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	Variability in Temperature Resistance among a Tropical Mountain Community of Dragonflies: Implications for Arthropod Dispersal Limitation in a Warming World
RSG reference	19846 – 1
Reporting period	Final report
Amount of grant	£5000
Your email address	corneliobota@gmail.com
Date of this report	15/12/2017

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
Workshops with the kids in the local schools: reaching the community				We concentrated our efforts in the school closer to the park where we managed to involve the whole community including the adults in the activities. Also we visited two schools and gave talks and workshops in 1 day.
List of species for the Park and description of new species				Four papers were published and one is in review process, dealing with Tatamá's dragonfly taxonomy - four new species, descriptions of three previously unknown females, rediscovery of one species and new records for the country are provided.
Field guide				We got pictures for 100 of the 104 species recorded in the park and surroundings. We wrote diagnoses and natural history remarks in Spanish and English for all the species. We are still working on the elaboration of distributional maps which will be the last step to give the manuscript to our designer and then publish it, we expect to have the books in March 2018.
Measurement of ecophysiological characters (Critical thermal temperatures and temperatures of heat avoidance).				We measured a total of 912 individuals from 72 species; among them we got samples of 10 or more individuals for 38 species. All data were statistically analysed and properly discussed.
Scientific paper to communicate the thermophysiological results found.				The first manuscript is done, now we are in the discussion process previous to submit it to a scientific journal

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

The equipment to measure temperature in dragonflies broke for 3 weeks and then we experienced very bad weather in December 2017 and January 2018, with a lot of rain and therefore scarcity of flying dragonflies. Therefore we had to work even on Sundays to compensate for the bad weather days. We had extra help from three volunteers, two of them BSc students who worked with the project while developing their thesis. Nevertheless we had to hire extra people for more time.

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

With our thermos-physiological measurements added to the environmental temperatures measured in the past 3 years at the park, and the projected temperatures, we created an index of extinction risk due to climatic change, in which the species with thermos-physiological limits closer to the environmental temperature were much more endangered than species whose thermo-physiological limits are far from the environmental temperatures they inhabit today. Sadly, we found that close to 20% of the species are endangered despite of their presence inside a protected national park, since global warming will affect all the planet without discrimination between protected and unprotected areas.

We managed to create a complete list of the dragonflies of the region with 104 species, describing four new to science, rediscovering eight species and recording four species and one subspecies for the first time in Colombia. These results are being published. Four scientific papers are already published and we are working on another one that is close to being submitted for review, the field guide will summarise all of the findings presenting them in a language accessible for the general public.

We got accepted by the kids in the schools - they were very receptive to our message and they got in contact with a different point of view regarding the great diversity that surrounds their houses. They understood well the importance of preserving the forest not only because of the amazing and beautiful species that live there but also because of all the services it provides for their own lives. At the end of the workshops the kids made a puppet show for their parents, sharing the messages we were working on. We managed to reunite the whole community including park rangers and all the families living in the park surroundings in a nice afternoon of traditional food, puppet show, soccer, traditional music and conservancy messages.

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

In addition to the workshops in the schools, we hired three local people to guide and assist us in the field and during the thermos-physiological measurements. They got involved in the project, learning a lot of insect biology and ecology, especially on dragonflies and getting so interested that, for example, they made some of the pictures we are including in the field guide. Since some of them are already birding

guides, and we expect to promote dragonfly tourism in the park they surely will become excellent dragonfly guides too.

5. Are there any plans to continue this work?

Yes, we have the opportunity to expand the fieldwork to the lowlands (Santa Cecilia town), where a big community of afro-descendants and Embera Indians live. The area harbours an amazing diversity with several social problems which are directly affecting the natural resources and conservancy of the species there. On the other hand, we did not find a good relation between thermos-physiological resistance and altitude in the adults, so we can`t explain the altitudinal segregation of the community of dragonflies in Tatamá. Now we want to go back and continue the project but this time the headquarters and most of the workshops will be concentrated in Santa Cecilia; we want to keep the thermos-physiological measurements but this time our target will be the aquatic dragonfly larvae which can be the limiting phase for their distribution.

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

We are publishing scientific papers with the findings of the project, also we will get the field guide finished and printed in the first months of 2018. Two talks were given in 2017, one in the International Congress of Odontology held in Cambridge, UK and the other in the Students Colloquium at the Ecology Institute in Jalapa, Mexico. In the future, we plan to give a talk in the Latin-American Congress for Aquatic Macroinvertebrates which is going to be held in Quito, Ecuador. Also, we shared some of our results in the social networks (like the puppet play video https://www.youtube.com/watch?v=_KqNSiBP6mA&t=540s), we plan to make a Facebook group for Tatamá dragonflies after the publication of the field guide.

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

We began using it on July 2016 and it is still being used since we have not spent the money to print the field guide. The time is longer than we expected as we had trouble with the weather when doing the fieldwork and we expanded our area of study to the lowlands, which made the taxonomical work more complicated and longer. I have been invited to work in other projects and have to fulfil a lot of requirements for my university to graduate on time, so this also made the publication of the results slower.

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
Bus tickets (Round Xalapa-Mexico DF; Cali- Pueblo Rico; three Medellín-Pueblo Rico, for two people)	100	130	-30	The ticket costs raised.
Round Air ticket Mexico DF-Colombia Bogotá	320	320	0	
Internal Air tickets in Colombia (Bogotá-Cali and Medellin-	70	70	0	
Transportation from Tatamá to Pueblo Rico (once each week, during eight months, for two people)	250	200	50	Because we move to Santa Cecilia for some weeks we save on the transportation
Food in the field (eight months, for two people)	2880	2880	0	
Housing in the field (eight months, for two people)	2400	2400	0	
Housing and food in Cali (One month, for one person)	355	355	0	
Housing and food in Medellin (One month, for one person)	400	400	0	
One Chamber Temperature controller PELT-1 and its controller PELT-5 (Sable systems)	80	80	0	
Thermocouple TMC- 2000 (Sable Systems)	80	80	0	
Other materials and equipment for measuring dragonflies critical temperatures (three 250 Watts bulbs, one pound of beeswax and electric wires)	70	70	0	
Materials to store, transport and collect dragonflies (Ethanol, acetone, plastic boxes, Glassine envelopes, Ziploc bags, pens and field notebooks)	90	90	0	

Materials for the community workshops (200 sheets of Bond paper (1x1m); five boxes of 120 crayons; Sandwiches and juice for around 15 people x 10 times)	385	400	-15	Some products were more expensive.
Print of close to 200 field guides (approximately 80 pages and 70 colour plates)	1320	0	1320	Still in process, we have not spent the money yet.
Local field assistant (half time contract for eight months)	600	1000	-400	We have to pay extra time to compensate the bad weather days.
Totals	9398*	8475	925	*(5000 RSG + 4398 other)

Notes to budget: Rate when grant funds were received 1 Sterling Pound = 4100 Colombian Pesos

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

1. To finish and public the field guide.
2. To finish and publish the thermos-physiological paper.
3. To get funds for coming back in a second project for the lowlands in which the work with the larvae will be the nuclear part.

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, I used the logo in the acknowledgement slide of the two congress presentations and at the end of the video showing the puppet play. Also, the Rufford Foundation was acknowledged in the four scientific papers that were published this year. Also, it will be acknowledged in the coming papers and in the field guide.

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

Fernanda García Ibarra (Biology student), Volunteer for a month, she helped in the field catching dragonflies, photographing them and making the temperature measurements, she is also involved in the field guide process making some illustrations for the morphology section and editing texts.

Angie Orejuela Yustes and **Daniela Ayala Sánchez** (Biology students), they volunteer working for the project during seven weeks, then began their thesis with dragonflies, Daniela worked in Tatamá looking for the capability of adult dragonfly communities to indicate the conservation stage of an ecosystem. Angie worked in urban

wetlands at Cali, looking for the relation between pollution and deforestation and dragonfly assemblages in these ecosystems.

Camilo Flórez Valencia and **Juliana Sandoval Hernandez** (Biologists), they were hired for two months to help in the field catching dragonflies, photographing them and making the temperature measurements. Juliana is involved in the field guide process she is doing the distributional maps and she is also editing the texts, she co-authored one of the taxonomy papers.

Daniel Borbon (Teacher) in charge of La Selva School where most of the workshops with the kids were performed, he participated actively in all the activities with the kids, becoming a great support for the project.

Blas Cardenas (Peasant and environmental leader at Santa Cecilia), hired as guide and field assistant for two months.

Antonio Tapasco and **Leopoldina Tapasco** (Peasants and birding guides), hired as guides and field assistants for two months.

Natalia Uribe Macias (Biologist), volunteered in the field and worked on the illustrations of some of the diagnostic characteristics of the new species.

Analiesse Ibarra (Designer), is working on the design and edition of the field guide.

Rodolfo Novelo Gutiérrez (PhD in Science) got involved from the writing stage of the project, and has been a very important support for all the aspects of the project, especially for all the taxonomic part of the project, he is coauthor of two papers and is involved in the field guide process as author he wrote part of the guide.

Carlos García Robledo, **Gustavo LondoñoGuerrero** and **Federico Escobar Sarría** (PhDs in Science) they got involved in the project from the writing stage, their advice and support have been crucial for the ecophysiological part of the project.

Libaniel Osorio and **Carolina Guzman** (Park rangers), join us in the field several times, helping us to catch dragonflies and making the thermophysiological measurements, they also helped us the school workshops.

12. Any other comments?

We apologise about the delay with this last report, we were trying to get the field guide done to send it complete, but it takes us too long. Thank you so much for all your help and comprehension - we will let you know any further news of the project.