

Final Evaluation Report

Your Details	
Full Name	Paul Allin
Project Title	Improving accuracy and precision of aerial census in the savanna biome, using remote sensed imagery and machine learning.
Application ID	37725-1
Date of this Report	26 March 2024

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Algorithm development		X		As the development of algorithms is happening so fast, I have identified four that have shown potential in published literature. All have all been fully prepared and will be trained, tested and compared once computing issues have been resolved
Optimisation of drone flight parameters and algorithm			X	Following a number of tests in the field and literature review the optimal parameters have been identified.
Collection of dry seasons data by drone			X	All breeding camps flown three times.
Collection of dry seasons data by helicopter			X	All breeding camps flown three times.
Collection of wet seasons data by drone			X	All breeding camps flown three times.

2. Describe the three most important outcomes of your project.

- a) Collection of all data (RGB and thermal) in the breeding camps to calculate accuracy and precision of an AI algorithm in both the wet and dry season.
- b) Identification of the most promising algorithms for the processing of the collected data.
- c) Understanding the practical applications and limitations of drones in the field through experience and how this can be used in the next phases of this research.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

Unseasonable weather made flying in the dry season a challenge on some days. I had reserved an extra day for additional data capture for training data which I then forfeited to enable the capture of the replicates. Also, when flying many consecutive flights, the drone batteries were not able to cool down enough between flights to be safe to charge. We eventually used a cooler box with ice and batteries in zip lock bags to lower the temperature sufficiently.

I had not anticipated having such difficulty uploading the large quantities of data and then processing these data in the cloud. I have 500 Gb of data from these two surveys, and it has been a very slow process to upload with the limited bandwidth available locally. Once uploaded I need to access the imagery via the cloud to label images for training and testing of the algorithm. This in essence requires me to download each image and then reupload it which has been debilitatingly slow. I have decided to invest a significant amount of money in a new computer, to enable me to process and run these data and models locally.

4. Describe the involvement of local communities and how they have benefited from the project.

Not applicable.

5. Are there any plans to continue this work?

Yes, this covered the 1st year of fieldwork for my PhD, the proof of concept. The next phase will be modelling the data and then scaling the project up to an ecologically relevant sized landscape.

6. How do you plan to share the results of your work with others?

I participate in the annual postgraduate presentations at Stellenbosch University, as well as the weekly lab meetings at Davies Lab, Harvard University. Here I share the progress and results of the work so far and discuss the challenges.

The data collected during this 1st year of fieldwork will be sufficient for two publications in peer reviewed journals. Furthermore, I will be submitting an abstract to present at the upcoming South African Wildlife Managers Association annual conference in October 2023 as well as the Savanna Science Network Meeting next year where I will share the work I have done. Both these conferences are live streamed on YouTube and will therefore be widely accessible.

7. Looking ahead, what do you feel are the important next steps?

As soon as I have the computing power the next big step will be to complete the labelling of the data and to train and test multiple algorithms. This will result in the best available algorithm for my data, and I will be able to demonstrate its accuracy and precision compared to a helicopter survey.

Following this I need to figure out how to finance and gather sufficient data for the large-scale testing of this model so that it can help answer the ecological questions laid out in my PhD proposal.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

I have not yet had the opportunity to, however I will include the logo in the upcoming postgraduate research presentation at Stellenbosch University as well as the SAWMA and SSNM conferences where I anticipate being able to present. I will also include the acknowledgement to The Rufford Foundation in my manuscripts.

9. Provide a full list of all the members of your team and their role in the project.

Primarily the team consist of myself and my supervisors: Prof. Dr. A. J. Leslie (University of Stellebosch), Prof. Dr. A.B. Davies (Harvard University) and Prof. Dr. F.G.T Radloff (Cape Peninsula University of Technology) and Fadel Seydou (Machine learning graduate, EPFL) and Tom Lautenbach (Drone pilot Davies lab Harvard University).

My supervisors and I regularly discuss the research, I update them on the progress, the obstacles and challenges and they give their input on how to overcome these.

Fadel has joined with a wealth of knowledge in Machine Learning and helps with the creation of the algorithms and pre-processing data for training, testing and validating of the algorithms.

Tom has much practical experience flying for research projects across Africa and has been able to advise on practical issues related to drones and flying.

10. Any other comments?

I am extremely grateful for the opportunity that The Rufford Foundation has provided me and many other students like me, to conduct research that otherwise I would not be able to do. As this is a growing field, with many researchers and companies engaged in the space of remote sensing and animal detection I try to connect with as many people across the globe to ensure that the research I am conducting is as relevant as possible. I fundamentally believe that science should be shared and I intend to make the algorithms available via web-based platforms such as GitHub, so that others may build and expand on my work once it has been completed.