Project Update May 2024

Your Details	
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Project Title	Sensory traps in arid environments of Mexico: New insights for bat conservation in a drier future
Application ID	40398-1
Date of this Report	09/05/2024

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
1. Ultrasonic detection and recording		50%		We have monitored 40 points in the arid landscape of central Mexico between the states of Guanajuato, San Luis Potosí, and Aguascalientes, out of which 37 rendered useful information to be regarded as permanent monitoring points. The monitoring activity took place at 10 points at a time, first inside or in the vicinity of a solar park, then, another 10 in sites away from any solar park. Upon collection of ultrasonic recordings, activity indexes were estimated counting the total minutes of detection for each species for more than 2160 minutes of continuous activity, i.e. 3 nights in a row at each monitoring point. This was done in two seasons, winter 2023 and spring 2024. All the monitoring

				points were placed in sites near a solar park (Solem I, Aguascalientes) at less than 1km, and at more than 30km from this park or any other solar park in the area. The ultrasonic detectors were installed near solar panels (less than 10m), water bodies (less than 5m), or vegetation (less than 1m), in a way that in sites in the near range to Solem I, detectors were recording over solar panels and water bodies; in sites with no influence of solar parks, the detectors were deployed over vegetation and water bodies also. This scheme rendered a total of 79,530 minutes of ultrasonic recordings, and 25,932 useful records of insectivorous bat passes.
2. Aerial imagery acquisition		50%		I was awarded an Education and Research Standard (PlanetScope) Grant from Planet, which provides me with 5000 km² of high-resolution imagery (4.7m x 47m) per month for 1 year. Using these images so far, we are extracting landscape features from 1km-radius circular buffers, which origins are the monitoring points with the ultrasonic detectors. With field-collected training points we classified the predominant land uses and land cover: trees, water, solar panels, buildings, and other human constructions, shrubland, cropland, barren, grassland. This was done for all the past monitoring seasons (November-December 2023, February-March

				2024). This will continue in the next monitoring seasons.
3. Filed experiments		20%		We engaged in a series of conversations with solar park managers to borrow 20 solar panels for the experimental set, so we no longer must recreate one set of those with wood and plastic. The experiments are planned to happen in the warmer months since bats in the wild would be more motivated to search for any water source.
4. Community outreach		50%		The approach to the local community of El Salado (San Luis Potosi) was facilitated by colleagues who have been working in the same places for over 3 or 4 years with grassland birds. The people who grant you access to their community at the sheriff house or Comisario Ejidal who is the representative of the community, runs a little interview on you to get to know your interests on their lands better. There you have a first chance to explain your project, and who supports you and what are your perspectives. After receiving all this information, people who previously have collaborated with other conservation projects in the area (prairie dog mainly), turned interested in this idea immediately, out of which Aziel Montoya and Baltazar Montoya wanted to engage in the activities to be developed in our first fieldwork. They received information on bat ecology and biology, and in combination with

				the perspective that poses the water scarcity in places like El Salado, they came with the realisation of the importance of being involved in efforts to ameliorate the consequences of climate change and the water crisis. We visited different locations in the ejido, remarkably one of those was a *Tadarida brasiliensis* colony at the local Elementary School; there we tested our thermal and ultrasonic equipment, which aroused even more the interest in Aziel and Baltazar, since they are local advocates for wildlife conservation, and consider these to be excellent tools for their observation activities. For Bat Week during October 2024, we are preparing a workshop for all ages in the community to share what we have learned out of this work from the perspective of Aziel and Baltazar.

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

a). General insectivorous bat activity is higher in monitoring sites outside the solar park influence area (over water bodies and vegetation patches) compared to the activity levels recorded in sites inside the solar park or in its vicinity (1km away), over solar panels or water bodies. Nonetheless, the identification of the species and the estimation of each species activity level, could reveal different patterns for the species hypothesised to be more susceptible to falling in a preference for spending time over solar panels versus water bodies or other landscape elements rendering higher fitness outcomes. This also could be more likely to happen in the warmest months of the year when additional water stress pressure appears with rising temperatures.

b). In sites with less predictable water availability is more difficult to capture bats for acquiring ultrasonic references. All the captures were produced exclusively over water bodies in sites away from the solar park, although most of the mist-netting

efforts were directed to capture bats over vegetation patches and open areas near and away from the solar park.

c). People from local communities engaging in research and conservation activities are the keystone for transferring such scientific and conservationist efforts to local hands. Their vision of the work to be done in bat conservation on arid environments is determinant for other community members to also have a more open-minded perspective about bats and contribute to these efforts.

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

There were significant factors that lead us to change and adjust some of our proposed methodology and consequently the budgeting. From my perspective all the challenges presented to us as work team have been overcome in an effective way. The first challenge we confronted was the heavy management burden for this small project if we wanted IPICYT (my institution) to receive the funds granted by The Rufford Foundation, since is a federal institution and must abide to certain legislation. Product of this, we had to turn down the option of IPICYT being the organisation receiving funds and look for an NGO able to provide this management service. The Organización Vida Silvestre – OVIS, accepted the offer for fund management, but charged a 10% management fee, which came out of the project budget. In response we revised the project budget and concluded that we needed to modify the way in which aerial imagery were to be collected and opted for purchasing high-resolution satellite imagery. This way the traced goals on quantifying the landscape can be achievable for a fraction of the price of a drone. Moreover, in early February 2024 I was awarded with a grant from Planet.com that provides 5000 km^2 of high-resolution satellite imagery monthly for 1 year. Hence, the costs associated to aerial imagery acquisition could be redirected to cover the management fee from OVIS.

The second important challenge we faced was the negative attitude of three of the four solar park managers that agreed on granting us access to their premises for conducting the study. Only the managers of Solem Solar Park agreed on collaborating with us without the restrictions that the other parks were imposing, like censoring the information resulting from this research, or even taking legal action against the researchers. This implied the use of an alternative approach to the proposed experimental design of the monitoring points. Fortunately, Solem is divided into two solar parks, Solem I & Solem II, generating 150MW and 140MW respectively; this allowed us to rethink the extent of the buffers of each monitoring point, so we reduced the radius of the buffers from 2km to 500m.

Consequently, the number of monitoring points was increased to have a more representative sampling of the overall bat activity around the solar park and control sites. In addition, the water bodies proposed to be monitored inside each 2km-radius buffer were scarce in the vicinity of Solem I & Solem II; most of them were entirely dry when we visited the sites located with old aerial images. Only few water bodies remained; being this the case for almost all the proposed control sites at Venado, Charcas, Estación Catorce and la Mesilla, we opted for exploring additional sites with more permanent water bodies at El Salado, Palma de la Cruz, Cañada del Lobo, Mexquitic de Carmona, and Santa María del Río in San Luis Potosí state, and at San Pedro in Guanajuato state.

This also contributed to the modification of the monitoring methodology: now we were placing the ultrasonic detector in the edge of the water, or a vegetation patch, or a row of solar panels, and this would constitute the centre of the new 500m-radius buffer. In this sense, now were monitoring five points with solar panels and five with water bodies inside or very near Solem I & II simultaneously, and five points with water bodies simultaneously with five on vegetation patches in the control sites, more than 30km away from any solar park.

Originally, the proposed monitoring intensity was 5 nights per buffer, over four buffers inside solar parks, and four in control sites. Considering the monitoring of maximum two buffers at a time depending on the number of available ultrasonic detectors, this would total approximately 40 monitoring nights per season. As a result of the increment of monitoring points, we had to decrease the total time of recording to 3 nights per monitoring point, to obtain manageable data volumes. These 20 points monitored simultaneously for a given season along 3 full nights, resulted in 60 monitoring nights per season. This way we gained spatial and temporal resolution when adjusting to the available monitoring points.

The last challenge is an ongoing issue, the limited co-funding by IPICYT. Since this year the presidential election in Mexico will take place, there is a law that withdraws federal fund expenditure and limits the amount to be devoted to certain activities, like fieldtrips and other related expenses, or the acquisition of hardware and miscellaneous material. This adjustment was done acquiring more cost-effective options for the thermal cameras, the desktop computer, the spring-scale Pesolas and the calliper Vernier, to compensate for the increase of the budget devoted to field trip related costs, like meals, lodging, petrol, and other hardware and supplies for mounting the experimental set.

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

We have selected a team of six people from the local communities. They have been trained to use acoustic equipment and to work with bats in the field. It is our intention that they will become ambassadors in their communities and change the negative image they have of bats. We have taught them about the importance of these organisms to their dry landscapes. A cornerstone of the various conservation strategies proposed for the arid regions of Mexico is to involve them and share this knowledge.

5. Are there any plans to continue this work?

Definitely. The data suggests a seasonal fluctuation on bat activity, and this only with data from winter and spring occurring immediately after the warmest year on NASA records, 2023. This makes further monitoring needed, since cooler years can shape bat activity in a different way; monitoring more than one year could foster the envisioning of a broader picture on how bats respond to water and solar parks, as the extent of these two changes over time. Therefore, monitoring for two or more years could render more robust data on seasonal variation of bat activity.

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

We are preparing a first manuscript on the variation of temporal activity patterns of insectivorous bats in arid landscapes with the presence of photovoltaic utility-scale installations and diminishing presence of water bodies.

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

First, we need to complete the next two monitoring seasons, the thermoacoustic monitoring inside the solar farm, run experiments of surface preference, and extract the landscape features for these upcoming monitoring seasons, so we can better understand the activity patterns of bats and how they are shaped by the changes in this arid landscape.

Furthermore, we need to keep close track to the trajectory of the bat community in the arid landscapes of central Mexico to come up with novel ideas and approaches to implement successful conservation strategies. This needs to be done while exploring feasible ways with the government and the landowners, farmers, and cattle ranchers to put back some of the water they use in their productive processes for environmental purposes.

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?

I've only portrayed the logo of The Rufford Foundation in the presentations I give to my advisors committee every 6 months as part of the evaluation process in my grad school. The next presentation will be on May 30, 2024, for the current semester evaluation. I'm planning to include the logo in the material of the workshops we are preparing for the Bat Week for October 2024.

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

Biol. Gabriela González Olimón: one of the main duties of Gabriela was assisting me in the field with the prospection of the monitoring points, installation and maintenance of the ultrasonic detectors and the capture and identification of the bat species that we needed to record for building our echolocation signal reference library. We shared countless hours in the road and in the field, and I'm sure without her help, all these data would have been harder to get.

Dr. Leticia Cab Sulub: Leticia helped me with the extraction of the landscape metrics of all the buffers of the monitoring points and other spatial analysis performed with Google Engine. The expertise of Leticia helped me in understanding the importance of having a good classification on land cover and land uses and prompted me to do my best in the training point acquisition process in the field, so the classification was the most accurate possible, and the resulting models associating landscape metrics to bat activity patterns were as fit as possible.

Dr. Michael Smotherman, Dr. Felipe Barragán, Dr. Bruce Robertson: Michael and Bruce had a significant input in this first part of the research given they helped me in conceptualizing the idea and guided me towards the use of better and simpler methods and refining the experimental design. Felipe contributed also to rethink the experimental design after our first prospections of monitoring sites, when we realized that finding water bodies with the current climate in our study sites was more difficult than I anticipated. In this spirit, Felipe was always eager to explore new sites and was a key piece for gaining access to some of the currently used monitoring points.