

**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 | 16945-1 |
| Reporting period | April 2015 – February 2016 |
| Amount of grant | £4542 |
| Your email address | kgaynor@berkeley.edu |
| Date of this report | 3 March 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 |
|---|--------------|--------------------|----------------|---|
| Main objective: Determine the effects of human activity in Mozambique's Gorongosa National Park on patterns of ungulate anti-predator behavior at multiple scales. | | X | | The project adhered closely to the main objective, although certain objectives were modified and some aspects of the project are still in progress (see below for specific objectives). I quantified patterns of human activity and assessed patterns of anti-predator behaviour, and am in the process of finalising analyses. There appears to be a small but important effect of human activity on ungulate behavior in Gorongosa National Park. |
| Analyse remote sensing imagery to create map of human infrastructure. | | | X | I created a map of settlements in the study area (eastern portion of the park). However, satellite imagery is not up-to-date, and future research should utilise more current data sources to account for settlement expansion. |
| Use participatory mapping approaches and park data to identify location and timing of activities, including hunting. | | X | | Given the sensitive nature of human activity in the park (most activities are illegal), I was unable to conduct a rigorous quantitative analysis of activity. Instead, I relied on informal interviews, visual observations, and remote sensing to identify spatial patterns of activity. |
| Map research and tourism infrastructure and activity. | | X | | I was able to map the locations of research and tourism infrastructure (buildings, roads) but did not quantify activities in the park. However, I used distance to headquarters as a proxy for vehicle traffic. |
| Observe flight distance, vigilance, and group size along randomised transects. | | X | | I had initially planned to use random walking transects, but safety and access issues made this impossible. Instead, I observed all behaviour (flight, vigilance, group size) along driving transects on existing park roads. |
| Set motion-sensor cameras to obtain fine-scale data on spatial and temporal activity patterns. | | | X | I set cameras at 36 locations in a systematic grid around two communities in the park to assess the effects of settlement on wildlife distribution and activity patterns. |
| Conduct dung count transects to provide an estimate of relative abundance. | X | | | Grass density was too high to conduct dung counts along transects. |

| | | | | |
|---|---|---|---|--|
| Record GPS coordinates and group sizes from wildlife encounters along behavioral data collection transects. | | | X | I conducted road surveys of wildlife in Gorongosa and will be assessing distribution in relation to habitat as well as human activity in the park. |
| Create fine-scale map of vegetation in the park. | | | X | Not an original objective, but I realised that it was essential to have a better map of vegetation communities in order to understand habitat preferences of different species, and therefore control for habitat preference when assessing anthropogenic effects. |
| Conduct spatially-explicit analyses to examine how anti-predator behaviors vary across activities. | | X | | I have already completed analysis based on the camera trap data. Data analysis on anti-predator behaviour observations and on distribution from road transects is ongoing, and will be completed within the next few months. |
| Analyse spatial patterns of wildlife population change using existing census data | | | X | I created maps of wildlife population densities across the park for various years, and calculated changes in density across the park. I still have yet to include the most recent data (2014) in the analysis. |
| Use regressions to link observed spatial patterns of anti-predator behaviour to localised population trends | | X | | I conducted preliminary analyses linking anti-predator behavior to population trends, but did not find any significant results. I believe that different factors are driving anti-predator behaviour and population trends (human activity is important in determining both, but is not the central driver). |
| Model patterns of behaviour and demography under various scenarios of human activity expansion | X | | | I have not yet modeled future behavioural and demographic scenarios, but I still plan to achieve this objective. I am currently in the process of obtaining the demographic data and model parameters needed to construct robust predictive models. |

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

In my original proposal, I planned to focus on the three keystone ungulates in the park (zebra, wildebeest, and buffalo). However, the low population densities of the proposed focal species led me to expand my research to all 17 terrestrial ungulate species. This expanded focus also allowed me to ask questions about how species with different ecological traits respond differently to human pressures, taking a community-ecology focus.

As noted above, I was unable to conduct the dung surveys that I proposed, due to the high density of grass, and instead relied on transects and camera traps to assess wildlife distribution. I was also unable to complete the proposed walking transects for observing and counting wildlife due to

difficulty traversing dense vegetation and personal safety issues, and therefore instead conducted all transects from a vehicle.

I learned that it will be challenging to ask questions and obtain data about sensitive issues such as bushmeat hunting, and I am currently researching survey methods that account for people's unwillingness to disclose certain information. I am hoping to team up with social scientists who can lead further research on the characteristics and drivers of various human activities in and around Gorongosa National Park, to complement my research on the ecological effects of these activities.

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

First, my project yielded several robust datasets in a system that has been understudied and is currently undergoing a rapid ecological restoration. Using road transects, I gathered over 1,100 observations of 15 species of large mammals. Each observation is associated with information about GPS location, demography, group size, and anti-predator behaviour (flight distance and vigilance). I also collected fine-scale spatial data on vegetation communities in the park, which I am translating into a map and GIS layer that will be useful to scientists and managers in the future. I also collected over 10,000 images of animals from my camera traps, which will be added to the park's existing camera trap data set to provide insights into distribution and activity patterns of large mammals in the park.

Second, my project provided insights into the effects of settlement and human activity on the Gorongosa ecosystem. Although preliminary, I assessed patterns of activity through observations, informational interviews, and remote sensing data, and identified key threats facing the Gorongosa ecosystem. While the footprint of settlement appears to be small, and there is limited habitat degradation around settlement, the continuation of hunting and the expansion of agriculture and settlement remain threats to conservation in the park. I am currently in the process of analysing data that I collected on wildlife behaviour and distribution to assess how these patterns of human activity translate into effects on wildlife.

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 shared the first of several reports on my findings with the management team, which 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 with a full-time field assistant, Mateus Dapitaia, from the local community of Nhamatanda. I also received assistance from members of the local Muaredzi and Muanza-Baixo communities where I set up camera traps to monitor wildlife activity around settlements. Additionally, I held meetings with community members and leaders to explain my research and to enlist their cooperation, and informally interviewed people to learn more about their perspectives on wildlife around their communities.

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. In down time from my own project, I accompanied the EcoHealth department to their mobile clinic, where they provide vaccines and family planning services, and attended demonstrations by the Department of Agriculture at a model farm in a nearby community. I also led field trips for African students and conservation professionals, who were visiting the park for the Lost Mountain Symposium on conservation practice, hosted by the Community Education Center.

5. Are there any plans to continue this work?

Although my first 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, and I plan to continue this project for the next several years. In future years, I will be developing other aspects of my dissertation 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.

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

Park management: I prepared a report that I delivered to the Gorongosa Restoration Project and the management team of Gorongosa National Park. The 61-page report was titled, "Wildlife distribution and activity around settlements in Gorongosa National Park, Mozambique: A preliminary camera trapping assessment of Muaredzi and Muanza-Baixo." I am currently working on additional reports that will summarize other components of this research, including flight behaviour in relation to human disturbance, and wildlife distribution across habitat types in the park.

General public: I have also written a blog post for the Howard Hughes Medical Institute BioInteractive page, which will reach a global audience. I am also actively participating in HHMI's citizen science programme WildCam Gorongosa, and have uploaded my camera trap photographs for crowdsourced classification by citizen scientists. In addition, I maintain a blog on my personal research website. 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.

Local communities: I have shared reports with the outreach teams, and with local staff. When I return to Mozambique in 2016, I will 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.

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 March and August 2015 (including purchase of field equipment). The fieldwork component of the project took place from May to August 2015, as anticipated, followed by data 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 | 960 | 1920 | +960 | Vehicle expenses were higher than anticipated. However, the Rufford funding went towards the purchase of a new truck for the Gorongosa Department of Scientific Services rather than rental. |
| Fuel costs for vehicle | 230 | 60 | -170 | The majority of fuel was provided as in-kind support from the Gorongosa Restoration Project. |
| Bushnell TrophyCam trail cameras | 1894 | 1136 | -758 | I budgeted enough to purchase 20 cameras and accessories, but only purchased 12 cameras after receiving others from an IdeaWild equipment grant, and only needed to purchase accessories for 18 cameras |
| Security boxes for cameras | 328 | 295 | -33 | |
| MasterLock Python cable lock | 232 | 209 | -23 | |
| SD cards | 113 | 102 | -11 | |
| Batteries | 307 | 276 | -31 | |
| GPS unit | 102 | 102 | 0 | |
| Rangefinder | 107 | 107 | 0 | |
| Binoculars | 269 | 0 | -269 | Secondhand binoculars were used in lieu of purchasing a new pair. |
| Field assistant salary | 0 | 222 | +222 | Field assistant expenses were not initially budgeted. |
| Field assistant accommodation | 0 | 20 | +20 | |
| Miscellaneous | 0 | 93 | +93 | The remainder of the Rufford budget was spent on miscellaneous field expenses, including pens, notebooks, a first aid kit, flagging tape, storage containers, and field guides. |
| Total | 4542 | 4542 | 0 | |

All values are calculated using the exchange rate 1 USD = 0.64 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?

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

11. Any other comments?

I greatly appreciate the support of the Rufford Foundation, which provided the bulk of the funding for this project. I am pleased with the outcome of the research. I believe that this year was a great success, and the start of an exciting chapter of research at Gorongosa National Park.

This project was also supported by an equipment grant from IdeaWild (for additional camera traps) and a small student research grant from the Animal Behavior Society, as well as fellowships from the University of California – Berkeley Institute for International Studies and Center for African Studies and a contribution from B. Alireza.