

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	Flavia Alejandra Montano Centellas
Project title	Mixed-species flocks and climate change: towards a more mechanistic understanding of avian social systems
RSG reference	19758-1
Reporting period	July 2016 – July 2017
Amount of grant	£4,760
Your email address	flamontano@ufl.edu
Date of this report	August 15th, 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
Assess the composition and structure of mixed- species flocks along an altitudinal gradient in the Andes of Bolivia.				One main component of the project was to encounter and follow mixed species flocks in the field for as long as possible, noting data on species richness, number of individuals and foraging behaviour (Figure 1). Overall, I collected data on more than 207 independent flocks along the full gradient. This number is much larger than my original expectations based on the low visibility and conditions in the field. Although I am still going through the recordings to add any species that we might have missed, overall my species count has stabilised. I registered 159 species participating in the flocks (about 35% of the overall community) in the gradient. Species richness per flock ranged from 2 to 25 species (mean=12 species).
Collect data on morphometry of species participating in mixed species flocks along an altitudinal gradient in the Andes of Bolivia.				The second component of my field work involved setting mist nets along the gradient (Figure 2). Although my original design was setting them in 11 elevations, I ended up setting them at eight elevations as literally no areas were available for setting nets and camping sites for the original design. Nevertheless, I consider this part of the project successful as I ended up capturing more than 800 individuals, and colour banded about 400 that participated in mixed species flocks. As planned, nets were set for 12 days and opened from sunrise to sunset, except with heavy rain. Data on body sizes and morphological traits (wing length, bill length, gape width, wing length, tail length, hand-wing ratio, tarsus length, sagittal and lateral diameter of tarsus) was obtained from each captured individual. Besides being



		use for the trait based analysis in my
		dissertation. I plan on cleaning and
		preparing this data and share it in a
		repository such as dryad, along with the
		repository social data L have callected
		morphological data i nave collected
		 from museum specimens.
Monitor		To monitor environmental variables
environmental		along the gradient I set one Lascar™
variables along the		data logger at each of five elevations
aradient		(1500, 2000, 2500, 3000, and 3500 m asl)
gradierni		along the gradient. Data loggers were
		active from May 20th 2014 until August
		active from May Suin, 2016 Unit August
		25th 2017, and recorded temperature
		(max, min and average), relative
		humidity and dew point every hour
		during the evaluation period.
Examine the relative		I have analysed how the species
importance of		composition changes across elevation
nositive		and if I found evidence of environmental
		filtering or biological filtering (the
		intening of biological intening (the
interactions, and the		potential two ecological processes
relative importance		acting upon communities). I found that
of ecological		both processes are important however,
processes in shaping		positive biological interactions are more
in the structure of		important than expected by chance
mixed species flocks		(using null models) in the highlands.
in the Andes of		suggesting that where environmental
Rolivia		filtering is extreme facilitation might be a
BOIIVIG		much mare important biological force
		allowing species to coexist. I am rather
		excited about this portion of the project
		and presented a preliminary analysis on
		May 19 th at the Congreso Boliviano de
		Ornitologia (Figure 3).
		In a second part of the analyses. I used
		network theory to test for the effects on
		elevation on network topology My
		preliminant results suggest that notworks
		preliminary results suggest man here works
		in the highlands are less rich and
		complex, with lower density and lower
		modularity. Interestingly, I found that with
		species level metrics, species ID was a
		stronger predictor than elevation. When
		examining each species response
		separately, it was evident that the
		position in the network as the role of the
		spacios within the flack changes geress
		species within the nock changes across
		elevations (tor species with large



		elevational distribution). Although I have analysed my data at a network level, now I expect to further examine each species pairwise interactions to determine how species change in position/role might affect the overall network. This last part was not proposed in the original project, but I think this will provide even more interesting insights into the forces driving diversity patterns in mountain systems. I have presented the preliminary analysis of this part at the Ornithological Congress of the Americas (Iguazu, Argentina) in August 10 th , 2017, at a Mixed Species Flocks Symposium (Figure 3).
Assess the potential main factors determining the structure and change of mixed species flocks along the gradient and elaborate predictive models on mixed species flocks facing climate change.		Although I have gathered the information required, I collected information from the data loggers in August 2017, thus I did not have time to analyse spatial data on precipitation and temperature yet.
Use the results from the predictive models to inform conservation planning in the region, in consultation with BIOTA.		The project goal was to provide with adequate information to create predictive models of climate change consequences. These model scenarios will further feed conservation planning at a regional scale done at the last stage of my dissertation project, in consultation with BIOTA (a Bolivian NGO). As I have not finished this part of the analyses, working on the document to share this information with decision makers is still ongoing. However, I have met with BIOTA researchers and we have organised a collaboration network to work on this part later this year. Despite the delay, they are keen to support this portion of the project and I consider is just a matter of time to advance on this document.



Training of students and early researchers on avian study techniques		This was one of the most successful goals (and fulfilling, for me) of the project. When starting, I set an announcement looking for volunteers willing to learn about birds and work in hard field conditions. I received more than 180 applications and selected the most enthusiastic candidates. At the end people from Bolivia (La Paz, Cochabamba and Santa Cruz) as well as students from Chile, Argentina, Mexico, Spain and Peru worked in the project. I am extremely proud to say that I counted with 16 excellent volunteers that have learned about mist netting, bird biometry, bird census and behaviour. Some of them have decided on their dissertation research or side projects within my dissertation are were extremely enthusiastic about studying elevational gradients in the face of climate change. I currently serve as advisor for two of them and am collaborating in small papers with other two. Three of the 2016 volunteers have come back this year to do more censuses and discuss their own projects with me. These amazing students have grown incredibly in this year! More about this amazing team can be read at: https://flamontano.wordpress.com/field- assistants/
Submission of a scientific manuscript on the main results of the project		I have extended my field work to 2017 and thus have a delay on the manuscript preparation. However, the main results have been partially analysed (with a set of the data) and presented in scientific meetings. Scientific papers will be submitted in late 2017 and early 2018.
Presenting the ideas and results to local communities and Park rangers.		The project launched three different meetings, one with the local community of El Chairo, and two with park rangers. In each one, I presented the ideas of the project, the main results (to that point) and explained how the results would be used in the future. Unfortunately,



		attendance in the park meetings was very low and they cancelled our meeting twice. I repeated the meeting (therefore, I had two with them) as only three people assisted to the first one (Figure 4). Five people (including two of the people that had already attended the first meeting) attended the second one. The main reason for their absence was (as they communicated to me) that they had no funding to travel towards the meeting point. As the park has low funds, most park rangers are destined to work in one of the small communities thought the park, they are never in the same place.
Preparing and printing educational leaflets on mixed species flocks		The project had set the goal of preparing educational materials about mixed species flocks. Unfortunately, I was not able to prepare nor print the leaflets. Although I have work on some ideas with a fellow designer, the original budget was not sufficient to cover this part, and I considered field work a priority at this stage. I am still working on the leaflets ideas and also in t-shirts with the species in the flocks. The t-shirt idea came from the park rangers, who stated this would be a good "motivation" for them to explain about birds to the people they interact with. This year, I will try to raise funds to finish this part of the project, specially the leaflets.





Figure 1. Pictures of us conducting the census of mixed species flocks in the Andes of Bolivia. Me on a rainy day in the left panel and Sebastian Moscoso and me at the highest extreme of the gradient in the right panel.



Figure 2. Mistnetting and morphometric data collection. To the left, Mariano Perez, Darwin Solano and I taking data on a captured bird. To the right, Darwin taking out a bird from the net.





Figure 3. Presenting partial results of the project at the Congreso Boliviano de Ornitologia (Cochabamba, Bolivia, left panel) and at the Ornithological Congress of the Americas (Iguazu, Argentina, right panel).



Figure 4. Presenting the project to park rangers at Cotapata National Park.

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

Meeting with the park rangers was probably the most challenging part of the project. They have no office but are settled in different villages, thus despite confirming their assistance, they just did not attend the meetings. I repeated the meetings/visits in five different occasions and only in two, the meeting happened. The situation of the park administration is precarious and the funds destined for such meetings are non-existent. Although I often argue against this, I would consider providing a "reward" (a stipend is forbidden) for participation, such as t-shirts or some equipment for their work. The t-shirt idea was proposed by one of the participants and it sounded as a good idea. Further, we can also use the printing design for educational purposes. Unfortunately, I did not print the t-shits due to lack of funds, but will include that for future reference. Considering motivational rewards



might be key for planning these meetings, and for a small difference we can reach a much larger public in the future if using these non-monetary rewards.

Although my field season was successful, I had stablished my data loggers last year, and needed to get back to the field in 2017. Thus, I conducted an additional month of field work this year and still need to examine that new data set, and add it to my former analyses. This has strongly delayed my data analyses and overall advance; however, I think increasing my field effort and sample size will greatly strengthen my results.

One problem I faced was having insufficient funds for some items such as printing leaflets. When I applied for the Rufford Small Grants, I used the official conversion rate at that time 1 USD Dollar = 0.69 GBP. However, when I got the funds, the GPB had dropped. Thus, the same £4,760 were 6039.72 US Dollars (instead of the 6899 US Dollar I have calculated). Despite this difference, I could finish all field related activities but had to delay the educational leaflets for the future.

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

The most important outcome of this project was finding that mixed species flocks represent sub-communities that are shaped by different ecological forces than the rest of the community. My results suggest that whereas lowland flocks are structured by negative interactions (i.e. competition), positive interactions are much more important in the highlands. Thus, mixed species flocks might be one of the main reasons why high elevation ecosystems, where conditions are "harsher", are able to sustain highly diverse avian communities. In other hands, participating of flocks might be a much more rewarding strategy in the highlands, whereas competition might prevent individuals to join towards lower elevations. My study provides the first quantitative analysis on the relevance of positive and negative interactions along such a large gradient and to test the importance of different ecological forces on the assembly of mixed species flocks. Beyond the scientific value of these results, they will feed predictive models that will inform on potential cascading effects of climate change acting upon mountain biotas. The main results of these models will be presented as a conservation tools to the park administration and other conservationists.

Data collection in the field was very successful and I have gathered a fair amount of information on poorly known species in the Bolivian Andes. Besides the overall analysis I will conduct, I think that the value of these natural history information (behavioural, morphological data, etc.) is great. While starting the PhD, I struggled with the very low availability of such data for Bolivian species. Having obtained this amount of information is by itself a great achievement. As mentioned before, I plan on organizing this data and make it available in a repository for other researchers to have access.

Student involvement is a second great outcome of this project. As for now, I have had 18 volunteers working in the field work of the project. From them, eight remain involved and are working small papers with the data we collected. Some of them



have decided on their dissertation topics, or have been inspired to work in the same ecosystem and taxa after the project. Moreover, we (as a group) have created a bond and a network of collaboration that will last long. Having impacted the career of at least a few of them is, by far, the greatest achievement of this project.

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

Local students with limited access to research opportunities were the core and heart of the project. Capacity building to these future conservationists was the greater benefit of the project to date.

There are no local communities in the exact area where fieldwork was conducted (the gradient dissects primary forests with no land management), however during the project we communicated with people from the communities in the surrounding areas. Not only some of them participated as field guides but we tried to acquire food and services from people in these communities (camping sites at the end of the trail, transportation, trail cleaning) as much as possible. We also conducted three informative meetings explaining avian fauna and its values in the area to local communities and park rangers.

5. Are there any plans to continue this work?

Yes, my results are exciting and I am willing to continue on this (and other) topics in the same landscape. First, I plan on keep working on the components of this project that were not finished during the year granted. In particular, working with BIOTA to create the document with recommendations based on the predictive models. Further, I plan on keep studying elevational gradients in this region as they are highly threatened and we need urgent understanding of its structure and dynamics. For now, I have two Bolivian students/collaborators that will remain conducting studies in the site. The first one, Rhayza Cortes, an undergraduate student at the University of San Andres (La Paz, Bolivia) has framed her thesis research under this project. She is analysing altitudinal variation in song structure for a few species and will use data from my field work (recordings, environmental data, and spatial data) as well as her own data on individual variation to test her hypothesis. The second one, Mariela Yapu, is a student that volunteer with me in 2016 and 2017 and has just graduated. Now, we are working on a project on seed dispersion along the same gradient, to further test the importance of positive interactions in the assembly of bird communities. In this project, she will use my data on bird communities, the morphological data I collected during the field work and the environmental data collected with the data loggers. Her project was submitted to an early career fund at the University of San Andres and if successful will start in November 2017. I will be involved in the project as an advisor and collaborator. Although not yet prepared, I plan on writing a second part of the project to further explore mixed species flocks in the Andes of Bolivia.



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

As of today, I have already shared the results to scientific communities at the local level (Congreso Boliviano de Ornitologia) and regional level (Ornithological Congress of the Americas). At the Ornithological Congress of the Americas, I have been invited to participate of a network of collaboration to study Neotropical mixed species flocks. Thus, my results will likely feed on regional initiatives for data analyses. In the near future, I plan on presenting the scientific papers as proposed and writing the final version of my dissertation. I also plan on sharing raw data on repositories and make my data available to other researchers.

Finally, I plan on pursue the idea of the educational leaflets on mixed species flocks and share them to a larger audience. If successful, I will add workshops with local schools and tourism agencies to further spread information on the nature, structures and threatens of avian faunas and mixed species flocks in the Yungas of La Paz.

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 Rufford Small Grant was used for a year, and covered most field work expenses at the first stage (June – December 2016). This worked perfectly, however, I returned to the field to collect additional data on summer 2017 (June – July) to increase my sample size and collect the data loggers set last year. Due to this new field season, I faced a notorious delay on my data analyses, however no major changes were made on the original idea nor data. The project then, extended for half a year more and will likely be finished (with manuscripts) in December 2017.

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.

ltem	Budgeted Amount	Actual Amount	Difference	Comments
Educational leaflets (printing)	407	0	407	No printing was done because of lack of funds (see point 2, unforeseen difficulties)
Food	1019	1156	-137	Cost of food for 69 days of field work camping (2 to 6 people per field trip) was very variable and added up to 10.140 Bolivianos. We camped on these days with food brought from La Paz city and tried to buy local food when possible. On 22 days, we stayed at an ecologe. Lodging costs in these



				days included food and is included below.
Lodging	1092	1557	-465	We stayed at the ecolodge El Jiri for 22 days. In each trip it was 2 of us and the cost per day/person is 295 Bolivianos. The 22 days added up to 12.980 Bolivianos. Additionally, I covered lodging expenses for some volunteers that were not from La Paz city at a youth hostel for days in between field trips. The hostel costed 45 Bolivianos per night/person for a total of 15 nights.
Camping gear	83	71	+12	I purchased two camping tents for field work (made in Bolivia). Each one costed 310 Bolivianos.
Local transportation	728	826	-98	Local transportation is also variable among sites. For 20 trips with 2 to 6 people, and additional three trips (2 people) for the meetings with local communities and park rangers, the amount added up to 7246 Bolivianos
International airfare	656	733	-77	Flight in American Airlines from Orlando – La Paz and La Paz – Orlando costed 927.76 US Dollars.
Other equipment	104	117	-13	Included flagging, ropes for nets, cloth bags for captured birds, plastic bags, large plastics for camping sites and batteries. Except for the VAS flagging (that costed 14.79 US Dollars) all materials were purchased in Bolivia.
GPS	207	197	+10	GPS Garmin GPSMAP® 64s. Cost was 248.96 US Dollars.
Poles for mistnets	91	114	-23	Poles for mist nets (made by hand by Bolivian artisans) costed 1000 Bolivianos
Mistnets	373	0	+37 3	I did not purchase mist nets, but borrowed them from a professor at the University of Florida
TOTAL	4760	4771	-11	Difference was covered with personal funds. Rate of exchange: 1USD = 0.79 GBP 1Boliviano = 0.114 GBP (official rates when the grant was deposited).



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

The next step for me, and the project is to summarise the main results and present them formally in scientific papers. However, the project has opened several new questions for me that would be very interesting to pursue in the future.

Besides completing the scientific portion of this project, the next key step is to translate the results into useful tools for conservation. Working next to the researchers at BIOTA will help with this particular task and the resulting documents will need to be shared in workshops with both practitioners and authorities.

Another step is to keep involved with the students and volunteers that have participated, supporting their writing and researching skills as well as their personal involvement in conservation initiatives.

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?

I did include the logo in each presentation of my work in scientific meetings and added the link of the Rufford Foundation in my web page. Also, the leaflets and t-shirts developed with the project soon will have the printed logo.

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

Besides me, I had 16 volunteers working in the project. All of them had the same role, participated from the mist netting and/or the census of mixed species flocks. One of them (Rhayza Cortes) participated of the meetings with local communities. Each one of them was key for the success of the project. As we face extreme conditions in the area hiking in dangerous landscapes with the equipment, materials food and for some areas water, large teams (up to six people) were required. Briefly:

Participated in mistnetting: Mariano E. Perez (Argentina), Julio Zacatzi (Mexico), Darwin Solano (Peru), Amanda Vilchez (Peru), Coral Salazar (Bolivia), Cesar Mayta (Bolivia), Cindy Veizaga (Bolivia), Teodoro Camacho (Bolivia).

Participated in census: Sebastian Moscoso (Bolivia), Paola Velasquez (Bolivia)

Participated in mistnetting AND census: Mariela Yapu (Bolivia), Miguel Angel Montenegro (Bolivia), Rhayza Cortes (Bolivia), Karen Losantos (Bolivia), Amanda Fernandez (Bolivia), Camila Agurto (Chile).

12. Any other comments?

Extreme conditions in the field and no facilities were the hardest part as result in several days invested in reaching the camping sites (hiking) with no data collection.



However, a lot of motivation from volunteers and the "adventurous" nature of the project was at the end a positive note for field success.

I am deeply grateful with The Rufford Foundation for financial support as well as to the University of Florida and the University of San Andres for field equipment and camping gear for the students. Although the project is not yet finished, I am confident all goals will be achieved, I am especially excited by the results and am keen to share them with a larger audience. I would very much like to expand my research to other areas in the threatened Andes and continuing this line of research and mentoring. I am particularly grateful for the opportunity of meeting and interacting with such amazing team of volunteers and future conservationists. Thank you.