Royal Zoological Society of New South Wales

Paddy Pallin Science Grant – Progress

Koalas, dingoes and drones: using thermal imaging to establish detection probability of GPS collared dingoes and determine koala density in the Myall Lakes Region of NSW

University of Newcastle

Project Leader: **Dr. Ryan Witt**

Participants: **Dr. Neil Jordan (UNSW/Taronga), Miss Shelby Ryan (PhD Candidate University of Newcastle)**

Project Description & Objectives

Summary
We recently developed and validated a real-time wild koala detection method using drones and thermal cameras (Beranek et al. 2019; Witt et al. 2020). To further develop our direct detection approach for use at a landscape scale for native wildlife, the proposed one-year study seeks to understand the abundance and probability of detection of both koalas and dingoes in the Myall Lakes Region of NSW. We will leverage a unique opportunity to obtain the thermal signatures of up to eight GPS collared dingoes by partnering with Dr. Neil Jordan and the Myall Lakes Dingo Project. In combination with our drone-thermal imaging protocol, which is already effective in locating koalas, we will use on-ground ecology to determine what factors influence koala and dingo detection probability and obtain validated imagery data to build artificial intelligence (AI) to drive efficiency of a landscape scale survey approach for both species. The project will generate density models to estimate koala and dingo population size for each location, evaluate koala and dingo population dynamics, inform recovery actions for Mid Coast NSW, understand drone survey limitations, and optimise and make available practitioner-friendly drone monitoring guidelines for a new species.

Objectives
By leveraging both the primary project and the supporting project, this study aims to use drones with thermal imaging capability to evaluate the density of the koala and dingo in the Myall Lakes Region of NSW. We will address three key goals.

1.Use drone based thermal imaging and on-ground ecology to detect koalas and assess the detection probability of VHF-GPS collared dingoes.

2.Using the data attained in #1, estimate the density, detection probability, habitat use of koalas and dingoes by modelling abundance and occupancy.

3.Collect drone-derived thermal imagery of koalas and the first validated thermal signatures of dingoes for use in an artificially intelligent machine learning algorithm that will be developed over the next 4 years as part of Shelby Ryan's PhD.

Project over duration of grant

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

There have been minor changes to the approved project relating to Aim 3. We have completed the first component of this aim 'Collect drone-derived thermal imagery of koalas and the first validated thermal signatures of dingoes'. However, the second component of this aim requires a change in direction 'for use in an artificially intelligent machine learning algorithm that will be developed over the next 4 years as part of Shelby Ryan's PhD'

Justification: Shelby Ryan's PhD project has taken a different direction and will now focus completely on the application of drone survey data to ecological modelling of occupancy and abundance and will no longer focus on the development of artificial intelligence models.

Solution: We will utilise our partnership with the NSW Wildlife Drone Hub, and transfer our library of dingo detections to their data scientists who are focusing on building AI for multiple species.

Refined aim: 3. Collect drone-derived thermal imagery of koalas and the first validated thermal signatures of dingoes for use in an artificially intelligent machine learning algorithm that will be developed by the NSW Wildlife Drone Hub over the next 2 years.

Plans
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.

In this period of funding, we aimed to complete all planning, logistics and project management to complete the field surveys required for data collection.

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

Yes. We have now completed all planning and field work for this project. The field work was completed between the 1st and 12th of August 2022. A total of 43 quadrats were surveyed (spatial effort = 25ha x 43 = 1075ha). Each quadrat was surveyed over 2 to 3 consecutive nights for a total survey effort in this period of 110 replicates (2,750ha of survey effort). We were able to detect at least 10 unique species including koalas, dingoes, spotted-tail quolls, grey-headed flying foxes, brushtail possum, ringtail possum, sugar or squirrel gliders, bandicoots, a rat and white-bellied sea eagles.

Our raw data suggests that we confirmed 11 detections of koalas and 17 detections of dingoes. However, these may not represent unique individuals as survey plots were repeated to allow for abundance modelling. We have not yet had the opportunity to analyse the dataset to draw out further results or findings.

Research findings to date: Preliminary findings developed during the surveys include,
- Dingoes and dingo dens can be detected using a Mavic 2 Enterprise Advanced.
- Koala recruitment can be detected using a M300 H20T and spotlight payload.
- No koalas were detected in Hawks Nest, pointing toward extinction of the local population
- Koalas were detected within the eastern side of Myall Lakes National Park from Brambles Green to Seal Rocks.
- The distribution of Dingoes overlapped with that of Koalas, however no dingo dens were located in habitat occupied by koalas.

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

There have been no impediments to the delivery of the project in the period leading up to this progress report.

Future Plans
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.

The project is now in the analysis phase. In the next project period we plan to:
1. Analyse the dataset by adding all koala data to an abundance model to be produced as part of Shelby Ryan's PhD which will be developed as a publication.
2. Explore options with Dr. Neil Jordan at UNSW to publish the dingo detection data as either a note, given that the pilot project has shown that drones could be a useful technique.

3. Evaluate if there is enough data to produce preliminary detection probability/occupancy models for dingoes to add into the above note.
4. Explore opportunities with Dr. Neil Jordan at UNSW to combine our findings with movement data collected in the Myall Lakes Dingo Project to understand the distribution of koalas and dingoes, and determine if a scientific paper can be produced that evaluates a predator/prey relationship regarding home-range of each species.
5. Transfer our dingo detection video data to the NSW Wildlife Hub for the build of dingo based AI.

Academic Outputs

Publications
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.

None developed for the period covered by this report.

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

Yes.

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.

Shelby Ryan and Dr. Ryan Witt delivered a presentation to the Myall Koala Environment Group on the 1st of September 2022. The presentation focused on the koala component of the project discussing with locals the areas in which koalas were detected, and also indicated the thermal drones were useful to detect dingoes. The newspaper article can be found via the following link: *https://www.newsofthearea.com.au/dr-ryan-witt-to-present-findings-from-koala-and-dingo-drone-surveys-in-tea-gardens-99098*

This project involved the training of two Work Integrated Learning Student's at the University of Newcastle to meet the requirements of ENVS3008 - Work Integrated Learning in the Environmental and Development Sectors - https://www.newcastle.edu.au/course/ENVS3008. The students are required to complete 80 hours of placement within an environmental project. Each student was supervised by Dr. Ryan Witt and developed and refined skills in data collection, and drone set-up for thermal surveys of koalas and dingoes.

Outcomes
End-user interaction and other project outcomes. If there are examples of the impact of this research Project not covered in items 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.

Not applicable to the project thus far.

Attachments and 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 RZSNSW website. 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?

There are three attachments:
1. Map of survey plots completed. Blue dots represent active koala sites.
2. Evidence that we have confirmed through this pilot that drones are in fact very useful for the detection of dingoes.
3. Evidence that we have confirmed through this pilot that it is also possible for drones to confirm koala recruitment.