

FINAL REPORT ON PROJECT SUPPORTED BY PADDY PALLIN SCIENCE GRANT

1. PROJECT IDENTIFICATION

1.1 PROJECT TITLE

Assessing the effectiveness of artificial refuge tunnels in post-fire small mammal population recovery

1.2 ADMINISTERING ORGANISATION

University of Sydney

1.3 PROJECT LEADER AND PARTICIPANTS

Project leader: Angela Rana

Participants: Thomas Newsome, Catherine Grueber, Peter Banks, Viyanna Leo (Australian Wildlife Conservancy)

2. PROJECT DESCRIPTION & OBJECTIVES

2.1 100- Word Project Summary

High intensity fires are becoming more frequent due to altered fire regimes, habitat loss and climate change, and are threatening Australia's native mammals. These fires decimate the ground layers which small mammals depend on for refuge, rendering populations in burnt areas particularly vulnerable to invasive predators. As bushfire seasons are set to become worse under climate change predictions, it is imperative to investigate methods of assisting post-fire recovery of small mammals. This project aims to determine whether artificial refuge tunnels built from wire mesh, which allow the entry of small mammals but prevent entry of predators, can assist post-fire recovery.

2.2 Summary of original objectives (150 words max)

The main objective of this project is to determine whether artificial refuge tunnels assist in post-fire small mammal recovery by providing shelter and thus refuge from predators.

The specific aims are to:

- A1: Determine if small mammals increase activity in the area surrounding refuge tunnels in burnt areas
- A2: Determine if tunnels afford small mammals with increased foraging opportunities
- A3: Determine if animal populations recover at a faster rate in the presence of tunnels

The predictions that will be tested are:

- P1: Small mammals will display higher activity in burnt areas with tunnels in comparison to burnt areas without tunnels
- P2: Foraging behaviour (quantified using Giving Up Density trials) will be a function of distance from tunnels, whereby small mammals increase foraging behaviour as the distance to tunnels decreases
- P3: Small mammal populations will increase at a faster rate in burnt sites with tunnels, compared to burnt sites without tunnels

3. PROJECT OVER DURATION OF FOUNDATION GRANT

3.1 Have there been any changes to the project? If yes give details

Minor changes were made to the methodology to account for accessibility and feasibility. Specifically:

- A second round of Giving Up Density (GUD) trials was not conducted as we decided that the first round, in which 60 foraging trays which were deployed at all sites over a 6–7-day period (in the previous reporting period) is sufficient to address Aim 2
- Follow up live trapping was not conducted due to low capture rates in the first round of trapping. As monitoring cameras remained in place at both tunnel and control sites for the duration of the study period (November 2020 – May 2022), we decided that using activity metrics to compare differences between tunnel and control sites was more appropriate

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).*

For the reporting period, we intended to wrap up fieldwork and process data. This included:

- collection and processing of the remaining camera data
- possible follow up GUD and live-trapping surveys
- formal analysis of data
- development of manuscript for publication

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)

Data collection was completed, and all sites were monitored for a total of 18 months (November 2020 – May 2022).

Statistical analysis was conducted on the first 6 months of data. There was a significant difference in the number of animal events at tunnel sites compared to control sites ($p = 0.04$), with more animals occurring at control compared to tunnel sites (Figure 1). However, there was no significant difference of activity in small mammals between tunnel and control sites ($p=0.08$; Figure 2). Differences in animal activity are likely contributed to the increased activity of medium-sized mammals at control sites, as no medium-sized mammals were detected at tunnel sites (Table 1).

There was also no change in animal activity at tunnels over time for all species (small mammals and birds) detected at tunnels ($p=0.09$; Figure 3). Overall, these preliminary results show that small mammals and birds use tunnels, and that animal activity remains constant 6 months post-tunnel installation. Although small mammals did not increase activity at tunnel sites in comparison to control sites, this could be attributed to the high rate of vegetation regrowth post-fire which occurred due to above average rainfall.

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

As mentioned in 3.1, the second round of GUD trials was not conducted. Although we decided that it was unnecessary as sufficient data had been collected, it was also made difficult as major flooding in early 2022 meant that study sites were inaccessible for prolonged periods of time. This high rainfall also meant that the vegetation was regrowing at a faster rate than expected, which would have limited the interpretation of GUD trials. This is because GUDs rely on the presence of variable risk in the landscape, but regrowing vegetation may have provided similar amounts of refuge (therefore safety) as the artificial tunnels.

The collection of monitoring cameras was delayed, initially due to 2021 lockdowns, and then again due to flooding in early 2022. Cameras were only collected in May 2022, meaning that processing of camera data, analysis of the full dataset, and preparation of a manuscript have been delayed.

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)*

Processing of all camera data and statistical analysis of the whole dataset will be completed, and a manuscript will be prepared for publication.

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)*

An abstract for the project, covering the preliminary results from this Wollombi tunnel project and a parallel North Head tunnel project, has been accepted for a 15-minute oral presentation at the Ecological Society of Australia conference in November 2022. The refuge tunnel study running parallel at North Head was presented at the Ecological Consultants Association of NSW conference in June 2022.

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

This project will contribute to a chapter of my PhD thesis.

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).*

Conference presentation:

Rana, A.F., Grueber, C., Banks, P. Leo, V. & Newsome, T. (2022, July 18-19). *Investigating management solutions to assist post-fire recovery of small mammals.* [Conference Presentation] Ecological Consultants Association of NSW Annual Conference 2022, Wollongong, NSW.

<https://www.ecansw.org.au/download/investigating-management-solutions-to-assist-post-fire-recovery-of-small-mammals/>

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.*

N/A

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?

Yes, a PDF containing figures from preliminary results will be attached. A video summarising my project will also be attached.