

PROGRESS REPORT ON PROJECT SUPPORTED BY PADDY PALLIN SCIENCE GRANT

Instructions to Project Leaders for Completing This Form

Progress reports are required to be submitted 12 months after the start of the project, and then at 18-24 months as a final report . Grants usually begin on the 15th September in the year in which the grant was awarded. Payment of the second grant installment is contingent upon the receipt of this material. Updates are to be provided during the tenure of the grant, and at the time the final report is submitted. Payment of the final grant installment is contingent upon receipt of the final summary which is to summarize the outcomes of the project during the tenure of the grant.

1. PROJECT IDENTIFICATION

1.1 PROJECT TITLE Roosting ecology and requirements of flying-foxes: detailed insights using high resolution spatial mapping techniques

1.2 ADMINISTERING ORGANISATION Griffith University

1.3 PROJECT LEADER AND PARTICIPANTS Tamika Lunn (recipient), Remy Brooks (student), Dr Alison Peel (supervisor), Dr Peggy Eby (advisor), Prof. Hamish McCallum (supervisor)

2. PROJECT DESCRIPTION & OBJECTIVES

2.1 100- Word Project Summary

A growing number of flying-fox roosts in Australia are exposed to programs of vegetation modification, including roosts of the Vulnerable grey-headed flying-fox. Several sites host ongoing habitat restoration work that aim to increase sustainability of roost vegetation, where removal of weeds is a central component. By contrast, roost management policies promote the removal of roost trees near houses as a method for reducing human-wildlife conflict. The impact on bats of substantial modifications to roosting habitat is poorly understood, however, and details of their roosting ecology are not sufficiently known to provide guidance for restoring degraded habitat, nor removing perimeter trees.

2.2 Summary of original objectives (150 words max)

The broad aim of this study was to characterise the fine-scale roosting ecology of three sympatric species of flying-fox in South-eastern Queensland and North-eastern New South Wales (grey-headed flying-fox: *Pteropus poliocephalus*, black flying-fox: *P. Alecto*, and little red flying-fox: *P. scapulatus*) by collecting fine-scale, systematic data on their roosting patterns through space and time. Specifically, we asked:

1. How does roosting structure and animal density change through space and time in seasonally dynamic flying-fox bats?
2. Are there roosting preferences within species and demographic cohorts of flying-foxes, and what biotic and abiotic habitat factors drive this?

Herein, referred to **Objective 1** and **Objective 2**

3. PROJECT OVER DURATION OF FOUNDATION GRANT

3.1 Have there been any changes to the project? If yes give details *This could include changes to the research Project resulting from funding from the Foundation being at a lower level than requested. By indicating changes to the budget, aims and research plan in the Report, you are requesting approval from the Foundation for a revision of the Project. A 'satisfactory' assessment of the Report and the Project by the Paddy Pallin Grants Committee means that the revision has been approved.*

We have made slight changes to the budget of the project, but all original research objectives and activities have been fulfilled. In our research application, we requested funds to support longitudinal data collection (field assistants to help carry out bat roosting surveys and habitat surveys) (\$3,280) and for the purchase of temperature and humidity loggers (\$3,696).

During the course of the project, the PhD candidate and recipient of the grant, Tamika Lunn, was awarded a fellowship to travel and study at an institution away from the field sites in Queensland/New South Wales, and as a consequence necessitated a higher budget for field assistants than originally anticipated. However, we were able to secure additional funding for the purchase of macro-climate loggers through Griffith funding of honours student, Remy Brooks. In the revised Paddy Pallin budget we diverted funding away from collecting macroclimate data, and used the difference in funds to augment the budget for field assistants in the final four months of the data collection. This enabled us to keep the monthly bat roosting surveys continuing for the full duration of the proposed project (12 months), to achieve **Objective 1** (*how does roosting structure and animal density change through space and time in seasonally dynamic flying-fox bats?*), while still being able to answer **Objective 2** (*are there roosting preferences within species and demographic cohorts of flying-foxes, and what biotic and abiotic habitat factors drive this?*) with the additional funding source.

3.2 What were your research plans and objectives for the period covered by this report? (150 words max) *(The answer to this question should be consistent with the original Application or the preceding Progress Report).*

The research plan for the period Sept 2018-2019 was to collect field data relating to flying-fox roosting patterns, specifically:

1. Complete monthly surveys of bat roosting patterns at eight selected roosts over a period of 12 months, including:
 - a. Repeat index bat abundance measures from 2,522 previously tagged trees
 - b. Repeat measures of total counts, min/max roosting heights, proportion of each sex, and proportion of reproducing females, from a subset of tagged trees (480)
 - c. Repeat measures of perimeter, area and total abundance
2. Measure habitat features of selected roosts, including tree-level measures (n=480):
 - a. Tree species
 - b. Diameter at breast height (DBH)
 - c. Maximum height
 - d. Indexed number of branches (0=no branches through to 6=100+ branches)
 - e. Leaf type (simple or compound)
 - f. Bark type (smooth, rough or half/half).

And subplot-level measures:

- g. Shrub density

3. Collect macroclimate data from a sub-set of selected roosts:
 - a. Temperature
 - b. Humidity

3.3 Did the research project proceed as planned? What have you achieved over this period? Outline the research findings to date (200 words max)

The research has progressed as planned, including the following **Activities**:

1. Monthly surveys of bat roosting patterns – We have conducted 12 months of surveys from all proposed sites (August 2018–July 2019). This has generated a repeated measured dataset from 2,522 trees, giving 30,264 datapoints in total.
2. Habitat features – Tree-level and subplot-level information on roosting habitat has been collected from all eight sites. Combined with data from the bat roost surveys (**Activity 1**), preliminary analyses have found:
 - a. Higher abundances of total flying foxes in taller trees (below 33 meters), with a larger diameter at breast height (DBH above 60 cm), from 15-40 branches and rough bark.
 - b. A higher male abundance with taller tree height
 - c. A preference for rough bark type by female bats
3. Macroclimate data – Two Hygrochron ibuttons were installed at four of the study roosts, and macroclimate data was collected for 5 months (October 2018 - February 2019). Combining data from the bat roost surveys (**Activity 1**), habitat surveys (**Activity 2**), and macroclimate data (**Activity 3**), we found that understory density correlated positively with humidity, and negatively with temperature, however neither temperature nor humidity were correlated with bat abundance across the studied roosts.

3.4 Have you experienced any difficulties that have affected the progress of the research project? If yes give details (150 words max)

The field methods proposed in the research plan had been previously trialled, and we encountered minimal difficulties with completing the proposed data collection. As described in **Section 3.1**, the PhD candidate (Tamika Lunn) was awarded a fellowship to travel and study at an institution away from the field sites in Queensland/New South Wales, and as a consequence necessitated a higher budget for field assistants than originally anticipated in order to keep the project continuing for the full 12 months. This diverted some funding away from collecting macroclimate data, but we were ultimately able to fulfil all research aims and questions originally proposed.

3.5 What are your research plans and objectives, including publication plans, for the coming year? (150 words max) (Please note that in your next Report you should report progress against these plans and objectives)

PhD student Tamika Lunn is currently analysing data from the bat roosting surveys to evaluate spatial and temporal patterns in roosting structure (**Objective 1**). She aims to evaluate site- and season-driven trends in roost structure (e.g. roosting heights, density, roosting area), as well as species differences in roosting structure. She will submit these

analyses for publication in the coming year. In addition, Tamika is building mathematical models of observed roosting structures to explore the influence of tree structure and bat density on infection dynamics in bat populations and aims to submit these analyses for publication in the coming year.

Honours student Remy Brooks has been awarded an “Honours write-up scholarship” from Griffith University to publish a manuscript from her Honours thesis. This will include analyses of both habitat and macroclimate data on bat abundance patterns (**Objective 2**) and will be submitted for publication in the coming year.

4. ACADEMIC OUTPUTS

4.1 Publications and other academic outputs directly related to this project. *(Please list all publications and those manuscripts accepted for publication, for the period covered by this report)*

Brooks, R. (2019) Habitat Characteristics within Australian Flying Fox Roosts. Honours thesis, Griffith University.

4.2 Evidence of scholarly impact and contribution. Is there evidence that this research project is having/has had and impact in the research field or the broader public domain? *Include examples of formal training (PhD /Masters) as well as other training.*

If yes, give details *(For instance, standard citation data on articles published in ISI journals, citations to books, re-publication, translations, reviews, invited keynote addresses, other invitations, newspaper/media/expert commentary).*

Scholarly impact can be seen via the successful completion of one honours student (Remy Brooks), and manuscripts in preparation arising from her thesis, and from two chapters (in preparation) in Tamika Lunn’s PhD thesis. This project was also accepted as a poster presentation at the 2018 joint conference by the Wildlife Disease Association Australasia and the Asian Society of Conservation Medicine (Sanur, Bali), as well as the 2018 Ecological Society of Australia conference (Brisbane, Australia). Components of this work were also presented at the 2019 International Bat Research Conference (Phuket, Thailand).

4.3 End-user interaction and other project outcomes **If there are examples of the impact of this research Project not covered in item 4.2 above please provide details.** *For example, introduction or modification of standards/protocols within an industry sector, preparation of proposals for funding from other agencies as a result of outcomes from this project.*

Analyses of data collected are still to be finalised, so have not yet been circulated to broader end-users. We foresee results from these analyses will have outcomes directly relevant for management and restoration programs of flying-fox roosts (for example, the recently announced Flying-fox Habitat Restoration Program). We plan to prioritise the dissemination of our findings over the coming year.

5. ATTACHMENTS & OTHER MATERIAL

Please provide, as separate files, any figures, graphs, images and other material that cannot be included in this form. Please also provide updated material (text and images) that can be used to revise your project summary on the Foundation's web site. Please provide text in Microsoft Word format and images in JPEG format with a minimum size of 600 x 400 pixels. If this is the final project report, the web page summary must be updated to reflect the outcomes of the project. Is any material being forwarded as additional attachments?

See brief abstract attached