Final Evaluation Report

Your Details	
Full Name	Brenda Johana Cruz García
Project Title	Potential and current distribution of bumblebees and dung beetles from the mountainous regions of Oaxaca, México
Application ID	30181-1
Date of this Report	November 2, 2023

1. 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
Dung beetle species list			■	So far, we have identified 30 species inhabiting mountainous areas.
Bumblebee species list		■		Fieldwork for bumblebees was delayed because we were focused on surveying dung beetles since they are season specific and curation time is really time consuming. We could survey two communities. Taxonomic identification is still in process.
Sharing results with the communities		■		Described below.
Maps of species potential distribution		■		Dung beetle potential distribution maps for the present and climate change scenarios are completed and were presented in the master's degree thesis. In order to include new bumblebee records into model construction, we will wait until we finish taxonomic identification.
Evaluation of conservation status		■		This analysis will be made once we finish the potential distribution maps for all the species.
Fieldwork			■	Three new communities were sampled. These new records were complementary to the current results dung beetles and will be for bumblebees once we finish with taxonomic identification.
Workshops			■	Described below.

2. Describe the three most important outcomes of your project.

a) We expanded our knowledge on the spatial and temporal distribution of dung beetles and the environmental factors that modulates their distribution. We have been able to return information about the project by coming back to the communities. Now part of the community acknowledges the ecological importance of dung beetles. This is a very important issue, since one of the main concerns of communities when we ask for permission is

whether or not we come back and share the results. It is also relevant because it keeps the doors open not only to us but to other students and researchers. At the end of the workshops, communal authorities and professors were really grateful to the team, and so were we.

b) Another important outcome is the ethnobiological information documented during the workshops. Traditional ecological knowledge, mainly in the form of languages (Tu'un savi or Mixtec, Dizde or Zapotec and Ayuujk or Mixe) and dialects of the study region offer additional information to complement the design of conservation strategies for dung beetles and bumblebees. We were also able to explore the perspectives (mostly positive) in regards to Family Apidae and Order Coleoptera in each community.

c) And finally, yet important, sharing the results with different guilds, including not only the academy, but also colleagues and students with different backgrounds (e.g., botanist, herpetologist, mastozoologist, geologist, geographer), as well as farmers and artisans that are interested to collaborate and document the biocultural diversity in their communities.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

The first difficulty we faced was working under the pandemic dynamics. We had a delay in the field activities of almost a year since the grant was approved. By the date we started fieldwork (June 2021) I had already started my master's degree, which meant more of my time attending classes. Coordinating all these activities has been really challenging, since the access to the laboratories was also restricted, meaning a delay in the curatorial work.

Other difficulties related to COVID were related with the access to the communities. At the beginning of the pandemic, no community was open to "foreigners", so we could access until June 2021. Moreover, in San Esteban Atatlahuca (Mixteca Alta region), one of the communities where we had work before, was going through an internal conflict derived from the forest defence. The authorities gave us permission to sample again with the condition to come back once the situation was not dangerous. Until 2022, the situation was "solved", and we could access to the forest again.

Another setback was presented when we travel to the community of San Juan Mixtepec (Sierra Sur); the roads of la Sierra Sur are often affected by storms and this year was no exception. The main road was closed due to a landslide. We collected in a community within the same Sierra named San Luis Amatlán.

Links about the conflict in San Esteba Atatlahuca:
https://www.nssoaxaca.com/2021/08/03/identifican-a-la-mujer-asesinada-en-san-esteban-atatlahuca/

https://www.meteored.mx/noticias/actualidad/donde-esta-la-ambientalista-mixteca-irma-galindo-barrios-secuestro-desaparicion-corrupcion-en-mexico-noticias-oaxaca.html

https://contralinea.com.mx/interno/semana/mas-de-200-desplazados-y-11-desaparecidos-de-san-esteban-atatlahuca-oaxaca/

4. Describe the involvement of local communities and how they have benefitted from the project.

In all the communities, we involved local people from the beginning. We are always open to let people to come with us to the field (including kids). We let them come with us to share our work. While doing this they share with us their knowledge (commonly related to behaviour, phenology and local names). When is appropriate we explain more about the species (e.g., taxonomic classification) and their ecological relevance. It is really important that they know what we are doing the field to create strong bonds of trust and also knowledge synergies.

Species lists are also relevant. Communities are always looking to document what species are distributed in their land. This information is often incorporated to local checklists that are publicly available to the community.

Dissemination talks and workshops were also helpful for students. They learn about topics that are not included in education programmes (according to school teachers). Printed material was also delivered to community libraries; this kind of material is also rare.

We maintain communication line open via email and WhatsApp. Some students and professors keep showing interest by sending pictures of different organisms, commonly insects and arachnids so we can identify them taxonomically or to determine if they are poisonous. Some high school students have also request for career guidance, such a universities and scholarships. Some members of the communities have requests to us for advice (e.g., land and resource management; medicinal plants and pests' control). All the team members have been open to assist these queries.

5. Are there any plans to continue this work?

Yes, there is still a lot of work to be done in this project. Derived from a more direct interaction with the communities, we have realised that conservation strategies must be design for the particular necessities and perceptions of each community.

We are currently working on another dissemination product in the form of a textbook. The texts will be translated to Zapotec, Mixe and Mixtec languages; for the pictures, we are looking to collaborate with local artists. We will also publish a preview article in regards of traditional ecological knowledge.

Moreover, I will keep with this project, moving it to new communities, modifying it and adapting it to the new questions and concerns, keeping in mind the same

objective of acknowledging different ways of management for communities and forming local students in this aspect.

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

Our results have already been shared in different ways.

- Oral presentation: "Geotrupids: the miners of the mountains" Brenda J. Cruz-García and at 24th SOLA Scarab Workers Symposium (May 2021).

- Oral presentation: "Geotrupinos de Oaxaca" Brenda J. Cruz- García and Alfonsina Arriaga-Jiménez at "La Fiesta de los Hongos Mixtecos" in the community of San Esteban Atatlahuca (August 2021).

- Workshop: "Alas, patas y antenas: bases técnicas para el estudio de los insectos" by Brenda J. Cruz García and Edwin Rafael Ariza Marín at Congreso Nacional de Ecología (May 2022).

- Part of the results were included on an oral presentation at XIII Reunión Latinoamericana de Escarabeidología by Alfonsina Arriaga Jiménez (October 2022).

- Dissemination talks/workshops: "Charlas para compartir: El maravilloso mundo de los escarabajos coprófagos" at the communities (May 2023 and October 2023).

- Reference collection of dung beetles was delivered to each community, accompanied with infographic and posters.

- On August of this year, I graduated from INECOL (Institute of Ecology) master's degree program. Professional examination consisted in an oral presentation based on most relevant thesis results.

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

As explained above, we will continue working with the communities. COVID opened a super relevant window for online communication. Professors, authorities and locals at communities have expressed interest in us doing online talks about different topics. The team (described below) is also willing to participate.

In addition, we will finish the rest of the dissemination products and peer-reviewed articles at the end of the 2024. We will also work on the assessment of the conservation status of the dung beetles and bumblebees and upload the information into the IUCN as soon as articles are published.

I am planning to do a PhD, but this time I want to incorporate another social element, by studying the perceptions of community members and integrate the results to the conservation analysis.

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

Yes. The Rufford Foundation logo was used on every printed material and oral presentation (first and last slide). Rufford Foundation logo was also included on dissemination entomological boxes.

9. Provide a full list of all the members of your team and their role in the project.

Main researchers: **Brenda Cruz García** (INECOL) and **Alfonsina Arriaga-Jiménez** (University of New England).

Taxonomic identification: **Fernando Escobar, Brenda Cruz García and Carlos Pinilla** (INECOL); **Bert Kohlmann** (Universidad Earth); **Mauricio Juárez** (identification of botanical material; INECOL).

Curatorial work: **Brenda Cruz García (INECOL).**

Fieldwork assistants: **Emilio J. Cruz, Héctor Bautista, Angélica Ramírez and Ricardo Tlalpachito** (Universidad Veracruzana (UV**); Laura Saldivar and Daniela Gómez** (INECOL); **Pamela Márquez and Betzayde Ortiz** (Benemérita Universidad Autónoma de Puebla, BUAP); **Osvaldo Sandoval** (Instituto Tecnológico de los Valles de Oaxaca, ITVO).

Fieldwork contacts from Oaxaca: **Emmanuel Blanco** (ITVO), **Osvaldo Sandoval** (ITVO), **Axel Arenas** (Universidad Autónoma Benito Juárez de Oaxaca, UABJO) and **Lucelli Pérez** (Universidad Comunal del Cempoaltépetl) and **Citlalli Pérez** (UABJO?).

Workshops assistants: **Edwin Ariza** (INECOL) **Emilio J. Cruz, Osvaldo Sandoval, Betzayde Ortiz, Angélica Ramírez and Richardo Tlalpachito.**

10. Any other comments?

All the team is deeply grateful to The Rufford Foundation for the financial support with which we have been able to give continuity to the project. The network of collaborators has increased, and we are happy with the outcome. Our goal was not only to focus on academic research, but also to connect people with different backgrounds and knowledge.

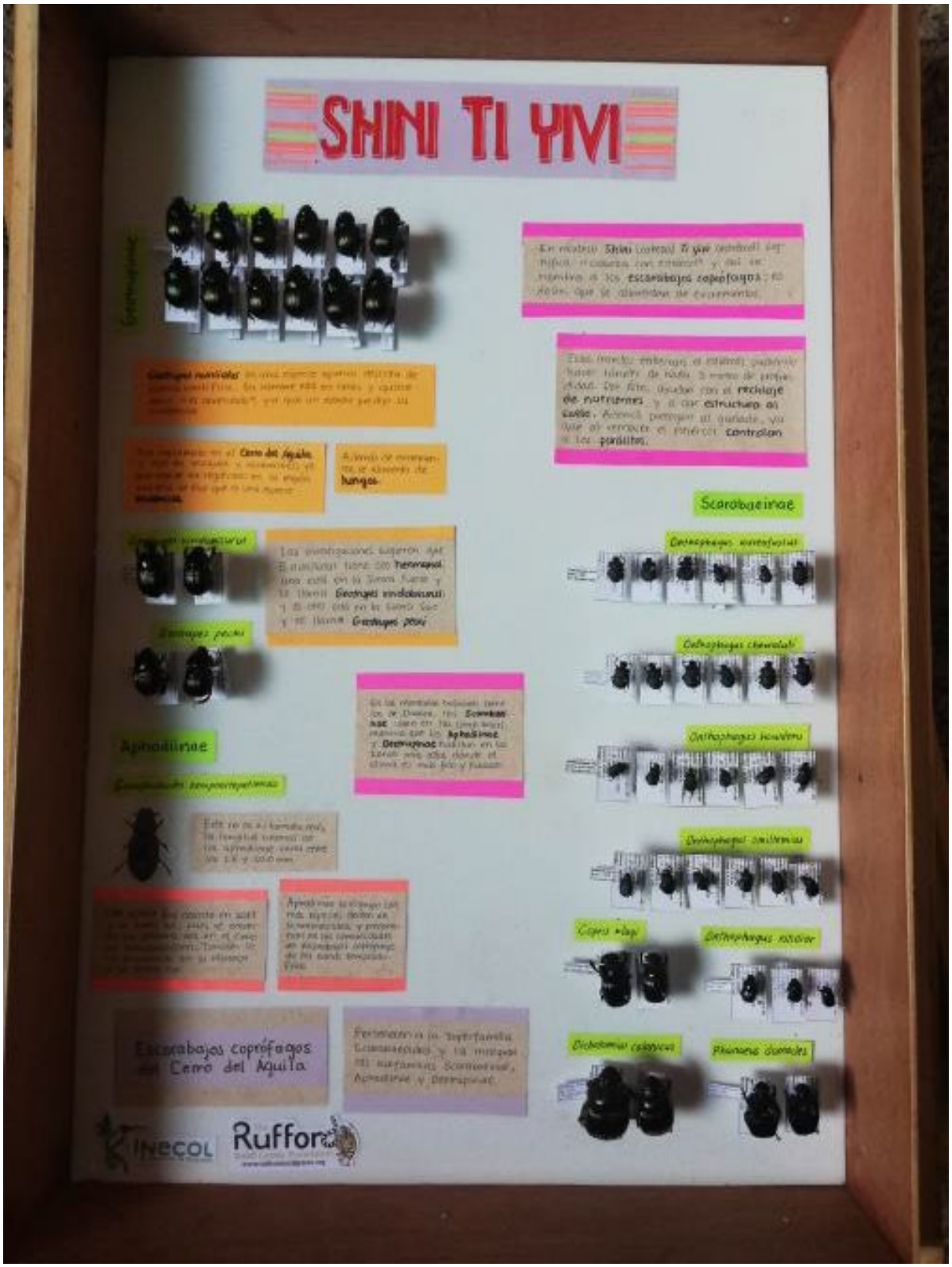
We aim to continue looking to collaborate with the communities and to strengthen the relationship that we have already built. This grant has not only allowed us to perform extended research and we think that we can integrate different visions that attend to the complexity of conservation praxis. Thank you so much!

Appendix I. Dung beetle (A) and bumblebee survey (B).

Appendix II. Dissemination talks/ workshops, poster presentations and entomological boxes.

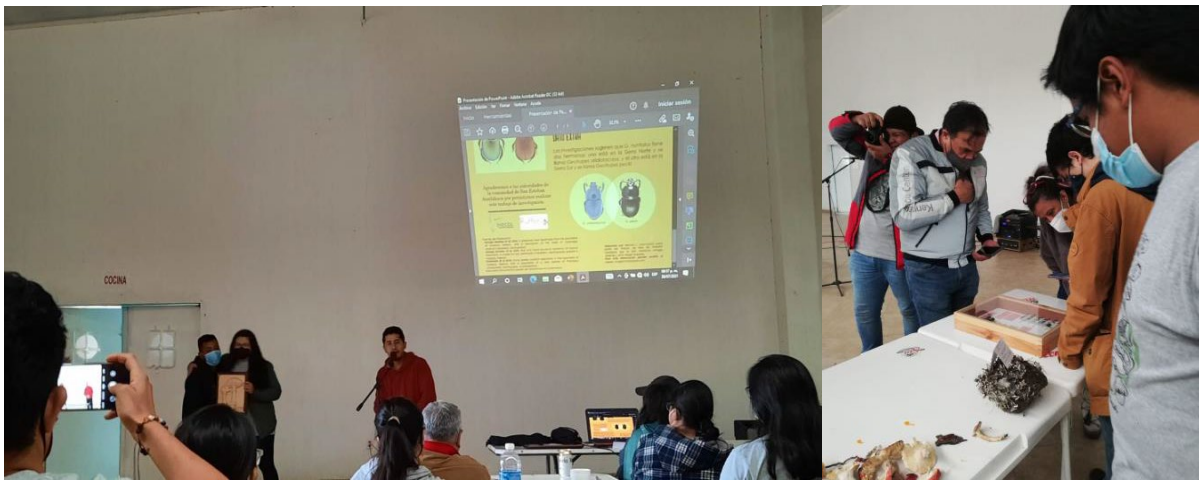
From left to right, Osvaldo Sandoval (colleague and work field volunteer), Brenda Cruz and Yesenia Velasco (local authority) during a didactic entomological box donation.

Dissemination talks at a communal meeting at San Atatlahuca (A). During this presentation we use books and entomological boxes as didactic material.

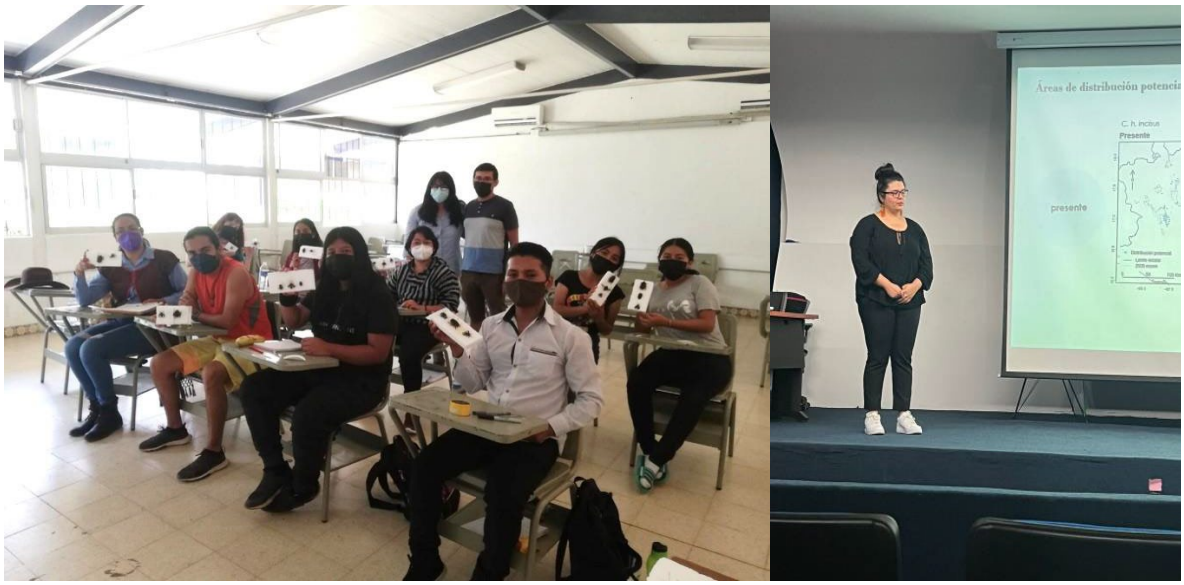


Example of a didactic entomological box. In addition to the specimens, relevant ecological information was included. "Sihini ti yivi" is the local name in Mixtec for dung beetles; Shini=head, ti=that carries, yivi=dung.

Dissemination talks/workshops at Huajuapan de León (A) and Tlaxiaco (B). Poster donation (C).



Dissemination talks/workshops at Tlaxiaco during "La Fiesta de los Hongos MIxtecos" (Celebration of the Mixtecan Mushrooms).



Left: Workshop at VIII Congreso Mexicano de Ecología at Instituto Tecnológico de los Valles de Oaxaca (ITVO). Right: Thesis defence at INECOL.

Appendix III. Some of the team members.

Left to right: Laura Burrola, Daniela Gómez & Héctor Bautista.

Left to right: Ricardo Tlalpachito, Axel Parral & Pamela Márquez.

Left to right: Osvaldo Sandoval, Fernando Escobar & Alfonsina Arriaga.

From left to right: Brenda Cruz, Emilio Cruz, Betzayde Ortiz and Angélica Ramírez. Photography was taken in front of mural outside Osvaldo's house; it was painted by Oaxacan artist, Oscar Axo.