

Final Project Evaluation Report

Your Details	
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Project Title	Integrated Research and Conservation of Endangered <i>Quercus insignis</i> Martens & Galeotti, 1843 (Fagaceae)
Application ID	25645-1
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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
Characterization of the plant species composition of cloud forest habitats dominated by <i>Q. insignis</i> , and identification of other threatened species that would be protected by the implementation of conservation programs in the ecosystem.				Plant species composition of cloud forest habitats dominated by <i>Q. insignis</i> was characterised for five locations in the Mexican states of Veracruz, Oaxaca and Jalisco. This objective is categorised as partially achieved. The taxonomic determination of the collected plants is currently unfinished due to the difficulties associated with the process for highly diverse ecosystems. However, up to now, at least 68 and 50 different species for Jalisco and Oaxaca populations respectively have been identified. Other threatened cloud forest oak species were registered as associated to <i>Q. insignis</i> such as <i>Q. skinneri</i> (Vu).
Estimation of the <i>Q. insignis</i> population's age structure and a better understanding of the species' germination ecology, which will inform <i>in situ</i> conservation efforts that address the necessary ecological concerns for this species and habitat.				Age structure was determined for all the surveyed populations. In order to do so at least 500 individuals were sampled and marked for future monitoring. Details of the results are presented in the extended final report.
Assembling a wide geographic collection of <i>Q. insignis</i> ' acorns to establish a healthy and representative <i>ex situ</i> conservation collection in botanic gardens throughout Mexico.				Acorns were collected for populations in Jalisco, obtaining 536 seeds. This collection was complemented by 175 acorns gathered by collaborators of the Instituto de Ecología A. C. Samples from both locations were germinated and are currently under several experiments. Once the experiments finish the seedlings will be donated to two Mexican Botanical Gardens.
Obtain a wide geographic tissue				A total of 334 samples of fresh leaves were collected for the entire species

sampling of <i>Q. insignis</i> that will allow us to estimate population genetic attributes and to prevent future loss of genetic diversity.				range. We performed DNA purification and standardised 26 molecular markers (11 nuclear and nine chloroplast Short Sequence Repeats, and six candidate genes associated to osmotic stress). Currently 153 samples have been genotyped.
Gathering of ancestral knowledge associated with use, management and conservation of <i>Q. insignis</i> by local communities to inform conservation practices that can be sustained long-term.				The communities refused to be recorded or to fill the predefined formats due to conflicts with the local and federal authorities, and intimidation from illegal woodcutters (mostly associated with drug cartels). However we reported the people's knowledge obtained through direct conversations. This information is registered on the expanded final report.
Creation of technical reports for government agencies and educational materials for the general public to share key findings and recommendations.				Despite the high priority we have assigned to the production of technical reports and educational materials, we have not finished analysing the entire range of the data gathered in this study, and these documents are still being developed. However, we did participate in several events where our preliminary results were shared (see expanded report).

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

The main unforeseen difficulties that arose during the project were related to several causes as follows:

1. **Deforestation and land use change.** The species natural habitat (cloud forest) is currently one of the most threatened ecosystems in Mexico. The most common threats are related to deforestation due to the increase of agricultural and timber exploitation. The rise of such activities has severely affected the studied species. From the historical records of *Quercus insignis*, we only succeeded to locate five persistent populations (14%). In the remaining locations the species has been eradicated and replaced mostly by grazing fields, coffee crops, roads and human settlements. Therefore, despite the species wide distribution range not only in Mexico but also through Central America, the existing populations seem to represent small, highly fragmented and threatened remnants. The above-mentioned situation required us to increase the field-trips coverage and therefore the scheduled activities.

2. **Changes in phenology.** Added to the fact just mentioned, changes in the rainy season regime experienced yearly seem to modify the species phenology, therefore it was complicated to achieve the acorn collection. Such modifications imply that several locations were revisited at least two times in order to be able to collect the seeds, and to survey the surrounding habitat floristic composition and structure. Also, locations from Oaxaca apparently did not produce acorns during 2018, or at least we did not find any physical or testimonial evidence.
3. **Social environment.** The species habitat is highly related to small settlements such as villages and towns. Also, the species distribution coincides with major biotic diversity hotspots in Mexico like the Sierras Meridionales of Jalisco and the Sierra Madre del Sur. Unfortunately, these locations and their related communities are under external pressures from illegal actors such as drug cartels that are currently deforesting natural areas in order to exploit forest resources, particularly in the Jalisco region.

On the other hand, local communities (mostly from Oaxaca) have had several differences with the state and federal authorities regarding the use of natural resources. Such historical differences difficult the development of the current project, as the communities are extremely cautious with foreign people visiting their territories. Similarly, despite our efforts to previously request the necessary permissions to visit the projected locations, the local government and authorities required personal auditions and several days to deliberate before allowing our entry.

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

The three most important outcomes of our project are divided in three different categories, as follows:

Scientific Research: We have gathered an important amount of scientific information that will allow us to communicate the species and cloud forest reality to the scientific community (see the attached extended report). Our results will impact areas like conservation genetics, population ecology, ecology of communities, conservation biology and also have enhanced the species representation in biological collections (national herbariums).

This information is vital to understand the species current state and therefore to propose alternatives to its sustainable use and conservation. Also, during the project stages several young scientist have incorporated, including two master's degree and three undergraduate students, their work represents an important outcome as it guarantees a continuous study of the species and its habitat.

Species Conservation: Besides generating scientific knowledge we have applied the obtained results in order to enhance the species and habitat conservation. The genetic characterisation of the species diversity will allow us to establish representative *ex situ* collections including not only from a wide geographic range but also genetically diverse in national botanic gardens. Also, our analysis of the

species distribution under climate change scenarios and connectivity patterns, allows us to propose strategies to favour the species persistence using the current *in situ* conservation programs (Natural Protected Areas) along with regional *ex situ* strategies (such as botanic gardens).

Integration: Finally, basic and applied scientific information is not enough to favour the species and its habitat conservation. Therefore, we have intensively worked to deserve the community's trust, to learn from their local experiences in sustainable use of the natural resources, and to understand the community's needs.

This dialogue showed us that it is necessary to favour the communication between communities in order to replicate and to enhance successful conservation and sustainable practices that have already been implemented locally. Finally, we have also shared our technical and scientific knowledge when the local communities require it, mostly for their participation in state and federal initiatives to receive resources for voluntary ecosystems protection, and payment from ecosystem services.

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

The participation of local communities is a keystone of the current project as most of the field work has been developed in Ejidal and private properties. Most of the geographic records within Natural Protected Areas represent small populations, therefore it is fundamental to work hand by hand with local communities in order to achieve an effective conservation program for the species and the cloud forest ecosystem. During the entire project local authorities, landowners and local people have actively participated in our project. Most of the activities they have done are related to guidance and accompaniment. However, they have also agreed to share and to teach us about the species and its ecosystem. As a product of our interaction we have shared our technical knowledge, necessary to continue with several ongoing local activities, directed to get into federal programmes of voluntary conservation, and to plan new potential economic activities such as rural ecotourism under a suitable framework. However, the project timescale makes it difficult to continue this processes, therefore new projects and activities with local communities will be proposed.

5. Are there any plans to continue this work?

As it was previously mentioned in items number four and five, there are several products and activities considering the scientific research, species conservation and integration fields that need to be continued. These activities will be developed mostly by postgraduate and undergraduate students under the advice of several researches, including myself.

However, we have set the basis to establish periodical monitoring of the species populations and the surrounding habitats, and we also have identified potential species that also require immediate study and attention in order to guarantee its conservation by *in situ* and *ex situ* programs.

Also, we have identified a great potential for the species conservation and its sustainable use by the currently implemented local strategies. Therefore, we consider fundamental to facilitate and to promote the exchange of ideas between communities, and to share our technical knowledge related to such initiatives in order to make the processes more efficient and productive.

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

The project results will be shared in several ways. Scientific information will be shared through specialised journals of international circulation. We expect to publish the generated data in at least two scientific papers between 2019 and 2020. Also, the scientific information will be freely available through the Universidad Nacional Autónoma de México thesis portal, as the result of several students' research activities.

Also, the main results, final report, technical report, activities memories and photographic material will be shared using our institution social media (e. g. Facebook and Instagram) and our web site (www.biologianeotropical.com). Finally, the entire project results will be shared with the local communities engaged with the project during future visits to the localities planned for a mid-term monitoring of the species.

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

This project was initially proposed for a one year period. Difficulties mentioned in the section number 2 implied changes in the initial programme of activities. However, most of the initially activities were developed during the total length period. Considering the main outcomes of the project, we hope to extend the period for at least 1 year.

An extension will allow us to develop a periodical monitoring of the species population dynamics, to keep enhancing the species representation in botanic gardens, to establish a collaboration network between communities closely related to the species and the cloud forest ecosystem, to include new research lines based on the species conservation and to include new and priority taxa into our integrate research and conservation proposal for the Mexican cloud forest.

8. Budget: 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. It is important that you retain the management accounts and all paid invoices relating to the project for at least 2 years as these may be required for inspection at our discretion.

Item	Budgeted Amount	Actual Amount	Difference	Comments
Acorn mailing expenses	118	80	-38	Two services were used for mailing acorns from Morelia to Jalisco. The

				difference was due to fluctuations in the exchange rate initially considered.
Field trips (fuel and tolls)	941	1041	+100	There were several locations where the species no longer exists. Therefore the field stage was enlarged to cover the species entire range in Mexico. At least 35 locations were visited. Funds for the extra visits were acquired locally.
Field trips (Lodging)	1177	1297	+120	There were several locations where the species no longer exists. Therefore the field stage was enlarged to cover the species entire range in Mexico. At least 35 locations were visited. Funds for the extra visits were acquired locally.
Field trips (Food)	2543	2793	+250	There were several locations where the species no longer exists. Therefore the field stage was enlarged to cover the species entire range in Mexico. At least 35 locations were visited. Funds for the extra visits were acquired locally.
Material		150	+150	It was necessary to replace several pieces of equipment for the field stage due to physical wearing.
Local guidance		300	+300	Several communities have local policies to access the locations and requested payment for local guidance and accompaniment.
Total	4779	5661	+882	
Local exchange: 1 £ equivalent to 25 Mexican pesos. *Differences corresponded to unexpected expenses during the development of the project. The necessary resources were covered by the Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (PAPIIT) at UNAM (México) Project ID IA208017 to HRC.				

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

There are four main categories that we consider as the most important next steps for the current project as follows:

Conclude the publication of results: It is fundamental to conclude the analysis of the results and its publication through scientific papers in international journals, to conclude the student's thesis under development, and to keep updating the social media and web sites with the information generated by the project.

Update the conservation status of the species for Mexico: Despite that the IUCN category for the species was updated in 2018, currently, the Mexican environmental authorities do not consider *Q. insignis* as a threatened species. It is therefore necessary to request and to propose a further update of the species status based on our findings. However, before that it is necessary to count with the necessary published scientific information that will support the mentioned request.

Continue monitoring activities and include new species: We have settled the conditions to establish a monitoring programme that could include local communities in order to evaluate the evolution of the remnant *Q. insignis* populations. Therefore, it is important to keep visiting the studied locations and to repeat the measurements of the populations with the objective of estimating attributes such as growth, recruitment and survival. It is also important to start characterising other species populations and community structure considering that several threatened taxa were identified during the floristic surveys.

Enhance communitarian work: We consider fundamental to promote and to facilitate the dialogue between communities and academia. In order to do so, we aim to strengthen our current relations with the visited communities, and to establish a permanent network of collaboration between cloud forest communities.

10. 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?

The Rufford Foundation logo was used in the presentations during the communication of the results. The most representative events where the Foundation was used were The International Oaks Society Meeting (California) and a colloquium held by the Department of Geography and the Environment in the College of Liberal Arts at The University of Texas at Austin. The Rufford Foundation logo was also used in the project web site (<https://www.biologianeotropical.com/biologia-de-la-conservacion>). Moreover, the name of the Rufford Foundation will be included in the acknowledgement section of the papers and the technical reports under preparation.

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

Biol. Antonio López: Antonio worked as field technician in our project and supported the sampling procedure. Currently, Antonio is a master's degree student at the Universidad Michoacana de San Nicolás de Hidalgo (México), his project aims to characterize the variation in functional traits for *Q. insignis*.

Biol. Melissa Naranjo: Melissa is a Master's degree student at Universidad Nacional Autónoma de México (México), her participation aims to characterize the species genetic diversity and to determine if there is evidence of genetic erosion due to the species habitat fragmentation and degradation.

Sofia Zorrilla: Sofia is an undergraduate student at Universidad Nacional Autónoma de México (México), her participation aims to define if there are particular loci under natural selection that evidence processes of local adaptation for the species.

Daniela Navarrete: Daniela is an undergraduate student at Universidad Nacional Autónoma de México (México), her participation aims to define the effect of climate change on the oak diversity hotspots for Mexico.

Luisa Capri: Luisa is an undergraduate student at Universidad Nacional Autónoma de México (México), her participation aims to define the potential connectivity between oaks diversity hotspots for México.

MSc. Audrey Denvir: Audrey is a conservation scientist working on the oaks of the Americas red listing, she has participated on the *Quercus* species risk assessments for Mexico, including *Q. insignis* and other highly threatened oaks. Her participation in the project includes the design of the proposal and the update of the species risk category in the Mexican normativity.

Dra. Tarín Toledo: Tarin is a researcher at the Instituto de Ecología A.C. (México). Currently, she is working on the Cloud Forest regeneration. We have collaborated with her by providing *Q. insignis* seeds in order to define the species capacity to regenerate naturally in the Veracruz cloud forest.

Dra. Susana Valencia Ávalos: Susana is worldwide authority in the *Quercus* species taxonomy and ecology working at Universidad Nacional Autónoma de México (México). Susana has advised us during the planning of the field stages and confirmed the collected *Quercus* species identity.

Dr. Jesús Llanderal Medoza: Jesús is a laboratory technician at the Universidad Nacional Autónoma de México (México). He has advised us during the molecular markers amplification of the species.

12. Any other comments?

We sincerely acknowledge the support that the Rufford Foundation has given us. The advance in the understanding of important and threatened species such as *Q. insignis* would not be possible without you support. Our commitment is to keep working and to materialise your support as useful information for the species conservation.





