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	Cornelio Andrés Bota Sierra
Project title	Quantifying the vulnerability of a tropical mountain dragonfly community to climate change challenges
RSG reference	26016-2
Reporting period	
Amount of grant	£5000
Your email address	corneliobota@gmail.com
Date of this report	25-02-2020

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
Weekly environmental workshops done with kids at Santa Cecilia, ending with a theatre play for the whole community (https://www.youtube.com/watch?v=MOXVKw2zprE).				This objective was harder to achieve than previously thought which made us intensify the workshops to two or three per week in the last 2 months (it took 4.5 months to finish).
Mural painting showing the region's history tangled with its biological richness. (https://www.youtube.com/watch?v=e4SbPSGsXHs&t=13s)				We had the opportunity to paint two murals, one inside an Embera indigenous town and other in Santa Cecilia's main square.
Measurement of the basal oxygen consumption performance vs temperatures dragonfly adults.				We performed 401 successful experiments in 23 species of six genera.
Measurement of the basal oxygen consumption performance vs temperatures dragonfly larvae.				We did not get the funds to buy the equipment required for this objective, so we changed the experiments we had planned for larvae (as described in the next objective that we included in the project).
Transplant experiment for larvae of the genus Erythrodiplax.				We raised larvae from the eggs to the adults at five different temperatures simulating the elevation gradient in the area. The eggs were collected at 350 and 1350 m asl. We got curves for optimal temperatures of larval growth.
To describe the new species found in the region.				We have described *Andaeschna occidentalis* and published a field guide for the region including two undescribed species in the genera *Archaeopodagrion* and *Telebasis,* the scientific publication is under process.

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

We did not get the funds to buy the aquatic oximeter needed to measure the breathing rates for larvae, so we changed this objective. Since we wanted to know how temperature is affecting the immature stages in dragonflies, we chose three species in the genus *Erythrodiplax* and raised them at five different temperatures that simulated the environmental ones along the elevation gradient, we measured the head size on each instar and this allowed us to find the optimal growth temperatures for the larvae.

We also had difficulties with the theatre play performed by the kids, it took us much more time and effort than previously thought, but we solved it devoting more time to this activity.

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

First, we manage to plant the seeds of ecology and conservation in several young minds through the environmental workshops. Also, the mural painting in the main square of Santa Cecilia was embraced by the community making them proud of their region and giving a message of conservation to the visitors.

Second, we collected valuable data on the ecophysiology of dragonflies, both in larva and adults, which helps us to understand the role of temperature in the biological richness of tropical mountains and gives us insights on how the climate change can affect these insects.

Third, we keep finding new species for the region and for science, making this the richest known area for dragonflies in Colombia. In parallel, we are collecting natural history data, both for adults and larvae, which is the base for future conservation and ecology projects.

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

Community got involved in several aspects in the project:

We were assisted in our experiments both in the lab and in the field by four people in the community; they learned taxonomy, ecology, and different lab techniques to work in ecophysiology and dragonflies. Also, they taught us about their culture and the way they use and perceive their environment.

17 kids participated in the environmental workshops; we involved their families sending some homework and through the final theatre play, when a big meeting was done to present what was done during all the time we worked with them. Besides the new ecology concepts, I think the most valuable learning for them is to acknowledge the importance of their territory and their culture, showing them the

vast natural richness they have, and that they did not recognise this before as it is not shown in television as a concept of richness (which is their cosmos).

In the mural painting represented a great knowledge interchange, it was done between the local community and the artist collective BioGrafos. We interacted for one week in Santa Cecilia while collectively prepared the mural design, and then, in the painting process, several local people approach to ask, talk, contribute new ideas, help painting, among other related activities, which makes of the mural a beautiful and representative future of Santa Cecilia's urban scene, product of the collective effort.

5. Are there any plans to continue this work?

Yes, right now we are attested with data and our priority is to publish a series of papers communicating our findings, mainly in the ecophysiology of the odonates studied in this region and also describing the new species or undescribed larvae of the dragonflies in this region. We expect to spend the next year in this process but after that we plan to go back to the field to keep closing the gap in the knowledge of dragonflies in Colombia. Right now, 17 species of endemic Colombian dragonflies are assessed as endangered by IUCN which means a lot of work to do.

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

We have used social networks as YouTube and Facebook to share the results of the social component of the project (theatre play and murals). We have published a bilingual (Spanish and English) field guide about the dragonflies in the region and five refereed papers on scientific journals. We did talks at universities, museums, and symposia sharing the results of this work. We plan to publish three more ecophysiology scientific papers and some others in taxonomy of larvae and adults of the region.

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

The grant was used from August 2018 to June 2019, it matched the anticipated length of the project pretty well.

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
Local field assistants	1400	1400		
Housing and food for six people (The artist collective) during two weeks at Santa Cecilia	300	300		There was an extra person, but the difference was covered with other funds.
Bus tickets (Round Medellín-Santa Cecilia, for six people, the Artist collective)	118	118		
Materials for the mural	150	150		
Materials for the community workshops (Stationery material. Sandwiches, oatmeal, and juice for around 15 people)	200	200		We did more sessions; the difference was covered with other funds.
Materials to store, transport and collect dragonflies (Ethanol, acetone, plastic boxes, Glassine envelopes, Ziploc bags, pens and field notebooks)	74	74		
Thermostate, thermometer, containers, pumps and others to make the larvae arena	200	200		
Housing and food in Medellin (One month, for one person)	200	200		
Housing and food in Santa Cecilia (five months, for two people)	1000	1000		
Housing and food in Tatamá (three months, for two people)	990	990		
Terrestrial transport from Tatamá to Pueblo Rico (once each week, for three months, for two people)	58	58		
Internal Air tickets in Colombia (Bogotá-Cali and Medellin-Bogotá)	50	50		
Round Air ticket Mexico City-Bogotá (Colombia)	160	160		
Bus tickets (Round Xalapa-Mexico City; Cali- Pueblo Rico; four Medellín-Pueblo Rico)	100	100		
Total	**5000**	**5000**		

***Note:** Here are recorded how we spent the funds provided by the Rufford Foundation, we did have extra expends which were cover with funds from other sources.

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

First, we have to publish the papers communicating our findings in ecophysiology and natural history. Second, we feel one of the crucial labours to conserve and learn from dragonflies in Colombia is their popularisation among the general public, we plan to work on field guides and resources for the public, also more workshops and talks around the country are needed. Finally, the collection of basic scientific data and the establishment of conservation plans for the endangered species are urgent in order to preserve these beautiful insects.

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

Yes, we used the logo in the field guide "Libélulas de la Cordillera Occidental Colombiana, una Mirada desde el Tatamá // Dragonflies of the Colombian Cordillera Ocidental, a look from Tatamá". Also, it is in the theatre play and mural videos in YouTube (https://www.youtube.com/watch?v=MOXVKw2zprE, https://www.youtube.com/watch?v=e4SbPSGsXHs&t=13s). Likewise, we use the logo in acknowledgement section of several talks involving the data of the project. Finally, we acknowledge the Rufford Foundation in all the scientific papers published in peer reviewed journals.

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

Advisors: **Dr. Rodolfo Novelo, Dr. Gustavo Londoño, Dr. Federico Escobar**, and **Dr. Adolfo Cordero.**

Field and lab assistants: B**las Cardenas, Jose Mosquera, Andrés Machado**, and **Viviana Tapasco**.

Co-researcher: **M.Sc. Juliana Sandoval**, who is in charge of the transplant experiment with the larvae and the analysis and publication of this data. Most of the data and the results were compiled in her Master's thesis, with which she obtained this degree She also actively participated in the environmental workshops and the mural painting.

BioGrafos artists collective: **Natalia Uribe, Veronica Uribe, Silvana Osorio, Ana Sepúlveda, Camilo Flórez, Natalia Flórez,** and **Ana Ospina**.