The Rufford Small Grants Foundation
Final Report

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

We ask all grant recipients to complete a Final Report Form that helps us to gauge the success of our grant giving. 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. 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	Hemant G. Tripathi
Project title	Understanding biodiversity response to habitat loss and fragmentation in the Miombo woodland of northern Mozambique using a multispecies approach- Mammals, birds, carabid beetles.
RSG reference	
Reporting period	2016
Amount of grant	£5000
Your email address	hemant.tripathi@ed.ac.uk
Date of this report	12-09-2016

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
Fragmentation and habitat loss mapping			✓	Using the above ground biomass layer (prepared by Ryan et al. 2015), we classified all the pixels above 20tC in the study area as woodland/forest and below it as non-woodland/forest. We divided the study area in to number of 1 km grids. Using Landscape ecology Statistics (LeCos) tool developed by Jung 2012 and python package NLMpy by Etherington et al. (2015), we evaluated the habitat and fragmentation parameters such as landcover proportion, number of patches, mean patch area, core area and landcover division index. We selected 40 of these grids representing a gradient of fragmentation and habitat from low too high for sampling biodiversity. Based on the woodland cover analysis, we found that across our study area, the considerable proportion of woodland (ABG >20tC) has undergone reduction from 2007 to 2015. From 2007 to 2010, 11.4 % of the grids indicated reduction in woodland cover and from 2010 to 2015, 64.15% of grids had 80% or less woodland than 2010 (Forest Cover 2015/2010 </= 0.8). With the loss of woodland patches, the landscape witnessed considerable fragmentation from 27% of grids in 2010 having high fragmentation (LDI>0.75) to 49% of grids in the year 2015.
Mammal survey by Camera trapping			✓	We placed one camera trap within the 100 m radius from the centre of the sampling grid at the best camera trapping location which is described in the O'Connell et al. 2011 as

				locations such as open and frequently used pathways that maximizes detection of species. The cameras were placed for a total of 50 days and were visited every 10 days to download the images and check the functioning. The data from camera trap were identified to the species level for further analysis. In each grid along with the camera trap based survey, we also carried out mammal incidence (presence) survey by observing evidences of mammal species.
Bird survey by point counts and acoustic recordings.			✓	We used acoustic sampling method to record sounds from each grid for 20 hour period from 15.00 hours to 11.00 hours. We have total of 680 hours (34 grids X 20 hours) of sound recording which will be analysed between October-November 2016. Using the species based song models that we will prepare in next 2 months, we will identify the bird species in the sound records. Also, we conducted a point count survey in each grid to measure bird diversity.
Carbid beetle survey using pit-fall traps.			✓	We collected 180 communities (insect trap points) of ground dwelling insects consisting of approximately 1550 individual insects. The collections will be further processed for taxonomic classification and identification in the University of Liverpool in the next 4 months.
Biodiversity estimation		✓		We have identified the mammal and bird species encountered during the fieldwork, but the insect identification and modelling of bird calls for acoustic models still remain to be done. We plan to do it in next 6 months. Based on the species and their proportions we will determine species richness, diversity and composition.
Preliminary results			✓	Mammals : Total number of species: 13 large to medium sized herbivores: vervet monkeys and bonnet macaques. Small omnivores: large grey mongoose, banded mongoose, large spotted genet,

				African civet, honey badger, African wildcat, African pygmy hedgehog, scrub hare, spring hare, African tree squirrel, rock elephant shrew, bushveld gerbil The most commonly found species was the rock elephant shrew with naïve occupancy (Ψn) of 31 grids followed by scrub hare (Ψn=19). The fragmentation (LDI) at the grid level negatively impacted occurrence of large spotted genet, African civet, large grey mongoose and honey badger. Species such as scrub hare, spring hare, African tree squirrel, rock elephant shrew, bushveld gerbil were more frequently observed near agricultural farms and mostly on edges of forest.
Trait data		✓		Using secondary sources and online trait databases we have started to compile trait information for all the species we encountered during our study. Using these traits we will analyse functional trait diversity in our sampling grids.
Data analysis using occupancy models	✓			We started to understand the occupancy frame work and write codes. We plan to do this over the next 4 months.

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

During the field data collection for this project we faced several problems. We had to change the site and system of our study from mopane woodlands in southern Mozambique to Miombo woodlands of northern Mozambique due the El Niño driven drought in the southern Africa. https://www.theguardian.com/global-development/2016/feb/17/mozambique-drought-hopes-harvest-evaporate

We had to postpone our fieldwork twice before changing our location to northern Mozambique. In the new site we could not again start our fieldwork on time due to the civil unrest in central Mozambique due to which the roads were blocked and

unsafe to travel. http://www.dailymail.co.uk/wires/afp/article-3497020/Mozambique-unrest-turns-key-highway-ghost-road.html

Eventually, we could do our field work after 6 months of delay. During the fieldwork, the whole team including local field assistants met with an accident which cost the life of a local (not related with the project) due to which we had to stop working for few days.

The insect collections made during the study could not be brought back to UK in time due to permit related issues. This delayed the insect part of analysis for few months.

We still completed our data collection. The major impact of all this is delay in data analysis and inference.

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

1. Loss of species and functional diversity in response to fragmentation and habitat loss: The study area, Gurúè in the northern-central Mozambique is a Miombo dominated area interspersed with inselbergs. The Miombo in this area is converted in to farming landscapes. During our study we found that there is a considerable loss of species and functional diversity in areas with lowest woodland cover.

2. Habitat patches and inselbergs mitigate and help in sustenance of biodiversity at the landscape scale: Although species are lost from the grids representing high habitat loss and fragmentation, there are hotspots of high biodiversity across the landscape. The sampling grids closer to the mountains and about 20% forest cover showed highest diversity and were occupied by many forest dwelling species.

3. Species groups respond differently to the habitat loss and fragmentation: Insect diversity increases in less intensive non-commercial mixed crop farming (this is an observation based inference which is still to be verified statistically).

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

We undertook field surveys in seven villages and in each village we employed two field assistants to help us with installation of cameras, recorders, pitfall traps and to collect background information about the forests around the village. Most assistants were from the age group of 18-25 years and with the training provided during this study, they can be a valuable resource for similar studies in future. I plan to conduct my next study in the same area which will be focussed on the mountains in the landscape to assess their biodiversity and conservation value. For field work in near future, I intend to employ these assistants again and also recommend them for any other field work that I may know of in that area.

5. Are there any plans to continue this work?

I plan to re visit the same site with an aim of just studying the biodiversity of mountains in the landscape. With agriculture driven woodland transformation common in the area, the mountains and forests on the mountain slopes act as refuge for biodiversity. Also, the biodiversity importance of these mountains are largely unknown. Local people attach religious and cultural significance and use these mountains to collect important medicinal plants and therefore along with biodiversity, I am curious to understand more about their ecosystem service value. I plan continue this work with an increased focus only on the mountains to estimate their biodiversity and ecosystem service significance.

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

I plan to share results of this work through research publications, blog and presentation in the local university through the travel grant that I may get from the Edinburgh University.

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

Our initial plan for this project was to end it by September 2016. But due to several problems (mentioned above) we had to change our plan to April 2016 to January 2017. We have completed the field work and now in the stage of data analysis and writing.

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
Camera traps	4300	4300	No difference	-
Memory cards	500	500	No difference	
AA batteries	320	200	120	Had to use more batteries than expected.
TOTAL	5000	5120		

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

1. Insect identification.
2. Bird call modelling.
3. Occupancy estimation.
4. Species and trait analysis.

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

We intend to present this work with RSGF logo in the forthcoming conferences:
Student Conference on Conservation Science in Cambridge 2017
15th Annual Savanna Science Networking Meeting 2017

11. Any other comments?

We are extremely grateful for the financial support provided to carry out this work. This grant enabled me purchase camera traps which played an important role in surveying biodiversity in my study area more efficiently. Also, I was able to train many local students in using camera traps. The images we got from the cameras were shown to the leaders of the local communities we worked with and they were delighted to see gennets and wild cats from the forest areas. This project has made me consider developing a community based biodiversity monitoring project in my study area where I can use non-invasive sampling methods like camera trapping.