

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	David A. Prieto-Torres
Project title	Defining conservation priorities of Seasonally Dry Tropical Forest, one ecosystem globally threatened: Conservation insights under future global climate change
RSG reference	16017-1
Reporting period	December 2014 – December 2015
Amount of grant	£5000
Your email address	dprieto@cmc.org.ve
Date of this report	January 2016

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
<p>1. To produce consensus of online and museum datasets using the information along the Seasonally Tropical Dry Forests (SDTFs) distribution, in order to selected target areas to perform field surveys for ornithological inventories (which was included in our analysis), as well to select localities for validation of SDTFs.</p>			Yes	See final comments section for a list of ornithological and botanical collections of international and national museums that kindly provided data included in the project.
<p>2. To generate data on the origins and relationships among the main SDTFs' current areas, providing information and hypothesis about the dynamic response of SDTFs to climate change and its effects in the biodiversity patterns.</p>			Yes	
<p>3. To provide evidence on the impact of the climatic fluctuations in the patterns of richness and endemism during the last inter-glacial and glacial maximum, as well as to understand the tendencies of potential response of SDTFs under diverse future climate scenarios (considering the use of climate projections from different global climate models in the short- and long-term).</p>			Yes	
<p>4. To identify unique biogeographical units to be protected at continental and national scale, considering the uniqueness of each area, their relationships among them, the species richness and endemism, as well the possible response to climate change and role of current protected areas in order to maximising conservation strategies in the ecosystem and their diversity.</p>			Yes	

<p>5. To develop community workshops and training young biologists to conduct conservation oriented research in the Neotropics, training to researchers, rangers and local people in fieldwork techniques, the birds' identification, and use of Geographic Information Systems.</p>			Yes	<p>We planned together with the Universidad del Zulia and the Instituto Nacional de Parques (INPARQUES), both from Venezuela, the development (for December 2015) of a new training course titled "Use of Geographic Information Systems (GIS) for Ecological and Conservation Studies", which is for undergraduate and postgraduate students, and for the local ranges in the Zulia state. However, this course was re-programed for March/April 2016 due the social-politic conditions in the country by the national elections of parliament.</p>
<p>6. To produce reports, papers, and other scientific-educational material about endangered SDFs and its birds' diversity to be disseminated among stakeholders.</p>		Yes		<p>The most of documents in this moment are in the submission (review and evaluation) process yet, or in preparation (see below, point 3).</p>
<p>7. To strengthen our collaboration with local NGOs, private and governmental institutions. This initiative is currently developed among a multidisciplinary team and some institutions with wide expertise in research about SDFs, biogeography and bird species.</p>			Yes	

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

As every macro-project some difficulties arose during the fieldwork, data collections and analysis process, which should be shared:

- Despite the information used in this project is mainly derived from a long list of online databases and national museums (ornithological collections and herbariums), is important to note that some national institutions contacted by us (which do not have their information in any open data source as GBIF or ORNIS) not expressed interest in participating or cooperation to facilitate access to their database. Unfortunately, we could not integrate that information and was not used that data in our analysis.
- Some collections do not have their database in digital form; which takes time and significant effort in order to integrate the information in the consensus of museums' datasets. Is important to note that this information was analysed with the Geographic Information System in order to identify gaps of information along the STDFs' distribution and to select the target areas to perform field surveys for ornithological inventories and validations of models of distribution.
- As we assumed, we found many areas with multiple gaps of ornithological

information along the SDTFs distribution in the Neotropics. Unfortunately, the budget and time available did not allow covering all these areas of study. Based in these points, the selection of sampling locations was focused on sites for the validations of the ecological models obtained for SDTFs distribution with very low amount of records associated of species. However, we consider important to promote and continue the surveys and ecological studies of birds' species in this ecosystem, primarily on information for endemic species. These kinds of species (i.e. endemic) represented a major difficulty for our analysis (i.e. ecological niche modelling) due that in some cases the presence records were few.

- The scanning process (including verification, validation and review of records by species) took longer than the originally estimated in the project, especially for the following reasons: 1) The large amount of data collected for the species of birds associated or reported over the distribution of these forests which was supported for a long list of institutions (see final comments); 2) The overlap in the schedule of academic activities, field trips and museum visits at certain times of the year; 3) The computer used for the fieldwork and the analyses broke down, which represented a delay in the develop of activities. For this reason, we hired staff to assist in the digitisation of data, and bought a new computer.
- In some cases the transportation, accommodation and feeding were more expensive than expected. We solved this problem modifying in some case the sampling period or if was need the original budget of project (only in particular cases).

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

- This project has provided updated basic information on distribution of bird species associated to SDTFs in the Neotropics, as well as richness patterns, threats and protection levels for the present and under climate change scenarios. Particularly, we provided evidence about origins and relationships among the main SDTFs nucleus in the Neotropics in order to identify protection priority units to maximising conservation strategies in the ecosystem and their diversity in medium- and long-term. It is important to note that local communities are not completely aware about the importance, value and potential of SDTFs; thus, one important outcome in this project was to provide scientifically data, training and advice to student and the local rangers in order to help them with monitoring of biodiversity (species recognition and the use of Geographic Information Systems).
- The results show that the specific impacts of climate change on SDTFs are not uniform across its distribution and illustrate the differing magnitude of effects that may be expected for the richness values of particular regions along their distribution. The following patterns emerge from these predictions when SDTFs species were modelled: (i) the coincidence between current SDTFs' distribution and future projections tended to decrease with time; (ii) in general, SDTFs will occupy higher regions above the current average elevational distribution; (iii) changes in the extensions of areas with low and high species richness pose species turnover in some local communities (i.e. it is expected that as climatic conditions change, new natural communities with unknown ecological properties may arise); and (iv) out of the SDTFs extent predicted to survive, less than ~45% will remain intact given current land use practices (anything except conserved natural forest) and only less than ~10.0 - 12.00% will remain under protection.
- The information achieved with this project, is useful to justify the importance of conservation planning and recovering activities in the protected areas, as well as the creation of new protected areas and ecological corridors within fragmented dry forest landscapes. However, the management and creation of protected areas must also extend to the wide area of influence and incorporate not only the conservation focal sites, but also surrounding areas under a social scope that considers restoration and sustainable development. Thus, we propose the creation of dynamic protected areas (DPAs) as an alternative strategy in

developing reliable adaptation and mitigation strategies to conserve the biodiversity of focal ecosystems. Our proposal of DPAs will concomitantly integrate climate-change scenarios within present conservation strategies and the shifting dynamics of populations throughout an ecosystem's distribution and its transitional areas. Therefore, the selection of new PAs could satisfy representation targets for both current and future distributional ranges at once. Adding new areas to conserve both present and future ranges of species represents a less costly strategy (in area and resources) than using a two-step process (i.e. representation of current ranges and afterward addressing the consequences of climate change; see Hannah *et al.* [2007] and Prieto-Torres *et al.* [2016] for a complete discussion).

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

We develop diverse academic and educational activities as part of our campaigns of the involvement of local communities:

We conducted the training of four young biologists (two undergraduate and two postgraduate) in the development of research projects oriented in the conservation, as well as in the fieldwork techniques, the birds' identification, and use of Geographic Information Systems. It is important to note that these students are from three different Universities and countries (the Universidad Autónoma de Queretaro-Mexico, the Universidad Nacional de San Antonio Abad de Cusco-Peru, and the Universidad del Zulia- Venezuela), and three of them are preparing their thesis projects in topics about the effects of climate change scenarios in the fauna distribution and identification of conservation unit priorities.

We carried out (in the Universidad del Zulia, Venezuela) the motivational talks entitled "*Why to study Biology? (¿Por qué estudiar biología?; in Spanish)*". These talks had the purpose to show the need to address problems about biodiversity conservation in the present time, and mainly we focused on demonstrating, based on increasing evidence, how the distribution and survival of species and the ecosystems in which they inhabit, are being affected by climate change. This shows the need of more biologists in the world to study those effects and develop conservations strategies.

We developed an academic course for undergraduate and postgraduate students of Universidad Nacional de San Antonio Abad del Cusco (Perú), as well as for the local ranges and ONGs. The academic course was titled "*Use of Geographic Information Systems (GIS) for Ecological and Conservation Studies*" (Uso de Sistemas de Información Geográfica para estudios ecológicos y de conservación; in Spanish)". Through this course, the 22 participants were trained in the following topics: the different uses of GPS; the development of spatial analysis of maps; the need of integrate social, ecological and biological components in the development of future conservation projects; and the importance to attend problems about the local and national distribution of species, ecosystems and biodiversity.

We participate, as invited conferences, in the following academics courses, where were showed the first results of this project: 1) Biogeography, coordinate by Dr Quiyarí Santiago-Jiménez (Universidad Veracruzana, Mexico), where we presented the talk "Ecological Niche Modelling approximation" (Una aproximación al modelado de nicho ecológico, in Spanish); and 2) Ecological Niche Modelling, coordinated by Dr Octavio Rojas (Instituto de Ecología, México), where we presented the talk "Ecological Niche Modelling and Species Distribution Models: Its use in studies of conservation and climate change" (Modelos de Nicho Ecológico y Modelos de Distribución de Especies: Su uso en estudios de conservación y cambio climático; in Spanish).

Additionally, we use every opportunity to explain local people and visitors about the importance of seasonally dry tropical forests, as well as about their diversity, the climate change effects and the importance of to protect species and environmental services.

Finally, it is important to note that, we planned together with the Universidad del Zulia and the Instituto Nacional de Parques (INPARQUES), both from Venezuela, the development (for December 2015) of an new academic course titled "Use of Geographic Information Systems (GIS) for Ecological and Conservation studies", which is for undergraduate and postgraduate students, and for the local ranges in the Zulia state (approx. 20 participants). However, this course was reprogramed for March/April 2016 due to the social-political conditions in the country by the national elections of parliament.

5. Are there any plans to continue this work?

Yes, absolutely. The extensive of study area and the ornithological information gaps through the SDTFs distribution areas showed the need to continue the studies and monitoring in order to generate more ecological and hardest information, mainly to adapt the recommendations to each particular region (i.e. national scales) in the Neotropics due that impacts of climate change on SDTFs structure and biodiversity are not uniform across its distribution.

During the next months, scientific publications, technical reports, and scientific-educational material will be prepared and will be submitted in order to complete dissemination of results obtained among stakeholders (including students, researches, ranger, local communities, NGOs and governmental institutions)

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

This project is part of my final work to obtain the degree of Doctor in Biological Sciences in the Instituto de Ecología A.C. (INECOL, A.C.), which will be finish during this year. Thus, we plan to develop public presentations of some preliminary results in local universities, and to have a discussion session after that, which allow us to show our research to other groups, as well as to explore possible collaborations in the near future.

At this time, We presented three oral presentations of the project and its results in the following international and national events:

I Simposio de Biogeografía Ecuatoriana: Cambio climático, biodiversidad y ecosistemas amenazados. Quito, Ecuador (September 2015).

Rojas-Soto O. y D. Prieto-Torres. De la autoecología a la cinecología: Reconstrucción de los ecosistemas terrestres a partir de modelos individuales de nichos ecológicos.

III Simposio Venezolano de Evolución. Caracas, Venezuela (November 2015).

Prieto-Torres, D., A. Navarro-Singüenza, E. Bonaccorso, D. Santiago-Alarcon, L.N. Naka y O. Rojas-Soto. Biogeografía de los bosques secos del Neotrópico: Un análisis basado en modelos autoecologicos de especies y paleodistribución.

XI Congreso Venezolano de Ecología. Porlamar, Venezuela (November 2015).

Prieto-Torres, D., V.C. Malavé-Moreno y O. Rojas-Soto. Estabilidad histórica y futura de los bosques secos tropicales de Venezuela y Colombia: Perspectivas de conservación a largo plazo.

Finally, at this time, we have published a paper in the Global Change Biology Journal, which was title "*Response of the endangered tropical dry forests to climate change and the role of Mexican Protected Areas for their conservation*". Additionally, it is important to note that we sent two

additional papers to scientific journals (in review and evaluation process yet), and two new papers will be send to journals in March 2016.

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

The Doctoral thesis project started in February 2014; however, the sampling period and data collection process was performed between October 2014 and December 2015. The grant provided by RSGF was used throughout the duration of the fieldwork as planned, between December 2014 and December 2015.

It is important to note that this phase of the macro-project -which was built on a 4-year project partially funded- some activities (i.e. produce reports, papers, and other scientific-educational material) were delayed some months later of what was expected at the beginning due the unforeseen difficulties cited previously (see point 2). However, this situation (very common during the dissemination of projects results) is being addressed and expected to send the final documents to journals and institutions in the next three or four months.

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.

This project has institutional support to cover the costs, including the *Instituto de Ecología A.C.* (INECOL, A.C.; Mexico), IdeaWild Foundation, *Consejo Nacional de Ciencia y Tecnología* (CONACYT, Mexico), and others. The total RSG found was used (from December 2014 to December 2015) to buy equipment and increase the number of fieldwork days in the countries, to collect information from records of species through inventories and visit national and international museums for verification of information and species records.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Field material (lamps free hands, rechargeable batteries, Waterproof rain, camping tents, sleeping bags, portable tables and chairs, and Carbon Steel Family Cook set, and others)	0.00	100.00	-100.00	We need to buy some materials required (ex. Dual-Port Solar Charger) because they were hurting or/and was lost during the fields activities.
Collecting materials (binoculars, field tags and laboratory, digital caliper, mist nets, cloth bags)	0.00	0.00	0.00	N/A
Equipment (Garmin GPS**, digital camera*, Laptop)	200.00	200.00	0.00	N/A
Equipment (Desk computer and Portable External Hard Drive)	200.00	100.00	100.00	The rest of money was used to buy a new laptop for the field activities.

International airplane tickets (to El Salvador, Costa Rica, Colombia, Venezuela, Bolivia, Ecuador, Brasil)	1,200.00	2,000	-800.00	Savings from Rental Vehicle and Accommodation allowed me to use the money for pay the airplane tickets; which were more expensive than expected.
Rental Vehicle	1,200.00	700.00	500.00	Transport for some field activities was provided by ONGs, Universities or local Communities
Feeding Meals (for 15 days for 2-3 people, 10 field trips)	1,500.00	1,600	-100.00	The feeding meals costs were more expensive than expected.
Accommodation (Lodging for 5 days for 2-3 people, 10 field trips)	700.00	300.00	400.00	Accommodation costs were cheaper than expected due that in some cases I have support of ONGs, Universities and local friends
Material (Field Notebooks, Pencil Box, Bookmarks, printer, letter paper, and CD's Box)	0.00	0.00	0.00	N/A
Participation in Conferences	0.00	0.00	0.00	N/A
Costs of publication of articles	0.00	0.00	0.00	N/A
TOTAL	5,000.00	5,00.00		

Notes: * Fund received from RSG was \$ 108,499.5 Mexican Pesos (£1 = \$ 21.83 MXN P [December 2014]); including the international interbank transfer costs.

The local exchange rate used was a mean of **24.29 ± 1.32 (21.9 – 26.87) in the year.

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

During this project, large amounts of data were collected with the purpose to be analysed completely before the submission of my Doctoral Thesis document. Considering this, ongoing work is being carried out to submit a final draft this year; thus, the most important step is to finish the production of reports, papers, and other scientific-educational material in order to prepare a draft of final document. This step is very important because the information obtained will contribute to the assessment of threats, the extinction risk and definition of conservation priorities, representing an important contribution to justify the importance of conservation planning and recovering activities in the areas through the SDTFs distribution areas.

The next step is to formally submit this information to local authorities (Environmental Directions, and NGOs), to enforce a strategy to support the conservation of natural forests while the local people keep a sustainable use of the resources they need (habitat, food, others).

Finally, we propose to study the possible species turnover in some local communities and among ecosystems (considering the transitional areas among them) due to climate change, which could lead to the emergence of new natural communities with unknown ecological properties. Despite, these kinds of studies might take several years to identify the patterns associated to changes; we consider that this would be an important next goal to achieve in the protection and conservation strategies for SDTFs.

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?

Yes, RSGF logo was used in each of the public presentations of the project results, as well as in the posters referring to the project and the t-shirt used by the personal during the fieldwork.

Specifically, I used the RSGF logo during the following presentations and events:

- **XI Congreso Venezolano de Ecología.** Porlamar, Venezuela (November 2015).
- **III Simposio Venezolano de Evolución.** Caracas, Venezuela (November 2015).
- **I Simposio de Biogeografía Ecuatoriana: Cambio climático, biodiversidad y ecosistemas amenazados.** Quito, Ecuador (September 2015).
- **Course: Ecological Niche Modelling.** Instituto de Ecología. Xalapa, México (Septiembre 2015).
- **International Course: Use of Geographic Information Systems (GIS) for Ecological and Conservation studies.** Universidad Nacional de San Antonio Abad de Cusco, Perú (Junio de 2015).
- **Course: Biogeography.** Universidad Veracruzana, Xalapa, México. (May 2015).
- **Motivational talks: "Why to study Biology?"** Universidad del Zulia, Venezuela (April 2015).

Additionally, RSGF will be mentioned in the acknowledgments of all documents arising from the analysis of the results of the project.

11. Any other comments?

It is important to note that in some cases (academic reports and article of journals) we changed the term "*Seasonally Dry Tropical Forests*" by "*Tropical Dry Forests*", especially for the following reasons:

1) The reviewers' suggestions received during the submission process; and 2) This last term is the most common name used today in the literature (see Sanchez-Azofeifa et al. 2005; Portillo and Sanchez-Azofeifa 2010).

- Many thanks to Rufford Small Grant Foundation for its support, without them most of the proposed activities would not be developed. I hope to receive the support of the Foundation for the development of the next projects.
- Finally, I would like to extend my gratitude to ornithological and botanical collections (and their curators) of international and national museums that kindly provided data included, as well as to volunteers and field assistants in the project. The list of Institutions include: Academy of Natural Sciences of Philadelphia, American Museum of Natural History, Bell Museum of Natural History at University of Minnesota, British Museum (Natural History), Burke Museum at University of Washington, California Academy of Sciences, Canadian Museum of Nature, Carnegie Museum of Natural History, Centro de Investigaciones De Quintana Roo (Ahora en ECOSUR Chetumal), Colección Nacional de Aves (Instituto de Biología, UNAM), Colección Boliviana de Fauna at Museo de Historia Natural (Bolivia); Colección Ornitológica del Centro de

Investigaciones Biológicas (UAEM), Colección Ornitológica Phelps (Fundación William H. Phelps; Venezuela), College of Natural Sciences (University of Texas at Austin), Cornell University Museum of Vertebrates, Datasets at Comisión nacional para el conocimiento y uso de la biodiversidad (CONABIO), Delaware Museum of Natural History, Denver Museum of Natural History, El Colegio de la Frontera Sur (Unidad Chetumal), Estación Biológica Rancho Grande (Ministerio del Ambiente; Venezuela), Field Museum of Natural History, Florida Museum of Natural History, Fort Hays State College, Herbario de Coro-Instituto Universitario de Tecnología "Alonso Gamero" (IUTAG Venezuela), Herbario de la Escuela Nacional de Ciencias Biológicas del IPN, Herbario de la Universidad de Sonora, Herbario del CIBNOR, Herbario del Centro de Investigaciones Biológicas del Noroeste (HCIB), Herbario isidro Ramón Bermúdez Romero (IRBR, Universidad de Oriente; Venezuela), Herbario Nacional de Mexico (Instituto de Biología, UNAM), Herbario Nacional de Venezuela (Fundación Instituto Botánico de Venezuela), Instituto de Ecología (INECOL, A.C.), Instituto de Historia Natural y Ecología, Laboratorio de Ornitología at Universidade Federal de Pernambuco (Brazil); Los Angeles County Museum of Natural History, Louisiana State University Museum of Zoology, Lund Botanical Museum, Moore Laboratory of Zoology (Occidental College), Museo Civico di Storia Naturale Di Milano, Museo Civico Federico Craveri Di Storia Naturale, Museo de Biología de la Universidad del Zulia (MBLUZ; Venezuela), Museo de Historia Natural La Salle (Fundación de Ciencias Naturales La Salle; Venezuela), Museo de Historia Natural Universidad Nacional de San Agustín (Cusco, Peru); Museo de Historia Natural Noel Kempff Mercado (Bolivia); Museo de la Biodiversidad Maya (Universidad Autónoma De Campeche), Museo de las Aves de México, Museo de Zoología (Facultad de Ciencias; UNAM), Museo de Zoología (FES Zaragoza, UNAM), Museo de Zoología de la Universidad Tecnológica Indoamerica (MZUTI; Ecuador); Museo Ecuatoriano de Ciencias Naturales (MECN; Ecuador); Museo Nacional de Ciencias Naturales, Museo Nacional de Costa Rica), Museo Regionali di Scienze Naturali Torino, Museum Mensch Und Natur Munich, Museum Nationale D'histoire Naturelle Paris, Museum Of Comparative Zoology at Harvard University, Museum Of Vertebrate Zoology (Berkley), Naturhistorische Museum Wien, Natuurhistorische Museum Leiden, New York Botanical Garden, Oklahoma Museum Natural History, Peabody Museum at Yale University, Royal Botanical Gardens, Royal Ontario Museum, San Diego Natural History Museum, Senckenberg Museum Frankfurt, Sociedad Para El Estudio de los Recursos Naturales Bióticos de Oaxaca, Southwestern College, Staatliche Museen Fur Naturkunde Stuttgart, Texas Cooperative Wildlife Collections, Herbarium of the University of Aarhus, Übersee-Museum Bremen, United States National Museum of Natural History, Universidad Autónoma de Chihuahua, Universidad Autónoma de Nuevo León, Universidad Autónoma de Querétaro, Universidad Autónoma de Sinaloa, Universidad Autónoma de Tamaulipas, Universidad Autónoma de Yucatan, Universidad Autónoma de Zacatecas, Universidad Autónoma del Estado de México, Universidad Autónoma del Estado de Morelos, Universidad de Ciencias y Artes de Chiapas, Universidad de Montemorelos, Universidad Michoacana de San Nicolas de Hidalgo, University of Alabama Biodiversity and Systematics, University Museum of Zoology at University Of Cambridge, University of Nevada Las Vegas, University of Arizona, University of British Columbia (Museum of Zoology), University of California Los Angeles, University of Connecticut University of Kansas (Natural History Museum), University of Michigan (Museum of Zoology), Western Foundation of Vertebrate Zoology, Zoologische Forschungsinstitut Und Museum Alexander Koenig.