

Final Project Evaluation Report

We ask all grant recipients to complete a project evaluation that helps us to gauge the success of your project. This must be sent in **MS Word and not PDF 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 – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Complete the form in English and be as concise as you can. Note that the information may be edited before posting on our website.

Please email this report to jane@rufford.org.

Your Details	
Full Name	María Victoria Capello
Project Title	Dung beetle diversity in intact forest landscapes of the Calakmul Biosphere Reserve: implications for conservation in adjacent human-modified landscapes
Application ID	15762-1
Grant Amount	£4873
Email Address	vicky.capello@gmail.com
Date of this Report	March

1. 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
Dung beetle species diversity in the Calakmul Biosphere Reserve (CBR)				47 species of dung beetles distributed in 16 genera have been identified. An illustrated checklist of the species in the CBR has been elaborated.
Dung beetle biomass distribution				The dry weight was determined for all specimens collected in ground traps during the rainy seasons.
Identification of factors that influence species occurrence and abundance in the CBR				Results shows how dung beetle species respond to variations in vegetation structure, micro-topography, soil compaction and ground level maximum temperature within protected contiguous forest.
Description of seasonal patterns in assemblage structure & composition				This study described differences in both the identity and abundance of species between seasons.
Examine the relative importance of rainfall seasonality and forest structure as determinants of Dung beetle assemblages diversity patterns				Rainfall seasonality, associated to changes in ground level maximum and minimum temperatures, was relatively more important than forest structure.
Vertical Stratification of dung beetle species				This objective has not been fully achieved yet. At the moment we are working on a review about dung beetles in the canopy and the fieldwork is scheduled for the next rainy season.
Natural Environmental Heterogeneity				Vegetation, soil and microclimate descriptors were registered at each of the 256 trap locations.
Dung Beetle Species Divulcation Field Guide for the CBR				With the support of the National Commission of Natural Protected Areas (CONANP) We are currently seeking funds to print and distribute the guide.

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

Like the final report form says: "Projects often do not follow the predicted course". Although we had put forward the study of the vertical stratification of dung beetle species, the corresponding fieldwork has not been completed yet due to logistics restrictions and overlapping timeframes.

Furthermore, during the period 2014 – 2016 *El Niño* event caused severe droughts in the Yucatan Peninsula. The total annual precipitation during the study was lower and the beginning of the rainy season was delayed compared to other years. It is possible that the contrast between seasons at least in the microclimate conditions, as well as in the fauna of Scarabaeinae, was not as marked at the time of the sampling of this study, as it may be in more normal years regarding the precipitation regime.

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

a). Contributing to knowledge of the biodiversity in the tropical rainforests of southern Mexico.

Mexico represents the northernmost limit of distribution of Neotropical forests. The Calakmul Biosphere Reserve is one of the largest and best preserved tropical forest remnants in southeast Mexico and an understudied region. Up to date, this has been the only study about Scarabaeinae dung beetles in the CBR and has generated baseline information on species diversity patterns. Data brought about is fundamental for monitoring biodiversity and assessing the ecological integrity of ecosystems. Even more so if we take into account that data gathering may be a critical element in developing plans for biodiversity conservation. Future conservation management strategies and research studies can use the results of this work.

b). Natural variation of ecological systems within protected areas, implications for conservation

In the study of landscapes under human use, the most extensive and best preserved fragment or remnant area is taken as a baseline to assess the magnitude of anthropic impact on biodiversity. And this is so, without explicitly considering the intrinsic spatio-temporal variation of reference ecosystems. The results of this work warn us about the considerable natural heterogeneity (spatial and temporal) that exists within preserved tropical forests and that has not been taken into account in studies about the effects of fragmentation, because among other things it has not been thoroughly examined. Temporal analysis, as well as multiscale spatial analysis, allow a better understanding of apparently inconsistent patterns that can be part of the natural dynamic of populations and of the assemblages formed by these populations. Protected areas cannot provide a reference measure to assess anthropogenic change if we do not know their internal variation.

c) Importance of water holes for life in a seasonal tropical forest.

In Calakmul the geological properties of soil cause rainwater to leak quickly. As a result, water is a limiting factor and permanent water bodies are scarce. Rainwater is accumulated and stored in water holes locally known as *Aguadas*. Several studies have shown the value of *aguadas* for human populations and mammalian fauna in the region, particularly during the dry season. For instance, primates and ungulates modify or reduce their action ranges throughout the dryer months, particularly centered in the vicinity of the *aguadas*.

The influence of rainfall seasonality on dung beetle abundance was different in different areas within the CBR. Contrary to what was expected, in close proximity to the *aguadas* we registered more individuals during the dry season compared to the rainy season. Subject to confirmation, the *aguadas* in dry season and the high concentration of mammals around them could be related to the differences in Scarabaeinae abundance between seasons.

Conservation management strategies should contemplate the protection of *aguadas* in the region. Permanent water holes in Calakmul are more frequent in the proximity of human settlements (ejidos), bringing about the importance of community involvement in the protection and management of these water bodies and biodiversity.

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

This work originated as part of a long-term research assessing the effectiveness of community based management strategies for biocultural diversity conservation (COMBIOSERVE). Accordingly, the Regional Popular Indigenous Council of Xpujil (CRIPX) in Calakmul, Campeche was engaged in the making and realization of this project from the very beginning. To a large extent their contribution comprised expertise on local vegetation and fauna, guidance and assistance in the field, as well as in situ logistics.

All the necessary permits to carry out this study were obtained. These not only consisted of those granted by governmental institutions responsible for biodiversity (i.e. the National Commission of Natural Protected Areas or CONANP and the secretariat of Natural Resources and Environment or SEMARNAT). We also referred to local authorities for permission to access and work in their communal lands located within the reserve. In pursuance of this, we met with the commissaries from Arroyo Negro, Conhuás and Dos Lagunas Sur to tell them about our project.

Throughout different phases of this study people from the neighbouring communities of Arroyo Negro, Conhuás, and Dos Lagunas Sur were involved in the project. Amongst other tasks they provided assistance with trail opening, the characterisation of vegetation structure and arboreal species, and pitfall traps setting. A significant part of the grant was destined to hire local field technicians.

5. Are there any plans to continue this work?

Yes there are. Currently, we are working on a review about dung beetles in the canopy of tropical forests and seeking funds to print and distribute the Scarabaeinae species field guide for the CBR. Moreover, the remaining fieldwork is intended to be done the next rainy season (June - August). Likewise, there is a long term interest in extending the work in Calakmul and other tropical forests in southeast Mexico.

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

The results of our work being and will be shared with others in several ways.

Information generated has been made available to stakeholders (local NGOs like the regional CRIPX, and "ejidatarios"), management (CONANP) and researchers through meetings, reports and my thesis manuscript.

As mentioned previously, funds are being sought to print the Dung Beetle Species Divulcation Field Guide for the CBR. We hope to be able to distribute it amongst the communities within the reserve and for it to be available at the CBR. Furthermore, all results derived from this research will be published in at least two scientific articles and an illustrated checklist of dung beetles from Calakmul.

We took part of the RSG conference in Mexico sharing our results and experience in conservation research. Moreover, In June 2018 we intend to participate in the XII Latinamerican Reunion of Scarabaeoidology (XII RELAS) in Guatemala.

Additionally, specimen vouchers have been deposited in several entomological collections: IEXA at the Instituto de Ecología (INECOL A. C.), Hope at the Oxford University Museum of Natural History (OUMNH) Dr. Gonzalo Halffter and Dr. Mario Zunino personal collections in Mexico and Italy.

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

Fieldwork started before the funds were released since we had planned to examine dung beetle diversity during both the dry and rainy seasons within the Master's degree time frame. At this time, some expenses were provisionally and complementary covered by my academic advisor funds, personal ones, Idea Wild and other funding sources. Though the project has exceeded the anticipated timespan, the majority of the proposed objectives within it have been achieved.

8. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Local Field Technician Salary	1325	1104	- 221	Budgeted amount included the vertical sampling of dung beetles.
Bus round-trip tickets Xalapa - Xpujil	368	368	0	
Accommodation in Xpujil	1656	1380	- 276	Budgeted amount included the vertical sampling of dung beetles.
Snake antivenom	966	966	0	
Drinking Water & Food	994	828	- 166	Budgeted amount included the vertical sampling of dung beetles.
Nissan 4WD DC Rental	1656	1380	- 276	Budgeted amount included the vertical sampling of dung beetles.
Fuel	864	720	- 144	Budgeted amount included the vertical sampling of dung beetles.
GPS	182	182	0	
Rechargeable Batteries (x4) + Charger	19	19	0	
Pitfall trap pack	294	294	0	
Photodegradable flagging	19	19	0	
Whirl-Pak Sterile Sample Bags	42	42	0	
Alcohol	255	255		
Disposable nitrile gloves	32	32	0	
Rite in the Rain Notebooks	5	5	0	
Library Materials (i.e. Labels, Pencils, permanent markers, scissors)	28	28	0	
HOBOS	650	650	0	

Digital Clinometer	120	120	0	
Compact refrigerator	69	69	0	
Fish eye lens kit	27	27	0	
Entomological material	0	360	360	We had to buy 5 entomological boxes at 20 £ each, 4 tweezers at 5 £ each, and pins (30 packages of different sizes at 6-10 £ each)
Macro photographer salary	0	350	350	Specimen vouchers for each species (and gender in the case of sexually dimorphic species) have been photographed
high resolution satellite imagery	0	782	782	Was processed and analysed attempting to classify the different types of forests.
Total	9571	9980	409	Total actual amount was £9980, we received from RSGF £4783. Items not funded by the Rufford foundation were covered using other funding sources.

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

The next important steps include:

- Integrating, publishing and disseminating the results obtained through this study. Printing the disclosure material. In these ways, we seek to make the information generated more accessible, especially to stakeholders, and to contribute to biodiversity conservation and sustainable development in the CBR.
- The continuation of the study of dung beetle species ecology and behaviour in the canopy of tropical forests. A deeper understanding of the biology of these species can improve the interpretation of biodiversity patterns, leading to more pertinent management practices for biodiversity conservation.

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

Yes, the Rufford Foundation logo has been and will be used in all materials derived from this project. All presentations related to this work in different institutions and by different members of the team exhibited the Rufford Foundation logo. Moreover, scientific papers, manuscripts and divulgation material will continue to acknowledge the support provided to this project by the Rufford Foundation.

11. Please provide a full list of all the members of your team and briefly what was their role in the project.

Gonzalo Halffter Salas, Fernando Escobar Hernández, Albert Maurilio Chan-Dzul Mauro Barrientos, Diego Meneses, and Fernando Gervasio.

12. Any other comments?

The members of my team and I would like to take this opportunity to express our gratitude and appreciation to the Rufford Foundation. Thank you very much for the funds granted which made this project possible.

