites – 66% of sites monitored. The overall detection rate has remained steady at 32% for the Autumn 2019 survey, down from 33% in Spring 2018.

There was a significant increase in the Squirrel Glider detection rate at Riparian sites, up from 6% in Spring 2018 to 43% in Autumn 2019. This has come without a single detection at riparian sites within the urban landscape across all three monitoring periods. This increase has stemmed from increased Squirrel Glider detections in riparian sites within the proposed development area; which has risen from one detection in Spring 2018 to five detections in Autumn 2019. Riparian sites were the only habitat type to see an increase in detection rates, with remnant, revegetation and roadside site detection rates decreasing. The preliminary data trends produced by the program to date justify continued monitoring to identify

changes in population density, distribution and other characteristics.

In addition to the proposed monitoring site off Kerr Rd which was cleared immediately prior to the Winter 2018 monitoring period, another site has been cleared and lost to development. Site 14, a revegetation patch in the urban land use area was partially cleared prior to the Spring 2018 monitoring period due to the construction of a service station at the corner of Thurgoona Drive and Table Top Rd. The patch around the target tree was still intact and the site was monitored during Spring 2018. The site was completely cleared prior to the Autumn 2019 monitoring period and will no longer form a part of the SGMP survey area. This site registered a Squirrel Glider detection during the Winter 2018 monitoring period. A photo of the cleared site along with the associated Squirrel Glider detection can be seen in Figure 20, below.

As well as these two monitoring sites being cleared so far during the SGMP, another eight sites have been encroached by development since commencement of the SGMP. That is, these sites have been partially cleared or immediately adjacent land has been cleared with developments underway.



Figure 20: Site 14 cleared prior to Autumn 2019 monitoring period. Insert: Squirrel Glider recorded at this site during Winter 2018 monitoring period.

There are still difficulties accessing proposed monitoring sites in the Wurlinga area, particularly in the east towards Lake Hume. This is due to landholders being either uncontactable or not amenable to the monitoring occurring on their properties (as discussed in Section 1.4 of this report).

If the SGMP could include those sites not yet monitored in future surveys, a greater understanding of the species distribution on a regional scale may be obtained.

This would ensure that the SGMP has covered the largest possible survey extent and has some relevant baseline data with which to plan, implement and analyse future monitoring efforts with the aim of protecting important Squirrel Glider habitat from urbanisation.

The survey methodology and extent would appear to be adequate at this point in time. Cameras being deployed for 10 nights allows for some variation in home range foraging by Squirrel Gliders as well as short term weather events which may impact foraging behaviour. There have been instances of weather events (high wind gusts) over a period of nights have resulted in no Squirrel Glider detections, however there were detections either side of the weather event. For this reason, it is recommended camera deployment remain at 10 nights.

The change in camera settings to run on a timer from 7am – 7pm instead of 24/7 appears to be a positive one. By excluding daytime images (where camera range and movement triggers are extended) we have reduced images from over 500,000 in Spring 2018 to less than 10,000 for Autumn 2019. This has significant reductions in processing/ analysing times as well as extending battery life and SD card storage capacity. The change has had no negative effects on detecting Squirrel Gliders, with the detection rate in Autumn 2019 (32%) being very close to that of Spring 2018 (33%).

Recommendations

1. To extend the SGMP to include yet to be monitored sites in Thurgoona /Wurlinga in future surveys to obtain even greater understanding of the species distribution on a regional scale.
2. To continue the current monitoring methodology, including motion-sensing cameras being deployed for 10 nights per site.
3. For the data collected to be pro-actively used by key stakeholders, particularly Albury City Council in the urban planning/ development application process, as well as other stakeholders engaged in on ground conservation activities.
4. To extend the SGMP geographically into City of Wodonga (Vic) – aligning with the intent of the Regional Natural Environment Strategy (draft) – in addition to targeting other endangered and threatened species (e.g. Brush-tailed Phascogale, woodland birds).

4. Acknowledgments

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Albury City Council for their assistance in land access and supply of GIS data.

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The people who volunteered in the implementing the SGMP in the field:

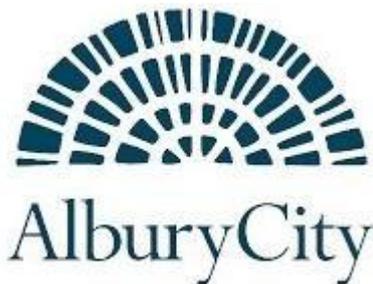
- Nikita Cronyn – Graduate Ecologist

Those people who volunteered their time online analysing images: Nikita Cronyn, Callum Crespan, Danielle Overall, Kate McWhinney & Nicole Baboucek

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This research has been approved by the Charles Sturt Animal Care and Ethics Committee (Protocol number A18021) under NSW Office of Environment and Heritage scientific licence (SL102071) and Department of Crown Lands combined licence (R1596463).



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Appendix A –Detection Images (Autumn 2019) by Site ID



Site 2 (Roadside). Yellow Box. 4m High



Site 9 (Riparian). Yellow Box. 3m High



Site 10 (Revegetation). Red Ironbark. 7m high



Site 11 (Remnant). Spotted Gum. 6m high



Site 13 (Roadside). River Red Gum. 5m high



Site 19 (Revegetation). Blakely's Red Gum. 4m high



Site 22 (Roadside). Grey Box. 6m high



Site 23 (Remnant). White Box. 5m high



Site 29 (Remnant). White Box. 8m high



Site 30 (Riparian). River Red Gum. 10m high



Site 34 (Remnant). River Red Gum. 4m high



Site 35 (Roadside). White Box. 5m high



Site 37 (Revegetation). Red Ironbark. 4m high



Site 41 (Riparian). Yellow Box. 5m high



Site 44 (Riparian). Long Leaf Box. 5m high



Site 45 (Riparian). River Red Gum. 8m high



Site 49 (Revegetation). Red Box. 6m high



Site 56 (Remnant). Long Leaf Box. 8m high



Site 57 (Revegetation). Stag. 9m high



Site 67 (Riparian). River Red Gum. 9m high