



Royal Zoological Society of
New South Wales

2019

Paddy Pallin Science Grant – Final Report

Restoring connectivity for the threatened squirrel glider in an increasingly fragmented and urbanised core area of NSW

CI: Ninon Meyer
Mentors: Matt Hayward & John Clulow
The University of Newcastle

Project Description & Objectives

Summary

Habitat fragmentation negatively impacts the squirrel glider (*Petaurus norfolcensis*). The establishment of biological corridors is an effective strategy to restore functional connectivity in fragmented landscapes, because they enable movement, gene flow and species survival. Yet, accurate identification of corridors is not trivial and depends on many parameters and the analytical approach used. In particular, expert knowledge is commonly used to estimate landscape resistance, but it is increasingly recognized that empirical data are more accurate. What type of data provides the best inferences about connectivity remain however unclear, and the functionality of corridors is rarely validated, which is problematic to inform on effective conservation strategies.

Objectives

The broad aim of this study was to identify effective corridors that allow movement and connectivity between populations of squirrel glider in a fragmented, urban landscape of NSW. Specifically, the project seeks to combine occurrence data with fine-scale movement data to (1) estimate habitat suitability and derive landscape resistance for the squirrel glider in the suburban area of Newcastle, to (2) identify biological corridors, and (3) validate them with genetic data.

Project over duration of the grant

Changes

Besides some delay in the field data collection and analysis due to COVID, the slight change is about the delineation of movement corridors. I wasn't able to gather a sufficient sample size of movement data to accurately landscape resistance (see *Difficulties* section). However, I was able to collect some movement and genetic data, analysed the spatial ecology of squirrel gliders in the study area, and teamed up with other researchers to estimate gene flow and draw least-cost paths.

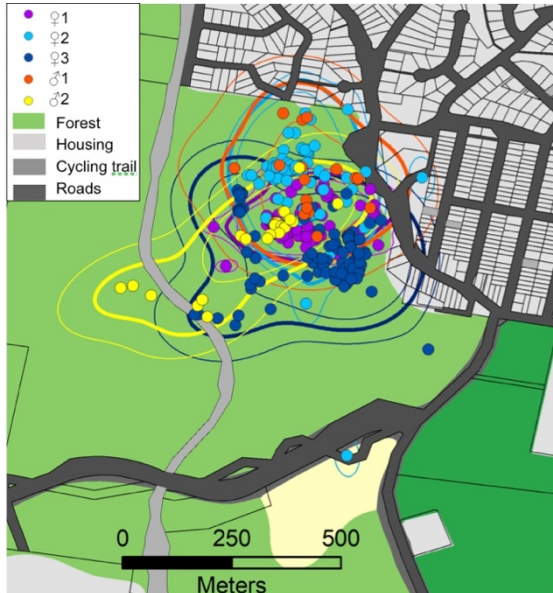
Plans

For the duration of this project, I was planning on collecting more movement data to infer functional connectivity, and test the corridors identified with genetic data. The plan did not go exactly as expected (see *Difficulties*

section).

Achievements

The research project objectives were partially fulfilled. We captured a total of 15 different individuals (over a period of 376 trapping nights), sampled tissues for DNA, and fitted a GPS-tag to 11 individuals (Fig. 1). The ranging area was estimated with the autocorrelated kernel density estimator, averaged 10.8 ha and varied from 4.6



to 15 ha, which is equal to or substantially larger than other studies that spanned over longer periods. Squirrel gliders tended to remain in the forest patch but occasionally crossed over a cycling trail (n=6) and a 2-lane road ~20m wide (n=2; Fig. 1). While gliders showed short-term patterns of stable space-use, it is likely that they did not reveal the full extent of the area required to satisfy their needs (reproductive, food, and shelter) throughout the year. We expect the ranging area to increase even more with additional fixes collected over a longer period. Using a landscape genetics approach, there was evidence of historical bottleneck, and clear effects of habitat fragmentation and biogeographical barriers on gene flow in the area (Knipler et al. 2022). A least-cost path was conducted using genetic samples.

Figure 1: Relocations and ranging areas determined with the autocorrelated density estimator (bold contour lines) with their 95% confidence intervals (light contour lines) of five squirrel gliders near Newcastle, NSW.

Difficulties

My field data collection was delayed by 4 months because of logistical problems that were beyond my control, i.e. the amendment to the ethical permit was submitted by the CI several months later than planned, and I received no training in trapping. As a result I only started trapping at the end of February 2020 instead of November 2019 as originally planned. Soon after, COVID restrictions started, and slightly impacted my work by delaying it another couple of weeks.

Another problem encountered was related to the GPS-tags that worked well for the first deployment, but systematically failed to fix the GPS locations during the second deployment. I shipped the tags to the UK for repair late May 2020. Unfortunately, it took several months for them to be repaired and sent back to Australia, a time by which my Research visa had expired and I had to return to Europe in August 2020.

Future Plans

I have started another postdoc position but still would like to use occurrence data from Atlas-BioNet to determine the suitability of habitat and estimate landscape to compare with outputs derived from movement data. Collecting more data would be an asset for this analysis. Moreover, I have applied to an ARC DECRA to continue doing research on the spatial ecology of several mammal species, including squirrel gliders in Newcastle and other National parks of NSW.

Academic Outputs

Publications

Meyer N, King JP, Mahony M, Clulow J, Beranek C, Reedman C, Balkenhol N, Hayward M. 2021. Large area used by squirrel gliders in an urban area, uncovered using GPS-telemetry, *Ecology and Evolution*, 11 doi: 10.1002/ECE3.7644

Knipler M, Dowton M, Clulow J, **Meyer N**, Mikac K. Genome-wide SNPs detect fine-scale genetic structure in threatened populations of squirrel glider *Petaurus norfolcensis*, *Conservation genetics (Accepted)*. doi: [10.21203/rs.3.rs-717093/v1](https://doi.org/10.21203/rs.3.rs-717093/v1)

Impact

I trained Dayna Mitchell, an undergraduate student from the University of Newcastle (UON) and she is now working on her honour's project investigating the density of squirrel gliders in the Lake Macquarie City Council.

Another 5 undergraduate students from UON volunteered and assisted with field work, including a student from the Natural History Illustration degree (Jemma Guillard), who created several pieces of art showcasing squirrel gliders for her final year project. Some of her pieces were exhibited at BIOMES, an online exhibition that celebrates biodiversity and call to action, and that was principally put up by staffs and students of UON <https://www.biomes.art>.

Finally, my collaboration with Monica Kipler, a PhD student in landscape genetics from the University of Wollongong, resulted in a joint publication (Knipler et al. 2022).

Outcomes

Findings on squirrel glider home range were passed on to officers of the Lake Macquarie City Council (LMCC) that is in charge of approving development projects in the area. The species is listed as threatened (vulnerable) under NSW legislation in the Threatened Species Conservation Act 1995 (TSC Act), and NSW Biodiversity Conservation Act 2016 (EPA, ACT, 1979) and is therefore considered in the planning and development approval process for any proposed development. Based on the findings of this study, it is advised to increase the minimum patch size from 4 ha (which is currently the norm to conserve squirrel gliders in the local government area) to 10 ha when prioritizing areas for squirrel glider conservation, or when assessing the impact of development plans.

Moreover, I teamed-up with a free-lance ecologist (JP King) and the Fern Creek Gully Landcare in Dudley, which flagship species is the squirrel glider. The landcare conducts post-mining restoration work in an important area for the species. We found squirrel gliders on the land so that was great news! We advised the Landcare team on the essential gliders' food plants, the mounting of ~25 nest boxes, and did some outreach activities with the group who counts with a large cohort of volunteers (see photo below). A short documentary even came out to tell about the Fern Creek Landcare's efforts to conserve the squirrel glider population in Dudley (<https://www.youtube.com/watch?v=XGVeUpArUH0>).

Attachments and other material



Male squirrel glider with a GPS-tag; squirrel-glider released on the tree after capture; Fern Creek Landcare volunteers in Dudley, overlooking Newcastle in the background.



"WE ARE THE CUSTODIANS"
NINON MEYER ECOLOGIST



FERN CREEK GULLY LANDCARE SQUIRREL GLIDER PROJECT 2020 NEWSLETTER – 31 – 1.06.2020



ECHIDNA (TACHYGLOSSIDAE)
"Slow, persistent, un-stoppable"



SQUIRREL GLIDER (PETAURUS NORFOLCENSIS)
"Clever, Smart, Spirited"

Follow us on - Facebook Page: @ FernCreekLandcare - Facebook Group: @ FernCreekGullyLandcare - Instagram: @ ferncreeklandcare



This project received grant funding from the Australian Government's Communities Environment Program

WE HAVE FOUND SQUIRREL GLIDERS ON SITE!



John Paul King and Ninon Meyer our Ecologists have found Squirrel Gliders on site.

They report: *"The glider trapping has been very successful, with 11 captures of five individuals made in the Fern Creek Landcare site (3 males and 2 females). In addition, 2 den trees were positively identified within the site, one on the southern flat amongst the Ironbark and Swamp Mahogany, the second on the northern ridge right next to Peter's house. Overall the results have been very positive with the identification of large areas of very good foraging habitat and now, positive evidence of breeding habitat onsite. The enhancement underway (planting of winter flowering plants and nest boxes) can only improve long-term viability for this sub-population. During the upcoming June-July period we will be continuing with trapping targeting the Northern Link to Glenrock and other patches in the Whitebridge area. We see this coastal cliff vegetation link as a potential bottle neck between the Glenrock and Awaba populations and maybe a great area for future enhancement and management programs. To all those that have assisted with the program so far a big thanks, we all look forward showing you these wonderful animals in the future."*

In addition Matthew Heyward, Associate Professor of Conservation Biology at University of Newcastle visited the site stating that he was impressed with our Ecologist's results and which showed the benefit of having 2 experienced ecologist involved with a restoration project like this.

June 2020 Newsletter of the Fern Creek Landcare.

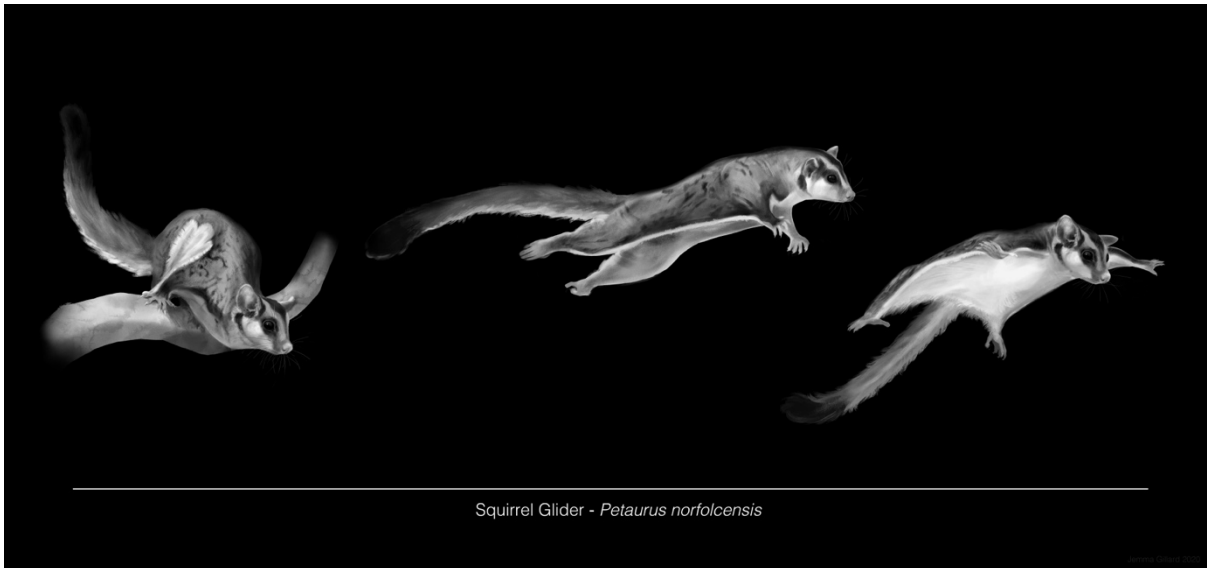


Illustration by University of Newcastle's student in Natural History Illustration, Jemma Guillard, of a squirrel glider. Jemma volunteered during live-trapping and got inspired to create this art piece.