

## Final Evaluation Report

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Your Details	
Full Name	Omar Antonio Hernández Dávila
Project Title	Ecology restoration of cloud forest riparian strips in fragmented landscape in Veracruz, Mexico.
Application ID	39701-2
Date of this Report	20/01/2025

**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
To analyze the information obtained from the work of Hernández-Dávila and collaborators (2020) on the structure and composition of riparian strip vegetation to determine which species are most appropriate for use in the restoration of cloud forest riparian strips			X	The analysis of the structure and composition of cloud forest riparian strips (Hernández-Dávila et al., 2020) allowed us to identify 40 tree and shrub species that, based on their natural regeneration potential, can be used in passive or active restoration strategies. This information can be found in a scientific article submitted to Restoration Ecology. This article also includes relevant information about each species such as: conservation status, successional status, dispersal syndrome, general uses, and uses for restoration. The article is intended to serve as a guide for the selection of suitable species for the restoration of cloud forest riparian strips.
To evaluate in situ the success of different assemblages of native cloud forest species with the potential for riparian strip restoration			X	In July 2023, we established 11 mixed plantations in plots of 20 x 5 m. In each plot, we planted a total of 90 individuals of 9 species native to the cloud forest (10 individuals per species). The selected species were <i>Quercus insignis</i> , <i>Q. paxtalensis</i> , <i>Q. pinnativenulosa</i> , <i>Q. cortesii</i> ,

				<p><i>Meliosma alba</i>, <i>Alnus acuminata</i>, <i>Trema micrantha</i>, <i>Juglans peryformis</i>, and <i>Turpinia insignis</i>. As of the date of this report, the plants have been growing for 18 months, and we have conducted two surveys to record height and basal diameter as growth parameters. Considering that ecological restoration is a medium- and long-term process, we will measure the plantations for another 12 months to have the data of 2.5 years.</p>
<p>To conduct outreach workshops for landowners to communicate the importance of the riparian strips as well as to understand the needs of the landowners in terms of how they use riparian strips.</p>		X		<p>We conducted three informative workshops on the riparian restoration project. The workshops were held at the offices of FIDECOAGUA (Fideicomiso Coatepecano para la Preservación del Bosque y del Agua). These talks allowed us to identify the people who were interested in the project, which in turn allowed us to locate the sites to establish the restoration plantations. We plan to conduct more informative sessions this year (2025).</p>

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

**a).** The selection of species for the ecological restoration of cloud forests has included different criteria such as conservation status, successional status, and

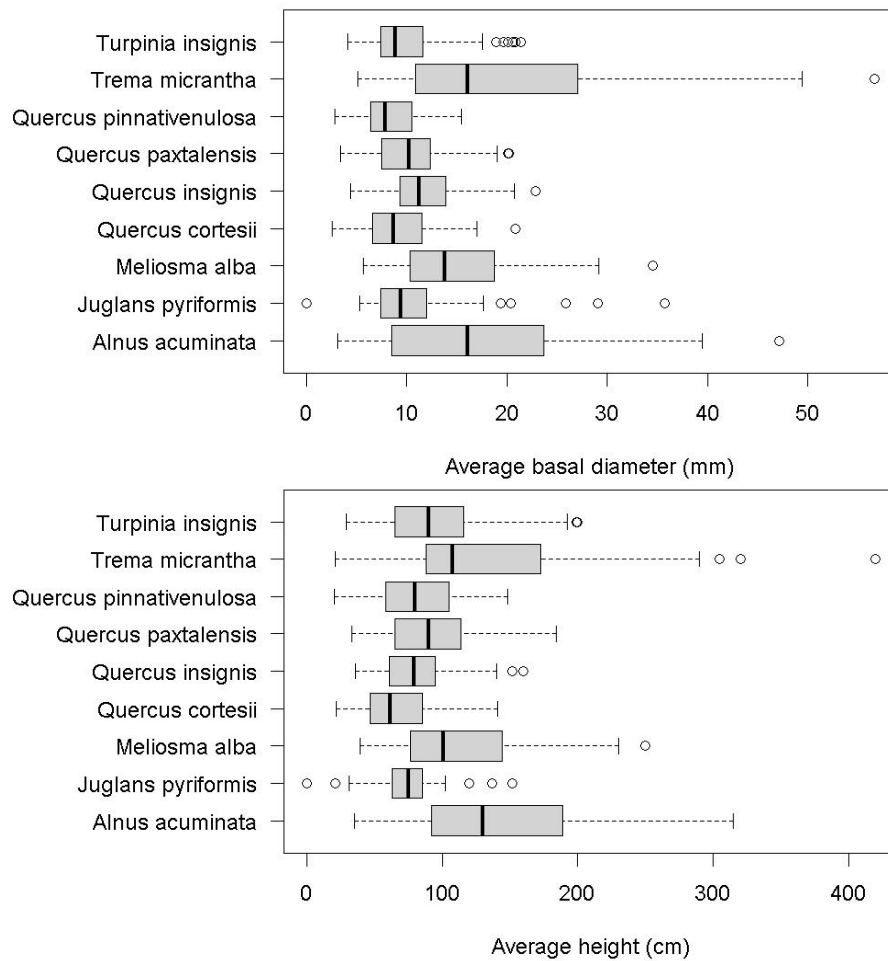
socioeconomic value. Many of the species that have been used for the restoration of cloud forests are typical or characteristic of inland fragments. However, even though riparian strips have tree elements typical of cloud forests, they have a different structure and composition than inland forests. Therefore, it was necessary to perform a specific analysis for these remnants. In the article, submitted to *Ecological Restoration Journal*, we address this and propose a list of 40 tree and shrub species with the potential to restore riparian strips. We also list a series of characteristics that may be useful when selecting these species.

**b).** In June 2023, we established 11 riparian restoration plots. Each plot contained mixed plantations that included 90 individuals of 9 species native to the cloud forest. The species used were *Quercus insignis*, *Q. paxtalensis*, *Q. pinnativenulosa*, *Q. cortesii*, *Meliosma alba*, *Juglans piriiformis*, *Alnus acuminata*, *Trema micrantha*, and *Turpinia insignis*. In July 2024 (after one year of growth), we recorded the first height and basal diameter measurements (**Figure 1**). According to our first results, the plants have reached a mean height of 58.77 cm, where the fastest-growing species has been *A. acuminata*, with mean height and basal diameter values of 143.3cm and 16.9 mm, respectively (**Figure 2**). In general, the fastest-growing species have been *A. acuminata*, *T. micrantha*, and *M. alba* (**Figure 2**). We intend to continue monitoring the plantations for at least one more year (July 2025) in order to determine the species with the best performance in terms of growth and survival. The results will be published in journals with a focus on ecosystem restoration.

**c).** PRONATURA Veracruz and FIDECOAGUA (Fideicomiso Coatepecano para la Conservación de los Bosques y del Agua) played a key role in the development of the project. Their involvement made it possible to conduct informative workshops on the project. This allowed us to identify landowners interested in the restoration of riparian strips. The participation of the landowners went beyond simply granting permission to work on their land, since they also actively participated in the establishment of the mixed plantations (**Figure 3**). In addition, in collaboration with REDFORESTA, we gave a talk on plant species characteristic of riparian vegetation and which species have the greatest potential to restore these environments.



**Figure 1.** Height and basal diameter record of the nine plant species used for the restoration of cloud forest riparian strips after 12 months of growth. Height (Right panel) and basal diameter record (Left panel).



**Figure 2.** Mean height and basal diameter values of the nine plant species used for the restoration of cloud forest riparian strips after 12 months of growth. *Alnus acuminata* was the species with the highest growth rate.





**Figure 3.** Participation of landowners in the establishment of mixed plantations for the restoration of riparian strips of cloud forest.

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

The main difficulty that arose during the project was the invasion of livestock in the plots. Even though the plots were fenced with barbed wire, the livestock managed to take down the fence of three plots. In two of these three plots, the livestock were able to graze on many of the planted individuals. Unfortunately, the individuals in these two plots did not survive. However, we managed to repair the fence of the third plot in time and only a few individuals were lost. Another difficulty was the theft of some of the sensors used to record the variation in temperature in the plots. However, we were able to replace the sensors. At present, the restoration plots have not experienced any setbacks.

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

In collaboration with FIDECOAGUA, we issued an invitation to individuals interested in the restoration of the cloud forest, particularly those whose land contained riverbeds. As a result of these meetings, we were able to identify landowners who allowed us to carry out the restoration project on their land. Once we identified the sites where the work was going to be conducted, we prepared the plots where the plantations were going to be established. The preparation of the plots involved marking, fencing, and hole digging. Subsequently, the establishment of the plantations involved the transportation of the plants and the planting of the individuals. During these stages, the participation of the landowners was crucial in establishing the 11 restoration plots. The individuals that took part in these activities were hired as field workers (day laborers) and thus benefited financially. In addition, we repaired fences, removed weeds, and conducted surveys of the planted individuals throughout the first year. We also hired the landowners for these activities, which were also remunerated.

#### **5. Are there any plans to continue this work?**

In order to determine the success of the restoration actions, medium- and long-term monitoring is required. Our aim is to record growth and survival for three years (2023-2026). As of now, the plantations have been growing for just over a year and the results look promising, with several species showing good survival and growth percentages. In addition, we would like to conduct a direct seeding experiment with the purpose of implementing a low-cost restoration strategy. Our objective is to compare both restoration actions in terms of cost, time, and species performance.

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

We will share the results and progress of this project in three ways:

1. Scientific articles in indexed journals: We recently submitted an article to Ecological Restoration, which was accepted and will be published in March 2025. In this article, we provide a list of 40 tree and shrub species with the potential to restore cloud forest riparian strips, as well as a list of useful restoration characteristics. In addition, we will prepare another article with the results of the performance, in terms of growth and survival, of the 9 plant species included in the restoration plots established in the present project.
2. Outreach articles. We understand the importance of communicating our results to the general public, and we will thus prepare outreach articles, infographics, and other audiovisual materials that will help transmit the results of the present project to the general public.



3. Informative talks. These talks will be primarily aimed at the landowners involved in the project, with the purpose of providing information about its progress and final results.

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

- To continue monitoring the restoration plantations for two more years (2026) to determine the success of the riparian restoration actions.
- If possible, to involve more people in continuing the riparian restoration activities.
- To communicate the results in specialized and non-specialized media, as well as in congresses and science outreach events.
- To continue conducting experiments on riparian restoration with the purpose of determining the most appropriate strategy to recover these environments. We are currently developing a direct seeding experiment to evaluate this low-cost recovery strategy.

**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?**

We used the Rufford logo in the various presentations we made during the project. These activities included:

- A talk during the "Environment week" organized in the municipality of Coatepec.
- Institutional seminar of the Instituto de Biotecnología y Ecología Aplicada.
- Participatory workshops with the communities at the offices of FIDECOAGUA.
- A talk that was part of the course "Restoring flows of water and life: Practice and theory of riparian and hillside restoration" organized by REDFORESTA.
- Presentation of the video "Restoration of riparian strips in the fragmented tropical montane cloud forest of the central region of Veracruz" in the modality "Say it in three minutes" of the 17 SID-INBIOTECA.

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

Dr. Lázaro R. Sánchez Velásquez participated in the following activities:

- Experimental design of the restoration plantations and continually supervised the activities of the project.

Biologist Flor Vázquez Corzas participated in the following activities:

- Participatory workshops as a representative of PRONATURA Veracruz.

Biologist Diana Vázquez Balbuena participated in the following activities:

- Workshops as a representative of PRONATURA Veracruz.
- Field activities for the establishment of the restoration plots.

PhD Candidate (INECOL) Ma. De los Ángeles García Hernández participated in the following activities:

- Experimental design of the restoration plantations.
- Field work for the establishment of the plantations.
- Annual monitoring of the restoration plots.

Omar Antonio Hernández

I designed, coordinated and implemented all the stages of the project.

#### **10. Any other comments?**

We would like to thank The Rufford Foundation for the grant awarded to us. The present project would not have been possible without its support.