

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	Marcela Cely-Santos
Project title	Cross-Pollinating Agriculture, Ecosystems and Food: Human/Bee Relationships in Traditional Small-scale Agroecosystems
RSG reference	17395-1
Reporting period	October 2015 – October 2016
Amount of grant	£5000
Your email address	Cely.sandramarcela@gmail.com
Date of this report	03-10-2016

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
To list floral visitors and to conduct pollination experiments on guatila (<i>Sechium edule</i>) plants, on farms under different agricultural management regimes.	x			Climatic variability has been high in the study region. During 2015 we went through a devastating El Niño event and all the experimental plants died. I learnt this plant species, when managed, is pretty vulnerable to temperature fluctuations and water availability.
To assess bee diversity on different farms under different agricultural management regimes in Anolaima		x		Because of the failure of my proposed study, I decided to conduct an alternative study to compare bee diversity during a wet and a dry season in 2016. I recently finished the second sampling season and right now I'm analysing data.
To measure local habitat and landscape configuration features corresponding to the study sites (farms)			x	I surveyed trees and features of vertical stratification on all the study farms. A geographer developed a GIS of the study region to analyse landscape features. Right now I'm analysing this data with data from the bee surveys.
To evaluate the socio-economic factors that determine the engagement in agricultural practices and that affect bee populations, viewed through the lens of the cultural understandings of the local community			x	I conducted diverse interviews with focus households and a general survey with the Anolaiman community. I am still transcribing data and I hope to have more concrete analyses soon.
To assess the proportion of foods consumed by households that require or are benefited by animal pollination for yield production.			x	

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

The original project I proposed failed because of El Niño Oscillation. I planned to conduct observations on the floral visitors of guatila (*Sechium edule*) plants, and pollination experiment on individuals of this same plant species. I sowed guatila seeds before the El Niño was announced, expecting the regular rainy season; it never arrived. While the mean temperature in Anolaima was 21°C, it reached 35°C in the last months. The three rivers providing water to Anolaiman people run dry. Guatila plants are water demanding and did not survive the current climatic conditions. Family plants in most farms have died. We took care of the experimental plants but, despite we tried different strategies to improve their performance, the plants did not survive.

I had to switch gear after the experimental plants died. The new plan was to evaluate changes on bee diversity across farms with different local habitat features and landscape configuration. Conducting a bee survey is more expensive in terms of instruments and the knowledge you need on taxonomy after the field stage is over. Also, it is conflicting to sacrifice a lot of bees while telling people to save them. However, it might have been more important to do this before conducting pollination experiments on staple plants with local residents, so they can know their bee diversity better and design more complete strategies.

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

- A list of the bees of Anolaima: While conducting surveys, we've found >80 bee morphospecies across the 17 farms we work in. These include halictids or sweat bees (~10 species), megachilids or leaf/petal cutter species (~7), colletids or plasterer bees (2), andrenid bees (2), stingless bee species (>10), and other apid-stinging bee species (>30). We could determine their genus and are still working on their specific names. I hope to design a poster with bee pictures to share with the community.

- Some understanding of the proximal and ultimate causes of land use change in the region: These are too complex and include peasant outmigration, commercialisation failures, the armed conflict and deep political asymmetries; it is difficult to differentiate their contribution to the dangerous transition towards agro-industrial food production. People in Anolaima are not food insecure but are nutritionally insecure. Their diets include ~1/3 of foods produced with the help of an animal pollinator, yet their economies, when based on agricultural activities, mainly rely on plants that are benefited by bees to produce fruits.

- A broader understanding of people-bee relationships: People in Anolaima are afraid of or indifferent to bees. We found >80 bee morphospecies in our sampling sites. These sites were situated in only 13 villages out of the 32 villages present in Anolaima (so there may be more bee species in the municipality). In the surveys with the rural population, most people only recognized the honeybee, *Apis mellifera*. This bee species is exotic, yet naturalized. Native bee species are mainly invisible to peasants. On the other hand, people have heard about pollination and its importance but they don't really understand what it is about and how it contributes to their livelihoods and food security. When we asked farmers whether they would like to encourage bee presence on their farms, many said they didn't care or that they would not want more bees. When we clarified there were stingless bees and solitary bees with different behaviours than the Africanised honeybee, they gave bees a second thought. With our surveys, interviews and focus groups we found that there is fear against the Africanised honeybee, and that this fear is translated to other insects. However, there are opportunities to transform this perception mainly residing in facilitating people get to know these organisms better. In general, peasants are open to learn about the outcomes of their practices and to transform them to account for bees and other pollinators. One thing I learned is that constancy and love for your study organism is contagious and it is the best tool to fight indifference towards invisible others (like bees).

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

My worked is an in-depth study evaluating the social and ecological sides of bee-human relationships in Anolaima. All the households participating in the study got to know the bees we collected in their farms and there were plenty of moments to reflect on the agricultural situation farmer's face and how it affects other beings. I also conducted a first workshop with members of these households, so they have found different avenues to relate to their local bees.

My research assistant is a young woman from the community. She helped me conduct surveys with people, and to sample bees and trees on the farms we work in. I hope she helps me to give continuity to any additional bee-related education and research activities in the municipality. On great ally is a young beekeeper/bee-lover of the region, with whom I'm registering additional data about bees in the municipality.

5. Are there any plans to continue this work?

Yes. In the short term I must finish fieldwork and write my dissertation. However, I have ideas about a citizen science project and a pollination game in the medium-term,

to get advantage of the information we obtained in the municipality and the relationship I established with the community.

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

I plan to conduct an additional workshop with the households I worked with, and others with the rest of the Anolaiman community. I will work on different peer-reviewed papers to share this review with the scientific community and I'm planning on giving one workshop in a restaurant in Bogotá to share some bee-knowledge with food consumers in the city.

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

I used the funds provided by the RSCG between October 2015 and the end of September 2016. The complete fieldwork season of this project was of 18 months, starting on March 2015, but it will extend a bit more until December 2016.

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
Costs for renting research space in 20 locations	2500	1700	800	I worked in 17 locations and only paid for the research space until I lost hope with the plants.
Vine –growing structure (in 20 locations)	300	510	-210	We built a vine-growing structure in 17 farms. It was more expensive than the expected because, when designing the budget, I considered the materials but not the human effort required to set the structure up.
Measuring instruments (GPS, densitometer, range finder, anemometers, luxmeters, calibrators)	300	430	-130	I had to order an additional set of instruments to be able to measure all variables in the bee survey. We were two people simultaneously sampling bees and recording biophysical records, so it was not possible to do this with just one set of instruments. The amount of money corresponds to the instruments,

				taxes and transportation fees.
Bee trapping and processing supplies (plastic bowls, PVC tubes and joints, insect pins, alcohol)	200	300	-100	I used four times the pins I expected to use with the original proposal. Materials to build bee pan-traps were more expensive than the expected because UV paint was not available in Colombia.
Miscellaneous research supplies (Flagging tape, measuring tape, photocopies to conduct surveys, other supplies)	0	100	-100	The new study and experimental designed required, in general, more research supplies to record different biological and biophysical variables on each study site.
Transportation costs within the study area	700	700	0	Motorcycle rides are cheaper, yet a bit more risky than transportation in jeeps.
Community workshops	1000	500	500	I conducted one workshop but I will conduct a second one in October 2016. The logistics are the most expensive part of these activities and it is better to have a clear strategy to invite people so that they actually attend the meetings.
Research assistance	0	760	-760	The research design for the general bee survey required two people sampling bees simultaneously on each study location. I had to find an assistant to help me sample bees. My assistant was a local beekeeper lady and I was actually happy to work with her because now I know she is an ally in any bee-next steps in the municipality.
	5000	5000	0	My dissertation project involved other activities for which I did not request funds but are essential to the project. Such activities were mainly related to the social side of bee-people relationships in Anolaima. I obtained funds for these activities from an additional funding agency. The RSCG funds were absolutely essential to conduct the natural-sciences component of my work.

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

Although I have shared the results of this study with the community directly participating on it, I think it is important to share results and bee knowledge (local

and western-scientific) with all of the Anolaiman community. I believe participatory activities are more demanding yet more fulfilling than vertical transmission of knowledge, so it is going to be an additional effort but it's worth it. I am finding additional funding for this and I hope to guide such workshops before my field season ends.

On the other hand and despite its importance, I think that conducting participatory workshops is not enough. After a workshop is conducted, people think about the implications of their practices on biodiversity for a short period; yet there are no long-term actions following these meetings. Besides, adults attend workshops but kids do not get to learn what we discuss. I am thinking on a different strategy for reaching out more segments of the community: a game. During the past year I learned about different pedagogies for science communication and a game is a good alternative to get to divulgate knowledge on biodiversity better, while bridging scientific and local ecological knowledge. This game can also be a platform to systematically incorporate a citizen-science project (if we get to a smart game design). I am structuring this idea and hope to materialize it in the short term.

An additional remark relates to my methods and the scope of my results. Studies like these are complicated to conduct in the Andes. They lack an important component: sampling the agroforest canopy. That's where most bees may be found but regular sampling methods do not reach such strata. My study lacks this but I believe this is something important to consider for a future study.

One final step would be to conduct pollination experiments on staple foods (my original plan), yet it is important to ask farmers about the ecophysiology of different crops under management and the biophysical conditions of the study region before choosing a crop, so there're greater chances of success in the experiments and people can see with their eyes the implications of bee pollination on their subsistence crops.

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

I used The Rufford Foundation logo on the presentations I used in the bee workshop and in a guest lecture I gave to share the results of my work.

11. Any other comments?

Thanks a lot for believing in this project!!!

Cross-Pollinating Agriculture, Ecosystems and Food: Human/Bee Relationships in Traditional Small-scale Agroecosystems



Genus	Number of sampled individuals	Genus	Number of sampled individuals
<i>Alepidosceles</i>	2	<i>Megachile</i>	7
<i>Ancylocelis</i>	2	<i>Melissodes</i>	3
<i>Anthidium</i>	7	<i>Melitoma</i>	2
<i>Apis</i>	457	<i>Mesocheira</i>	2
<i>Augochlora</i>	16	<i>Mydosoma</i>	2
<i>Bombus</i>	17	<i>Nannotrigona</i>	71
<i>Caenaugochlora</i>	1	<i>Parapartamona</i>	8
<i>Centris</i>	20	<i>Paratetrapedia</i>	3
<i>Ceratina</i>	6	<i>Paratrigona</i>	94
<i>Chilicola</i>	3	<i>Partamona</i>	66
<i>Chlerogella</i>	7	<i>Plebeia</i>	51
<i>Crewella</i>	1	<i>Protandrena</i>	2
<i>Diadasia</i>	9	<i>Scaptotrigona</i>	32
<i>Euglossa</i>	3	<i>Tetragona</i>	6
<i>Eulaema</i>	7	<i>Tetragonisca</i>	15
<i>Exarete</i>	1	<i>Thygater</i>	6
<i>Exomalopsis</i>	6	<i>Thygather</i>	5
<i>Florilegus</i>	2	<i>Triepeolus</i>	1
<i>Geotrigona</i>	1	<i>Trigona</i>	287
<i>Habralictus</i>	21	<i>Trigonisca</i>	3
<i>Halictini 1</i>	2	<i>Xylocopa</i>	8
<i>Lasioglossum</i>	15		