Final Project Evaluation Report

Your Details	
Full Name	Mr Raphael Reinegger
Project Title	The feeding competition between the Mauritian flying fox *Pteropus niger* and the invasive crab-eating macaque *Macaca fascicularis*.
Application ID	23082-1
Grant Amount	£5000
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Date of this Report	10-11-2018

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
Assessing impact of *M. fascicularis* on native food availability to *P. niger*				The results show that macaque compete for fruits of a number of species and also make the fruits of some of the plant species completely unavailable to bats.
Assessing impact of boar and deer on native seedling survival and establishment				The exclusion experiment showed that deer feed on exotic plants. Many endemic plants were left untouched in the control plots.
Assessing remnant forest richness				This has been fully achieved. The results already show the remnant forests are very rich compared to well preserved forests. However, the data on the composition of the forests and level of degradation still have to be analysed. Additionally, some species lists are still incomplete because some voucher specimens are still at the National Herbarium.

2. Please explain any unforeseen difficulties that arose during the project and how these were tackled.

Mauritius was hit by at least two big cyclones and a number of smaller ones, which made fieldwork impossible during January and February 2018. However, it was possible to extend my visa until January 2019 so I could catch up on the time that had been lost during those months.

The botanist at Ecosystem Restoration Alliance (ERA) left, which made the fieldwork more challenging. However, this forced me to improve my botany skills significantly and brought me in touch with the manager of the national herbarium, Claudia Baider. We have developed a really good relationship, since she enjoys teaching and my work also helped enrich the herbarium collection. Without her help, the project would not nearly have been as successful.

3. Briefly describe the three most important outcomes of your project.

a) The macaques make the fruits of certain food species unavailable to flying foxes, since all fruits on the trees are eaten at an unripe stage before they have the chance to ripen.

b) Plant species can have different times of flowering and fruiting depending on the region, meaning that different sites can play an important role in providing food to flying foxes at a certain time of the year when certain fruits would not be available elsewhere on the island. This emphasises the importance of forest patches across the island for the conservation of flying foxes.

c) The remnant forest on Mariannes is very rich and contains species which are extremely rare even in the best preserved forest of Mauritius. Additionally, a presumed extinct *Diospyros* and *Turraea* species may be present. This will be confirmed after the collection of flowers.

4. Briefly describe the involvement of local communities and how they have benefitted from the project.

The results of the project formed a part of educational talk ERA is conducting around Mauritius. Therefore local communities were informed about the importance of the remnant forest fragments in Mauritius, their value and the damage invasive animals as well as plants do to the ecosystem.

5. Are there any plans to continue this work?

I am planning to expand this MSc to a PhD and continue for another 3 years, since this research has only brought more questions and found new research gaps. It will be very important to monitor the competition between bats and monkeys for extended period of time. Additionally, it has to be assess how much damage monkey do to other plant species in Mauritius. This project indicated that the damage done by monkeys may have been underestimated in Mauritius. Additionally, some rare plants do not reproduce because of the monkey which feed on unripe fruits. Exclusion experiments on such trees would be essential. The project also highlights the importance of the sites ERA is working in and the urgent needs for their conservation due to presence of very rare plant species.

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

The results of this project will be published in peer reviewed scientific journals. It is important that these findings become available, so that the current understanding of macaque impact, flying fox diet and fruiting patterns can be updated. Furthermore, I am planning to do more research talks at the National Parks and Conservation Service (NPCS). I have also been invited to do a research talk at Chester Zoo when I return back to Europe. Results of the study are also used in ERA's educational programme.

7. Timescale: Over what period was the grant used? How does this compare to the anticipated or actual length of the project?

The projected started in September 2017 and continued until November 2018. The project was originally supposed to end in September 2018. However, my visa was extended until January 2019 so I could continue for another 2 months and monitor trees that were fruiting from September – November 2018.

8. Budget: Provide a breakdown of budgeted versus actual expenditure and the reasons for any differences. All figures should be in £ sterling, indicating the local exchange rate used. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Accommodation	1200	1200		
Living allowance	2400	2400		
Transport	2400	2400		
Fuel	600	600		
Metal fences	480	480		
Wooden poles and plastic mesh for seed trap construction	320	320		
Hand GPS	60	60		
Stationary	20	20		
	7480	**7480**		

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

To continue the project, there are a number of research gaps that can be explored. Remnant forests provide valuable food resources for flying foxes at different times of the year. However, the fruit yield of native trees (and therefore food availability to flying foxes) is most likely limited by invasive plant species that compete for light, nutrients and space. Studies show that weeding of invasive species increases the fruit yield of native trees in the following year. I am planning to monitor the same trees in the remnant forests that I have been monitoring so far and add additional replicates. The fruit yield of trees in non-weeded area can be compared to trees in areas that will be weeded next year. Since not all species selected for this study were used by any animals, the total number of species can be limited to about 8 – 10 species. A study like this has not yet been carried out in Mauritius. This will also provide more insights into fruiting patterns, since it is likely that patterns can differ between years.

Furthermore, the current population size of macaques is unknown, since the last studies were carried out in the 1980s. The population is believed to have increased since the 1980s and feeding behaviour and movement patterns could have changed since then. Therefore, radio tracking of the macaques could provide valuable information on their movement patterns, feeding ecology and impact on the regeneration of Mauritian forest. It has become clear that the macaque predate on immature fruits. However, observations by various researchers also confirm that macaque can damage orchids, seedlings and young plant shoots. Radio tracking would provide new insights into their impact on the regeneration and survival of native forests.

I am currently organising the extension of my MSc to PhD. As soon as this is confirmed I can start writing a new proposal and organise visa extensions to continue my work. The National Parks and Conservation Service are very pleased with my current findings and would be very happy to keep me for another couple of years to finish a PhD.

10. 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?

Research talks were held at multiple occasions and the Rufford logo was used on the title slide of the power point presentations. The preliminary results were presented at the bat research strategy workshop hosted by IUCN in Mauritius and twice at the National Parks and Conservation Service (NPCS) office in Réduit. The Rufford logo was also used for the title pages of the progress reports for NPCS.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Dr Ryszard Oleksy: Project supervisor and director of the Ecosystem Restoration Alliance (ERA). He is an experienced bat ecologist that has been working on the Mauritian flying fox's feeding ecology and behaviour for many years. He gave advice on the project methodology and overall design and provided feedback on my monthly progress. Furthermore, he provided accommodation and transport to carry out the project successfully.

Laurent Ayady: Ex- conservation biologist and botanist at ERA. He has many years of experience working for the Mauritian Wildlife Foundation (MWF) with endemic animals and plants. He has a considerable amount of plant knowledge and botany skill. He provided help and training from December 2017 until June 2018.

Ismael Janoo: Trainee botanist and conservation biologist at ERA. He is currently in charge of the endemic plant propagation programme at ERA. He is an experienced field worker and his botany and plant propagation skills are improving rapidly. I trained him in basic botany and feeding ecology of different animals. He joined ERA in June 2017 and has helped out with the project since.

Yogishah Bumsy: Education officer at ERA. She is in charge of the education programme that is aimed at raising awareness about threats to flying foxes and providing information on the ecological role of flying foxes in Mauritius. She was involved in the exclusion plot assessment and helped with the monthly transects walks since she is experienced with recognizing plants and recognizing macaque damage.

12. Any other comments?

I would like to thank Rufford for providing grant for this important study. Without the support from Rufford this study would have never happened and all these important aspects of the Mauritian ecosystem, its threats and challenges never research. The grant helped develop new research questions important for the conservation of bats and ecosystem in Mauritius. Especially during the times when the endangered Mauritian flying fox is undergoing another cull, this project highlights how important it is to control the invasive species in Mauritius and bring balance to the ecosystem.