The Rufford Foundation
Final Report

Congratulations on the completion of your project that was supported by The Rufford Foundation.

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. The Final Report must be sent in **word format** and not PDF format or any other format. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work. Please be as honest as you can in answering the questions – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please complete the form in English and be as clear and concise as you can. Please note that the information may be edited for clarity. We will ask for further information if required. If you have any other materials produced by the project, particularly a few relevant photographs, please send these to us separately.

Please submit your final report to jane@rufford.org.

Thank you for your help.

Josh Cole, Grants Director

Grant Recipient Details	
Your name	Onja H. Razafindratsima
Project title	Consequences of rodent invasion on seed dispersal mutualisms
RSG reference	13874-B
Reporting period	January – December 2014
Amount of grant	£11,945
Your email address	onja@rice.edu
Date of this report	20 July 2018

1. Please 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
Conduct field experiments on seed predation and removal in degraded and intact forest habitats			X	
Identify rodent species that remove seeds from primary dispersal location			X	I was able to identify, using camera traps, one species that seems to be the major seed predator in the system. The camera traps were less effective for small species, which may have biased our results. I plan to explore other methods to deal with this potential issue.
Determine where rodents cache seeds in order to understand how rodents might change the spatial patterns of seed dispersal		X		Despite using seed tracking methods tested in other systems, we had some issues following removed seeds because rodents often removed seed tags, which prevented us from finding them. In addition, a large majority of seeds were consumed on the spot rather than removed. However, this provided useful data on comparative seed predation rates.
Assess how invasion of non-native rodents may lead to change in forest regeneration patternsaffect secondary dispersal and seed predation		X		I was able to assess seed predation rates between areas that differed in invasion levels of non-native rodents. My team and I had trouble following removed seeds as discussed above.
Increase people's awareness on the importance of forest and biodiversity, and the effects of human activities on the ecosystem			X	I have been training and mentoring two Malagasy undergraduate students and an American student, and collaborated with three Malagasy research technicians / local guides. I have also given a workshop at a local Malagasy institution for college students in environmental science. I have written reports to park managers, and gave talks at conferences.

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

When I first got to Madagascar, our research permit had not yet been approved, mainly because the park managers were concerned about the methodologies of the research, so we were not able to start our research right away as scheduled. To address this, I met with the relevant park authorities to discuss and clarify the methodologies employed. After this meeting, they soon delivered the permit so we could begin the research; and we did not have problems where renewing the permit afterwards.

The main challenge I encountered with the actual implementation of the project affected our ability to track seeds and seed fate. One of my goals was to determine where rodents cache seeds in degraded and intact rainforest and to follow the fate of those seeds. Following an innovative method in the field for doing this, I used microchips (passive integrated transponders (PIT) tags) to mark seeds for tracking and identification if removed. This method was not successful because the dense understory vegetation in the rainforest limited the detection ability of the PIT tag reader even with the use of an antenna. So, I changed the method using fishing line with buried flagging to tag and track the movement of seeds from their initial placement. Unfortunately, rodents in our study system chewed off the line in almost all cases so we (my team and I) were unable to locate the destination of a majority removed seeds and to examine their fate. To address this, we modified again our method by replacing the fishing line with thin metal wire. The rodents were unable to remove the metal wire but ate a majority of seeds. Unfortunately, this meant that I was unable to address my original question of secondary seed dispersal. However, I was collecting a lot of useful information about seed predation. Therefore, I changed the focus and goal of the original project to examine the association of habitat disturbance and rodent invasion on seed predation levels. Since seed predation can have important impacts on plant demography and community structure, I expect my results will lead to an important contribution to the field as well as important implications for conservation management.

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

1) Provide insights on the anthropogenic impacts on biotic interactions and seed fate ecology.
2) Provide educational development and training opportunities for local people.
3) Increase people's awareness on the importance of forest and biodiversity, and the effects of human activities on the ecosystem.

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

I have trained and worked with four local technician/guides at Centre ValBio who are familiar with the forest and local flora within RNP. They provided valuable help in all aspects of the research. They benefited from this project through research training, English lessons, and professional development. The more research training and English communication skills they have, the higher the demand for their work. This allows them more opportunities as a research technician. I also contributed in the economic development of the locals who worked on this project, by providing start-up fund for small-scale pig farming. This also helped reduce waste in the forest since the locals take home our camping leftovers to use as part of the pigs' food. In addition, this provided them

another way to benefit from the protected area, where they are not allowed to extract natural resources like their ancestors did.

Lack of scientific capacity in terms of research training is a major obstacle for conservation in Madagascar, one of the hottest hotspots for biodiversity. I therefore feel very strongly about my contributions to science education and training of future environmental leaders in Madagascar. My project addressed this and also benefited Malagasy undergraduate students by providing them with field training, professional development and leadership skills. I have organised a workshop at the Institut de Fomation Technique (IFT) in Antananarivo for college students in environmental science (20 participants in their 3rd and 4th year of college). It was mainly focused on learning methodologies in designing and conducting conservation-related research, and the use of some equipment and tools related to this project, followed by a session of activities and discussion to engage students in critical thinking. I also led a workshop at the University of Antananarivo for undergraduate and graduate students of conservation-related fields about how to obtain funding for research. Madagascar has little internal funding for conservation science, which is a main limiting factor for graduate training and for Malagasy conservation scientists to have an active research programme. I also mentored two Malagasy undergraduate students who helped in data collection while gaining experience in conducting fieldwork. I taught them field methods and provided them guidance in project design. One of them is developing a thesis project based on this research to fulfil her degree requirements. These students also gained leadership skills through their experience with the project by leading and supervising a team of field assistants.

5. Are there any plans to continue this work?

My immediate plan is to analyse the collected data and write-up a manuscript for publication. In the long-term, I plan to conduct a research examining the effects of anthropogenic factors such as forest fragmentation and defaunation (species loss) the structure of mutualistic plant-frugivore networks and seed dispersal patterns (including secondary dispersal). Such research is critical because seed dispersal is vital for both ecosystem functioning and forest resilience in the face of anthropogenic and climate change.

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

The results of this project will be shared through publications in a peer-reviewed journal in conservation and/or ecology; through presentations in international and national meetings, conferences, and seminars. Collaborating with an undergraduate at Rice University, we have already presented some results at the Gulf Coast Undergraduate Research Symposium in Houston in October 2014.

I also hope to make the results of this study available to forest managers and policy makers in Madagascar by publishing an article in Malagasy conservation journals and via media communication to public.

I have been disseminating the results of my previous RSG-funded projects, including two published manuscripts in scientific journals, oral and poster presentations at several international and national conferences and meetings (for which I was three times awarded for best presentation), annual reports to Madagascar park managers, and multiple media interviews.

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

The RSG was used for 12 months, covering all field work and some data analysis representing 75% of the actual length of the project. I am still in the process of mentoring an undergraduate researcher on the project, further analysing data, and writing up the results for publication.

8. Budget: Please 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.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Airfare	3,300.00	3,146.43	153.57	Slight change in fare
Local transportation	832.00	847.94	(15.94)	Slight change in gas price
Porters	200.00	264.33	(64.33)	We needed more porters to carry equipment and supplies to/from field sites
Lodging, subsistence and station fees	1,450.00	1,591.46	(141.46)	Increase in station fees and cost of living
Expedition food expenses for team while camping	990.00	998.16	(8.16)	Slight increase in cost of living
Malagasy research technicians and local guide salary and per diem	1,300.00	1,264.17	35.83	There were some days off
Malagasy student assistantship	800.00	482.46	317.54	The student went in the field for a shorter period of time than planned
Malagasy student dissertation fees	165.00	165.00	0.00	
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CAFF/CORE representative in field	150.00	0.00	150.00	We were not required to have this representative supervise our fieldwork
Field equipment and supplies	1,100.00	1,715.84	(615.84)	We ran out of some field supplies, had some of our field and camping gear worn-out, and needed to replace some equipment accessories
Fees: Research, logistic, park entrance and camping	593.00	640.38	(47.38)	Slight increase in the costs
Communication and documentation	300.00	127.88	172.12	

Workshop-related costs	300.00	0.00	(300.00)	There was not much expenditure involved for the workshop, and most of the materials needed were covered in the "communication and documentation" outlined above
Other miscellaneous costs	150.00	146.90	3.10	
Visa application	150.00	232.33	(82.33)	Two times
Medical care in field	0.00	0.00	0.00	
Total	11,945.00	11,788.28	156.72	I plan to use the remaining funds for an outreach campaign promoting lemur conservation using T-shirts; a common tactic that politicians use to promote their agendas in the country. The plan is to donate T-shirts to the research team and important local figures (Mayor, village chiefs, teachers, etc) in villages near the park. A Malagasy graphic artist has already created a design for us.

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

My next steps are to analyse the collected data and write a manuscript to be submitted in a peer-reviewed journal

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

I used the RSGF logo and advertised my RSGF funding during my talks. I also put a link and information about the funding in my personal website. RSGF has also been acknowledged in publications and public media related to my research in Madagascar.