Final Project Evaluation Report

Your Details	
Full Name	Tania Marisol González Delgado
Project Title	Effects of fire on mammal communities in Orinoco landscapes
Application ID	25652-1
Grant Amount	£5000
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Date of this Report	10th July 2019

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
Selection of sites affected by fire: Spatial examination of sites with vegetation affected by fire.				Spatial analysis was carried out over the sites that presented fire-affected vegetation. These analyses were done with thermal anomalies and burned area information. This analysis was done for the whole Vichada State to have a wider view of the affected sites and to be able to select the sites where the forests may be currently affected Additionally, a remote sensing analysis was done with satellite images; this analysis yielded the general vegetation cover classification in the study area. This information was used to measure the width and length of the riparian vegetation strips improving the small mammals sampling design.
Survey field season (one-week long): establishment and confirmation of sampling zones (fire affected and non-affected sites, spatially independent).				I made a field trip, 1-week long, for field corroboration and selection of sampling sites. During this field trip I visited the natural savannas where the spatial analysis showed the presence of highly frequent fire and an extended affectation. These visits were done close to the Bita River and the Bojonawi Natural Reservoir, both located at the Vichada State. In this field trip, forests affected by fire at the Bojonawi Reserve were selected because the effects over the forests were severe and the fire disturbed the forests interior. These cases were different from other visited sites, where fire only affected the edge of the forest.
First sampling season (one-month duration, taking place on				**Mammals sampling:** It was designed to use 24 sampling stations, with 10 Sherman traps per station, distributed

November 2018): Small mammal's inventory, with the sampling of both established zones, fire affected and nonaffected. Habitat structural characterization and quantification at sampling sites.				in two rows and spaced every 15 m. Each station will be spaced every 150 m or more and pair with a control station. This sampling design will yield 12 replicas per site (12 in burned and 12 in unburned forest). The first sample event to capture small non-flying mammals took place on November 2018. We obtain 40 captures; we have captured species of the *Zigodontomys* genera and of *Oecomys* genus. For each individual capture the following data has been registered: 1. Genus and if possible, species, 2. Weight, 3. Sex, 4. Age and 5. Reproductive Stage. Whenever an individual was captured, it was mark with haircut over different parts of the body, this process was properly registered; consequently, the haircut facilitated the identification process when recaptures happened during each sampling event. At the first field sampling event, the identification of some captured individuals where not possible at the field camp, thus they were collected for a further identification process in the laboratory of the Natural Science Institute (ICN). Voucher individuals were duly deposited at the mammal's collection of the ICN at Universidad Nacional de Colombia. To characterise the vegetation strata, at the trap level, we used a circular plot of 1 m^2. We measured the vegetation, soil, gravel and roots coverture percentage. Additionally, a description of the composition and structure of the vertical vegetation was carried out.
Second sampling season (one-month duration, taking place on March and April 2019): Small mammal's inventory, with the sampling of both established zones, fire				The second sample event to capture small non-flying mammals took place on March and April 2019. This time frame corresponds to the end of the dry season at the study site. We obtained 37 captures, three of those were recapture several times, and we

affected and nonaffected.				got a new species. So far, we have *Zygodontomys brevicauda, Oecomys concolor, Oecomys* sp1. *Oecomys* sp 2., *Didelphis marsupialis* and one individual of the *Marmosa* genus. Starting at this sampling event, to corroborate the taxonomic identity of the captured individuals, blood samples were taken using an FTA ® card. This process permitted the liberation of the captured individuals and will allow the utilisation of a DNA barcode technique using a COI marker. During this sampling season I remeasured the vegetation variables at the tramp scale (composition, structure and cover).
Field data analysis.				All the vegetation samples taken at the tramps' locations are still in identification process, so far we have identified 80% of the samples. Also, the molecular analysis of DNA is currently underway, this will enhance the taxonomical certainty of the rodent species (samples sequencing).
Other activities				On September 11th and 12th 2018, I was part of the organising committee that held a workshop focused on the territorial management of fire Vichada. The workshop was organized and led by ECOLMOD (the research group I work with) in the framework of the project "Degradation of tropical forests in Colombia: impacts of fire"; The workshop was attended by the local communities, several NGOs with presence in the state, reforestation companies, and representatives from El Tuparro National Natural Park, the town hall and other governmental entities from the state. In this workshop, I was able to articulate the scientific knowledge with the local experience, discussing how fire affect the local fauna. With ECOLMOD, I attended the international forest degradation and

				restauration seminar from 27th to 28th September, 2018. The event organised by the Department of Agrarian Sciences of the National University of Asunción, Paraguay. I contributed with an oral presentation about my PhD research project. From the 1st to 5th October 2018 I attended the IUFRO Conference on Adaptative Management for Forested Landscapes in transformation in Posadas, Argentina. I presented a poster about my PhD research project. On November 30th 2018 I participated at the II National landscape ecology symposium with a lecture about the climatic change and ecosystem services at landscapes affected by fire. During this year with the Rufford grant, I have actively participated in an ECOLMOD initiative. The main objective of the initiative is to develop a baseline for the formulation of laws for an integral management of fire in Colombia. To this end I took part at several workshops with the representatives of Bogotás and Puerto Carreños town halls, also with several senators of the Colombian congress. The work with the concern parties is currently underway and in constant development.

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

At first, the project was planned to be developed close to the Bita River, however, after the spatial analysis and the field corroboration of the potential sampling sites, there were no signs of severe fire damage on the forests, and fire did not pass the forest edge. After further examination, the Bojonawi reserve, which is located at the same region and has the same natural ecosystems, had forests severely affected by fire. Thus, the forests at this reserve worked for the questions lay out for my PhD project and to develop the samplings.

Initially, all the captured individuals during the sampling of small mammals were identified base on morphological characters. However, it is common among the rodent groups that these characters will not suffice for the taxonomical

determination; mainly because these groups are constantly under thorough taxonomical revision and update, especially in a country such as Colombia where is a high probability of finding new species or species not previously registered. To solve this inconvenient, we look for advice with the genetics and evolution research group of the National University of Colombia, led by Dr. Luis Fernando Garcia. With their help, we will use barcoding techniques through the short sequence of DNA, obtained from hair and blood samples taken during the field events. This process will provide certainty in the identification.

Most of the collected vegetation samples, used for the habitat characterisation, had been at unfertile stage during the field events. Also, most of these samples belong to a natural regeneration and this has probe difficult at the moment of process and identification. Nevertheless, with the help of several experts from the Institute of Natural Sciences (ICN), identification keys and the herbarium material, I have been able to process 80% of the samples with a constant work on the remaining 20%.

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

1. In the first and second sampling events of small non-flying mammals at both sampling zones, burned and non-burned, we have obtained almost the same number of individuals. However, at the burned zone, the species *Zigodontomys brevicauda* predominates, this species can use numerous habitats and feed on different resources such as vegetative parts of the plants; which might explain the presence of this species in the affected areas

2. At the unburn sites we found a higher diversity of species, six species have been captured in total. All of them are nocturnal, solitary and ground dwelling except species from genus *Marmosops,* which can be found on trees. These species feed on insects and fruits and is reported to inhabit terra firme forests and seasonal flooded forest, preferring areas close to water bodies.

3. Regarding the habitat characterisation through the study of the vegetation, at the site scale, the burned zone presents a simplification of the structure due to a cover reduction resulting from the high mortality of trees after a fire event and to the accumulation of organic matter. The burnt zone also presents an understorey dominated by herbaceous plants and grasses. Also, this zone shows an increment in fire susceptibility, this is related to the decrease in the canopy cover and understorey humidity, which in turn increases the fuel charge. Likewise, it shows a decrease in parental tres.

On the other hand, the unburned zone vegetation structure is more complex since it has a higher quantity of strata with a dense understorey. It has a predominance of the Fabaceae, Rubiaceae and Phyllanthaceae families.

So far, the patterns observed has led to the conclusion that the small non-flying mammals prefer forests without disturbances, where the vegetation structure is complex.

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

Currently, the landscape ecology and ecosystems modeling research group (ECOLMOD), has a project that assess the degradation of tropical forests in Colombia, the focus of this research is on the affectation of the vegetation as a result of this disturbance and the development of policies for territorial fire management. In September 2018, we developed a workshop in which the local communities of Puerto Carreño and several representatives of NGOs, reforestation companies, El Tuparro Natural National Park, the local city hall and governmental entities participated. Here I had the opportunity to articulate the scientific knowledge with the local experience regarding the effects of fire over the fauna. One result from this workshop was a document with various guidelines to prevent wildfires in the region.

I have actively participated in an ECOLMOD initiative. The main objective of the initiative is to develop a baseline for the formulation of laws for an integral management of fire in Colombia. To this end I took part at several workshops with the representatives of Bogotá's and Puerto Carreño's town halls, also with several senators of the Colombian congress.

The field work process involves help and company for the sampling, transport and samples handling. For this reason, I have worked closely with local people, who have contributed greatly to the development of my PhD project in this remote place of Colombia.

5. Are there any plans to continue this work?

Absolutely. I obtained some funding from Colciencias, which is the institution that finance my PhD studies, to conduct a third field event around November-December 2019 to have an additional set of samples and strengthen the data. I would like to complement this research with new approaches and to develop them after this project is done. Those plans include the evaluation of more complex ecological interactions such as animal movement in areas affected and non-affected by fire, competence and predation, and individual post-fire behaviour. These is really important since the forests are seriously imperiled by uncontrolled fires which make them loose pivotal ecosystem services for the local communities. To continue this processes, I will apply to Rufford once again.

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

With ECOLMOD, I attended the international forest degradation and restauration seminar from 27th to 28th September, 2018. The event organised by the Department of Agrarian Sciences of the National University of Asunción, Paraguay. I contributed with an oral presentation about my PhD research project.

From the 1st to 5th October 2018 I attended the IUFRO conference on adaptative Management for forested Landscapes in transformation in Posadas, Argentina. I presented a poster about my PhD research project.

On November 30th 2018 I participated at the II National landscape ecology symposium with a lecture about the climatic change and ecosystem services at landscapes affected by fire.

Together, with ECOLMOD, beside the current projects in the region, from where I have had the opportunity to socialise the results and updates of our projects regarding fire, we are collaborating with a project that focus in the management and conservation of the Bita River and also seeks to propose this river as a RAMSAR site. We have collaborated with the monitoring of fire and the organisation of workshops to present our results in the second semester of 2019 and 2020. These workshops will include the local communities, reforestation companies, farmers, and cattle ranchers.

The final results of this research will be presented at national and international biology, zoology or ecology conferences, also results will be submitted for publication at indexed journals. Among the manuscripts to be submitted, there is a global meta-analysis about the effects of fire over the fauna that is currently underway.

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

The grant was used between July 10th 2018 and July 10th 2019. The proposal had seven activities, all of them were duly completed during that year thanks to the Rufford fund. However, the activities that were planned to take place before July 2018, such as the establishment of the sampling sites, had to be covered with other resources provided by ECOLMOD.

All the planned activities on the proposal were completed on time. Since this is a PhD project it is necessary more than a year of work and funding to be able to develop more samplings and strengthen the data, also to approach other more complex ecological questions such as the animal movement. Despite of these extra requirements, the Rufford grant cover the bulky part of this project.

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
TRANSPORTATION: 2 roundtrip (Bogotá – Puerto	£650	£726	+£76	Flight tickets for me as a PI and two field assistants for

Carreño, Vichada, Colombia) airfare for the first sampling season. 3 roundtrip (Bogotá – Puerto Carreño, Vichada, Colombia) airfare for the second sampling season.				the first and second sampling season. I hired an additional professional biologist for fieldwork. This was necessary to deploy and the daily check of the 240 Sherman traps, something that would be extremely complicated with only 2 persons.
SUBSISTENCE IN THE FIELD: Food	£200	£600	+£400	Daily feeding (breakfast, lunch and dinner) for researchers (2) and field assistants (3). For 1 field trip of 30 days (the first sampling season). Supplies for the first field trip were bought at Puerto Carreño's market.
ASSISTANTS: Researches (2) and field assistants (3).	£4150	£4850	+£700	A mastozoologist was hired for a month to help during the first field trip. The duties were: to help with the trap installation, captured individuals, animal identification and tagging. Also, too helped for 15 days with the samples treatment in Bogotá (monthly value £700X1. 5 months). 2 mastozoologists were hired for the second field trip. The handling and daily check of 240 Sherman traps was extremely complicated during the first field trip, thus I decided to employ an extra person. (Monthly value £700 X 1 month X 2 professionals). 3 Field assistants: guide and support. Cook, feeding logistics. (Monthly value £320 X 2.5Months X 3 assistants).
TOTAL	**£5000**	**£6176**	**+£1176**	**Local exchange rate: 1 GBP = 4.015,11 COP**

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

In first place, I would like to develop a third field trip around November- December of 2019 to have an additional sampling and strengthen the data.

Secondly, finish the simples processing and keep going on with the data analysis to prepare the publications derived from this work and complement my PhD document.

Thirdly, take advantage of the academic conferences that will take place in the region to spread the results of my research and participate actively in processes of fire management in Vichada and the country.

Finally, complement this project with new approaches to evaluate more complex ecological interactions such as animal movement, competition and predation, in order to know how they are affected and how resilient these ecosystems are to a disturbance such as fire.

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, I have used the Rufford Foundation logo in every produced material that is related to this project, always giving thanks to Rufford for the support of this project. This includes oral presentations at research seminars at the National University of Colombia, the international forest degradation and restauration seminar in the National University of Asunción, Paraguay (September 27-28 2018), the II national landscape ecology symposium (November 30 2018) and the Newton biodiversity workshop on tropical transitions: the role of biodiversity in resilience to global change of tropical South American ecosystems organized by the University of Oxford and Universidade Estadual de Campinas (October 29-31 2018).

Also, I used the Rufford Foundation logo on a poster presented at the IUFRO conference (October 1-5 2018).

The logo will be use in future conferences, seminars, symposiums and lectures where I will give the respective credits to the foundation for the funding and help.

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

Dolors Armenteras, PhD: she is my PhD advisor and she has collaborated with all the scientific, technic and administrative part of my project.

Nathalia Moreno, BSc: biologist with experience with sampling and handling of mammal samples. She was hired for both field trips, helping with the deployment of traps, capture and identification of the captured animals.

Francisco Luque MSc. BSc: biologist with experience in sampling and treatment of field samples. He was hired for the second field trip and help with the deployment of traps, capture and identification of the captured animals.

Beyker Castañeda: Puerto Carreño (local) resident. He helped with the organization and logistics of the field trip, he collaborated as driver and with the traps checking.

Brayan Marin: Puerto Carreño (local) resident. He helped with the field work logistics, he collaborated as a driver and with the trap checking.

Nelcy Vega: Puerto Carreño (local) resident. She helped with the food logstics and collaborated as a cook.

Others: this Project has counted with the collaboration of **María Meza** (Msc) and **Gina Sierra** (BSc), who had helped with the process of botanical samples.

12. Any other comments?

The additional resources needed to fulfill parts of the planned activities of this project and to continue with the field work, have been provided by ECOLMOD and Colciencias.

I am deeply grateful with The Rufford Foundation for the small grant awarded. It has been a great help and it has allowed me to develop the bulky part of this project. Because of it, I was able to work in a remote but highly biodiverse area of Colombia that is currently threaten by uncontrolled fires.

Field work at forest affected and degraded by fire at Bojonawi Natural Reserve, Vichada – Colombia. © Tania González.

Field work at Bojonawi Natural Reserve, Vichada – Colombia. © Tania González.

Zygodontomys brevicauda. © Tania González.

Oecomys sp. © Tania González.

Marmosops sp. © Tania González.

Vegetation identification process. © Tania González.

Collaborations in workshops, Vichada – Colombia. © Tania González.