

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	Maria João Veloso da Costa Ramos Pereira
Project title	Factors affecting patterns of diversity in bats and its consequences for virus prevalence: an analysis of assemblages in endangered neotropical savannas
RSG reference	Ref: 11041-1
Reporting period	Feb2012 – Feb2013
Amount of grant	£6000
Your email address	mariajoapereira@ua.pt
Date of this report	11 February 2013

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
To determine how different levels of landscape fragmentation influence the diversity, abundance and composition of bat assemblages in the Brazilian Cerrado.		✓		I have completed 1 year of fieldwork. I used a standardised sampling design of mist-netting and acoustic monitoring to sample bat diversity in three distinct Cerrado landscapes: Cerrado <i>sensu stricto</i> , Gallery forest, and Cerradão. Three replicates of three disturbance levels of each habitat (in a total of 27 points) were sampled twice (dry season and rainy season) during 2012. During the two sampling seasons over 1000 bats belonging to 48 species were captured and over 500 hours of recordings were gathered. Preliminary results indicate that pristine areas present very high diversity with the presence of rare, specialist species and that this diversity declines with increasing levels of anthropogenic disturbance. A full achievement of this objective is expected in the next few months by completing the analysis of the data collected. The submission of a paper to an international scientific periodical with referees is expected by the end of the first semester of 2013. Another paper, using solely the acoustic monitoring data will be also prepared and its submission is intended by the beginning of 2014.
The influence of habitat fragmentation and degradation on viral load.		✓		I was able to collect pellets from over half of the captured bats (ca. 500 individuals). These pellets were stored in a buffer solution to preserve the RNA profiles of the potential virus present. The lab analysis will start in the first trimester of 2013. Due to the high cost of these analyses a partnership with a German/Spanish consortium of virologists is being established. A full achievement of this objective is expected by the end of 2013. The submission of a paper to an international scientific periodical with referees is expected by the end of the

				first semester of 2014.
To determine the ecological characteristics and traits of bats that promote a higher vulnerability to habitat fragmentation		✓		Preliminary data analysis indicates that species at the top of the food web and dietary specialists are more vulnerable to fragmentation and habitat disturbance. The submission of a paper to an international scientific periodical with referees is expected by the end of 2013.

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

- i) Due to organisational problems at the Ecotropical Centre (Tocantins State) I changed the location of the sampling sites to an area managed by NATURATINS (Nature Institute of Tocantins). This area is the Lajeado Environmental Protection Area (which includes the full-protection Lajeado State Park). Initially this triggered a slight change in the field logistics and in the phytophysiognomies to be sampled. However, the partnership with NATURATINS has been extremely successful (as will be detailed in this document) and I believe that the results will be even more promising than I previously thought when submitted the application to RSG. In fact, NATURATINS is the state agency responsible for biodiversity and nature conservation in Tocantins, where almost 2/3 of the state is classified as Cerrado biome. The close collaboration with this institute, the establishment of a relationship built on trust, and the recent implementation of a formal partnership between my hosting institution, the University of Aveiro, and NATURATINS, leads me to believe that the conservation guidelines resulting from this project will be, at least to a certain extent, effectively implemented in Tocantins.
- ii) As expected, there was some delay with the permissions to capture bats in Brazil, but through the partnerships with the University of Brasília and NATURATINS I was able to get the fieldwork permits from the CNPq and IBAMA and to begin the first field season in April 2012.
- iii) Due to financial limitations of the University of Aveiro, the lab analyses were delayed. Since the economical scenario of the Portuguese research institutions is not expected to improve significantly in the near future, I have decided, together with my post-doc supervisor and the project collaborators at the University of Brasília, to establish a partnership with a consortium of German and Spanish virologist to fulfil the second objective mentioned above. I believe that this will be a very productive partnership because the project will gain from the expertise of top researchers in the virology discipline. With this partnership I will have more time to: i) complete the data analysis on the field data already gathered; ii) invest in additional fieldwork time during 2013 (specifically finding important roosts of those species with relevant conservation status); and iii) collaborate with the Brazilian authorities (in particular NATURATINS and also the Brazilian Program for Bat Conservation) towards sustainable bat conservation through a significant contribution for the management plans of the protected areas of Tocantins.

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

Preliminary data analysis indicates that the Cerrado biome is much more diverse in terms of bat species than previously believed and that the maintenance of continuous, well-preserved Cerrado areas of different plant physiognomies is essential for bat conservation.

Though this is just a preliminary analysis, it seems to me, from my experience in Amazonia regions, that the local diversity in pristine Cerrado areas is not significantly lower than that of Amazonia lowlands, but simply that some species occur in lower densities, involving a larger capture effort to detect similar levels of diversity.

Some of the rarer species captured are essential for the pollination or seed dispersal of Cerrado plants, which have a growing economic interest in Brazil. So, it seems that Cerrado sustainable development and bat population management within Cerrado areas are intrinsically connected together.

In the next months I expect to understand how habitat fragmentation and its consequences on bat diversity and dynamics affect the incidence of potential infectious diseases that may affect human health and well-being. By modelling the impacts of different future climate and socio-economic scenarios on the patterns of bat diversity it will be possible to develop effective conservation actions focusing bat diversity of the Cerrado.

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

The local communities were strongly involved in the project.

i) Several formal presentations of the project were made to different target-groups at the request of NATURATINS. These presentations would occur whenever a school, group of students or any other kind of organized group, would visit the Lajeado State Park during my stay there. Some have answered positively to my invitation to watch a nocturnal session of bat captures and returned to the Lajeado Park to do so.

ii) In exchange for the support with human resources given to me by NATURATINS, I have developed some environmental education products to be distributed by this institute. Some are still under development with the help a post-doc colleague from the University of Aveiro who works specifically in environmental education (these products include games, bags, etc.). The first product developed, still waiting to be printed, is a series of three bookmarkers presenting species of bats occurring in the Cerrado (a nectarivore, a frugivore, and an insectivore), and showing their main ecological features and requirements, all written in Portuguese (see Figure 1 below).



Figure 1. Series of three bookmarkers developed during the project as an environmental education product (three fronts, common back).

iii) Part of the field work was done inside the Lajeado State Park, owned by the Tocantins state and the remaining within the Environmental Protection Area of Lajeado, a buffer area surrounding the Lajeado Park, privately owned. Whenever working in private property, landowners and/or managers were invited to the capture sessions where I would introduce them to bat diversity while collecting and handling the bats. This has occurred many times, but I would like to highlight the sessions done at a land bordering the Lajeado Park, where a halfway house is implemented. Two very fruitful environmental education sessions were done with teenagers and young adults beginning their process of reintegration in society after issues with drug and alcohol abuse.

iv) I was assisted in the field by a biologist working at NATURATINS who has gained significant experience in bat ecological studies (capture, hand-handling, identification). This biologist, with the support of the Coordinator of the Protected Areas of NATURATINS, has decided to start an MSc project, under my supervision, focusing on unique sandstone bat roosts existing in the Lajeado mountain range (Tocantins, Brazil).

Overall, the collaboration with NATURATINS has been very successful. I have had great support from this institution and, in exchange, I have been very receptive to their suggestions to participate in environmental education sessions they promote. In fact, because they have continuous environmental education programmes in Tocantins, I am able to reach quite a large number of people, from very young to graduated students, teachers, conservation managers, ecotourism agents, and others. Besides, at the NATURATINS request I have been participating in several meetings and discussions concerning other conservation programmes under development or planned for the near future.

5. Are there any plans to continue this work?

Yes. The project financed by Rufford Small Grants Foundation is just a part of a 3-year programme. A second year of fieldwork will be done and the laboratory work will be completed in the next 2 years. A following project will include studies on population structure of Cerrado bats, intended to research patterns of genetic erosion under scenarios of anthropogenic habitat fragmentation and destruction. DNA samples from the bats captured were already collected with this aim in mind. Additionally, together with my colleagues of the University of Brasília, I gathered funding to start a database of ultrasound calls of bats of the Cerrado biome. This is important because bat survey and monitoring is not straightforward due to their nocturnal habits, their small size and because they are often difficult to capture either in their foraging habitats or in their roosts. Consequently, surveys that rely solely on visual encounters or captures of individuals are inefficient for comprehensive surveys of bat assemblages. Because all neotropical bats use echolocation for orientation and prey detection, acoustic surveys may be used as a complementary method to guarantee those comprehensive bat surveys in the neotropics and particularly in the Cerrado where the use of flight trails to set mist nets is much more difficult than in closed forests. To my knowledge, to the present, no bat inventory to date done in Cerrado areas used ultrasound monitoring as a complement to mist-netting, except for the one I have done in the context of this project.

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

I intend to submit at least three papers to international scientific periodicals with referees with the main results of the project. Annual reports will be produced to the supporting entities with conservation responsibilities (NATURATINS, IBAMA/CNPq). Ludmilla Aguiar, a research partner from the University of Brasília is the coordinator of the Brazilian Program for Bat Conservation (PCMBR - Programa para a Conservação dos Morcegos Brasileiros) that integrates the Latin-American Net for

Bat Conservation (RELCOM), a partner of the United Nations Environment Programme (UNEP). For this reason, the project has an immediate interlocutor to disseminate its main outcomes, namely in terms of conservation challenges and opportunities. Together with a post-doc researcher colleague from my research centre at the University of Aveiro who focuses on dissemination of science and on the building of bridges between scientists and society, I am planning to promote a documentary film about my research project and other ecology research projects under development in Tocantins (at least four others involve PhD researchers of the University of Aveiro, so the coordination of efforts will be relatively straightforward). Technical support from producing companies already working with our university and financial and logistic support from the Tocantins state will be sought.

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

The RSG funding started to be used in March 2012 and will probably end by June 2013. In fact, though most of the funding was spent in 2012 in the items detailed in the original application, about £900 was not spent because of the human and logistic support given by NATURATINS. I intend to use the remaining money to support the next field season and to buy reagents (RNA latter) to store the samples obtained in the field.

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
Flights	1350	1700	350	Changes in the prices of the flights since the RSG application
Second-hand car acquisition	870	0	870	NATURATINS has provided a car for the fieldwork
Fuel	1030	1030	0	
Daily expenses	870	870		
Field assistant	836	0	836	NATURATINS has provided human support (in exchange training and academic supervision of members of their staff is provided)
RNA latter	1044	1044	0	
Environmental education products**	0	500	700	In exchange for the human and logistic support given by NATURATINS, £700 will be used in the production of environmental education products to distribute at the schools of the Tocantins state. All products will include the University of Aveiro and Department of Biology, Naturatins and Lajeado State Park, and Rufford SGF logos.
TOTAL	6000	5144	856	

*Only items funded by RSG as in the original application

** Not included in the original application

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

The priority steps ahead are to finish the analysis of the data gathered so far, to begin the lab analysis foreseen in the project and to submit the above-mentioned papers to international and Brazilian scientific periodicals with referees.

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?

The RSGF was used and will continue to be used in the environmental education products developed. The RSG support is referred in all official reports produced (post-doctoral research report and NATURATINS progress report). The RSG support will be referred in all papers to be submitted to scientific and non-scientific periodicals.

11. Any other comments?

The RSG funding was essential for the development of this project that is a core part of my post-doctoral research. More importantly the results obtained so far indicate that the Cerrado biome presents much higher bat diversity than previously thought and that habitat disruption and fragmentation have significant impacts on bat diversity and, consequently, on the ecosystem services bats provide. Because bats are essential pollinators and seed dispersers of Cerrado plants, their socio-economic importance is straightforward, especially at times when sustainable exploitation of Cerrado products (especially fruits and fruit derived products) is battling with intensive agriculture (soy fields) and monoculture plantations (mostly of Eucalyptus trees, a monoculture now supported by some Brazilian states). Hopefully, the results of this project will contribute with significant information for the development of management actions that will preserve bat diversity and with it, the means of subsistence of thousands of people living in Cerrado areas.

Finally, I believe that this project is functioning as a pilot project towards a long and very fruitful partnership between the University of Aveiro, the University of Brasília and NATURANTINS, contributing to the exchange of expertise between the three institutions, and the technical and scientific training of technical staff of the nature conservation areas.