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	Kaitlyn Gaynor
Project title	Wildlife recovery amid human expansion in Mozambique's Gorongosa National Park
RSG reference	20566-2
Reporting period	November 2016 – December 2017
Amount of grant	£4497
Your email address	kgaynor@berkeley.edu
Date of this report	9 January 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
Main objective: Use camera traps to monitor wildlife populations in Mozambique's Gorongosa National Park.			X	The project adhered closely to the main objective. I have established and maintained a grid of 60 camera traps in Gorongosa National Park.
Set up and maintain camera grid of 60 cameras			X	Camera traps have now operated continuously for 1.5 years.
Collect data on ecological and anthropogenic variables that may be correlated with species occupancy			X	Completed in 2016.
Quantify broader environment around each camera site using remote sensing data		X		In progress; will be completed in 2018.
Upload images to WildCam Gorongosa for citizen scientist classification		X		Images are being uploaded, but have yet to be published due to a backlog of images on the website. Will be completed in 2018.
Build seasonal distribution maps of each species and quantify spatial shifts across seasons		X		I have created these maps for the dry season, and am currently analysing data for the wet season.
Assess daily species activity patterns		X		I have conducted preliminary data analysis with data collected from June – November 2016. I am currently processing images from November 2016 – July 2017.
Comparison of results from camera trap monitoring and aerial survey data		X		I am in the process of obtaining aerial count data from the Department of Scientific Services, which we will then compare to camera trap data.
Build niche and distribution models to tease apart diverse drivers of wildlife distribution to identify factors limiting recovery		X		I have conducted preliminary data analysis with data collected from June – November 2016. I am currently processing images from November 2016 – July 2017.
Evaluate patterns of species		X		I have conducted preliminary data

interactions and food webs with multispecies occupancy models			analysis with data collected from June – November 2016. I am currently processing images from November 2016 – July 2017.
Collect data on age and sex structure of populations for demographic analysis			To save battery life, I used a longer delay period between camera trigger events, which precluded my ability to collect complete information on the age and sex composition of groups.

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

Given that this was the second phase of my project, I had a greater knowledge of the system and fewer unanticipated challenges. I lost some camera traps to elephants, which destroyed the cameras in their playful curiosity, but funding from the Rufford Foundation allowed me to replace these cameras and ensure that they are all kept in steel cases to minimise damage. The particularly rainy year also created difficulties surrounding access. I was able to reach all of the cameras to download data and change batteries once the park dried up, but some areas where the cameras were located had become overgrown with vegetation that blocked the field of view. I had to clear the tall grass and accept that there would be several months where I could not use the data from those cameras.

There were some difficulties associated with transporting lithium batteries to Mozambique, as I could not take them on the airplane from the United States and they were not available in the country. I worked with the Department of Operations at Gorongosa National Park to purchase batteries in bulk from South Africa and transport them via truck to Mozambique. While this raised my initially-budgeted costs, it enabled my camera traps to operate continuously without interruption.

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

First, my project yielded a robust dataset on large mammal distribution in a system that has been understudied and is currently undergoing a rapid ecological restoration. I collected over 1,000,000 images from 60 camera traps in a grid around the park. These data provide a valuable baseline for future monitoring efforts, and will be combined with ongoing aerial count data to assess the recovery of large mammals in the park.

Second, my project will provide insights into the ecological and anthropogenic factors that drive large mammal distribution. By elucidating these factors, we can better understand the management needs of species in the park. Niche and distribution models will identify critical habitats and areas of the park for species of conservation concern at different times of the year. These areas can then be targeted for increased law enforcement and monitoring, or designated as

"wilderness" areas free of human disturbance. Fire management plans may also be adjusted to achieve desired wildlife outcomes.

Finally, I believe that the most valuable outcome of my project was the contribution that it made to conversations among scientists and managers in Gorongosa National Park about human-wildlife issues in the system. I have initiated conversations about future research that can inform management of growing wildlife populations. I am now in communication with key leaders and decision-makers who support my continued research in the system.

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

I worked closely with research interns based at Gorongosa National Park's E.O. Wilson Biodiversity Laboratory, including Castiano Lencastro, Diolinda Semente, and Gabriela Curtiz. These interns are all recent high school graduates from Vila Gorongosa, a community in the park's buffer zone. I helped to train them in research methods, ecology, and English. After participating in my project, Castiano was accepted to Mozambique's premier university to study science.

My research project is part of a larger effort by the Gorongosa Restoration Project, which is dedicated not only to conservation and research but also to community outreach and development. While I was at Gorongosa, I interacted with the park's Department of Community Relations and developed relationships with people who will help me to communicate my research and to engage the public in future field seasons.

5. Are there any plans to continue this work?

Although the season of field work funded by the Rufford Foundation is complete, my larger research project on human-wildlife interactions in Gorongosa is ongoing. I am still in the process of analysing data and preparing reports based on my work last year. I am currently coordinating with the Department of Scientific Services at the park to ensure that my project continues in perpetuity and serves as a tool for monitoring the restoration of Gorongosa's wildlife. In future years, I will be developing other aspects of my research on the effects of human activity and settlement on wildlife in Gorongosa National Park, exploring the effects of hunting on population trends and community composition.

I will continue to conduct this research in collaboration with the Gorongosa Restoration Project, which is engaged in an ongoing effort to restore the park's wildlife and promote conservation and development in the region. This project will inform adaptive management of the Gorongosa ecosystem. As we collect and analyse data on species distribution and activity, the park can develop management plans that incorporate this knowledge. Continued monitoring through the camera trap system will allow for the regular evaluation of the efficacy of interventions, which can be adjusted as necessary. It is therefore critical to secure

funding to continue to maintain the camera traps for the next several years, and ideally in perpetuity, as the restoration of Gorongosa progresses.

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

Park management: I am preparing a report to deliver to the Gorongosa Restoration Project and the management team of Gorongosa National Park. I am in regular communication with the science and conservation teams, and they have provided valuable insight into my study design and findings.

General public: I published a blog post about this project on the Gorongosa Science Blog, "Wildlife selfies for science" (http://www.gorongosa.org/blog/science/wildlife-selfies-science). I am actively participating in Howard Hughes Medical Institute's citizen science programme, WildCam Gorongosa, and have uploaded my camera trap photographs for crowdsourced classification by citizen scientists. I am active on the WildCam forum and on social media, and my data are used in high school classrooms to teach students in the US about science and African conservation. Gorongosa National Park also has an in-house media team, and I will collaborate with the media team to develop video content as the project progresses. At the University of California – Berkeley, I have access to a media and public relations team to disseminate the findings of my research to a broader public.

Local communities: I have shared reports with the outreach teams, and with local staff. I gave a presentation on my research as part of the science seminar series at the E.O. Wilson Biodiversity Laboratory in the park. I will continue to collaborate with the park's Department of Community Relations to communicate results to local communities and to visiting school groups.

Academic and management community: In future stages of the project, I will incorporate results into my PhD dissertation and publish findings in peer-reviewed conservation and ecology journals. I also plan to present at international and national conferences focused on conservation science and management.

My community at University of California – Berkeley: I work closely with the Undergraduate Research Apprenticeship Program, through which I engaged nine female undergraduate students in this project. These students assisted me with identifying animals in photos, and with data analysis and modeling. Through their participation in my project, they not only learned about wildlife and conservation issues in Africa but also obtained valuable research skills and connections.

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

Most expenditures were made between November 2016 and July 2017 (including purchase of field equipment). The fieldwork component of the project took place in November 2016 and June-July 2017, as anticipated, followed by data cleaning and analysis. The writing and communication aspects of the project are ongoing. Most of the Rufford Foundation funding was used to purchase equipment, which will

continue to be used through the duration of the project, and eventually donated to the Gorongosa Restoration Project.

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
Field vehicle rental – Ford Ranger 4WD	960	960	0	
Fuel costs for vehicle	304	73	-231	Fuel costs were significantly lower than anticipated.
Bushnell TrophyCam trail cameras	950	760	-190	I purchased the cameras at a lower cost during a sale.
Security boxes for cameras	213	260	+47	I could not find the boxes a-t the initial price quoted in the grant, and purchased them for a slightly higher cost.
MasterLock Python cable locks	152	0	-152	A colleague donated secondhand MasterLock Python cables to my project.
MasterLock brass padlocks	27	97	+70	I purchased 20 additional padlocks to secure all of the cameras.
SD cards	273	374	+101	I decided to purchase 32GB SD cards rather than 16GB SD cards, which raised the cost.
Batteries	1058	1347	+289	Batteries cost more than budgeted, due to changes in South Africa exchange rate.
Battery custom and transport fee	0	370	+370	I had not initially budgeted for the customs and ground transport fee for purchasing batteries in South Africa.
Ranger fee	0	92	+92	The park began to charge researchers to have rangers accompany us, for which I had not initially budgeted.
Miscellaneous	0	164	+164	The remainder of the budget went to miscellaneous project expenses, including drill bits, flash drives, pens, notebooks, etc.
Total	4497	4497	0	

All values are calculated using the exchange rate 1 USD = 0.76 GBP (same rate as grant, and typical rate at time of expenditures). The above budget only includes items for which Rufford Foundation funding was used or requested. Additional project costs (including all transportation and living expenses) were covered by other sources of funding.

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

Some of the next steps that I highlighted in my first grant report remain pressing issues for conservation in Gorongosa National Park. One of the greatest needs is to better understand spatial patterns of settlement and activities such as hunting. Settlement maps, generated from up-to-date satellite imagery or from drone or other aerial photography, would be useful for scientific research as well as community outreach. Settlement maps could be analysed in conjunction with spatial data on wildlife from camera traps, aerial surveys, or line transects to understand how animals respond to settlements.

Understanding spatial and temporal patterns of hunting will also shed light on challenges facing wildlife communities. Data collected and compiled by the Department of Conservation could be used to generate heat maps of poaching, or ecological niche models of snaring locations. These spatial models can then be linked to wildlife distributions and population trends. Furthermore, knowledge of which habitats and species are most vulnerable to snaring would inform our understanding of the ways in which hunting is restructuring community composition and driving population dynamics.

Given that humans and wildlife will be living alongside each other at Gorongosa, Park management should continue to consider how to best manage development to minimize threats to conservation. Challenges include the expansion of settlement and slash-and-burn agriculture, continued hunting, fishing, and firewood collection, and potential for greater conflict with elephants. Issues at the human-wildlife interface will likely continue to present critical challenges to large mammal conservation in Gorongosa and beyond.

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 Rufford Foundation logo in the report that I presented to the Gorongosa Restoration Project, and in posters and PowerPoint presentations based on my research. The logo is also featured on my homepage (www.kaitlyngaynor.com). I will acknowledge the Rufford Foundation in any further publications that arise from this work.

11. Any other comments?

I greatly appreciate the continued support of the Rufford Foundation, which provided the bulk of the funding for this project. I am pleased with the outcome of the second phase of the research. This work followed nicely from the first phase, and I look forward to continuing to work on research around conservation issues at Gorongosa National Park.

This project was also supported by small grants from the Explorers Club and Sigma Xi Berkeley Chapter, and from a fellowship from the University of California – Berkeley Center for African Studies.