



CONSERVATION LEADERSHIP PROGRAMME FINAL REPORT



Conservation of the endemic and endangered oak *Quercus brandegeei* in Baja California Sur, Mexico Project ID # 02783022

Location:

Los Cabos y La Paz, Baja California Sur, Mexico

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Project Partners & Collaborators

We are very grateful to the Conservation Leadership Program and its partners, Fauna and Flora International, Bird Life, and Wildlife Conservation Society, for financially supporting our project and for providing training to our team members.

We are deeply grateful to our mentors, Dr. Silvia Alvarez-Clare and especially Dr. Aurora Breceda (RIP) for their inspiration, human warmth, professionalism, and support until their last breath. We thank The Morton Arboretum through the Global Tree Conservation Program (GTCP), the Center for Biological Research of the Northwest (CIBNOR), and the Sierra La Laguna Biosphere Reserve for their support in different stages and processes of this conservation project.

To our great colleagues and allies: Abelino Cota, Fany Reyes, Christian Silva for their valuable collaboration, making the program generate a positive impact in the region, in addition to committing to improve the conditions of this species and its conservation. We thank the delegation of Santiago, its community, its representatives and public servants for all their support. We thank the entire Community of San Dionisio for receiving us and providing us with all the facilities to develop conservation activities, workshops on the esplanade of the Community, especially Don Victor Castro and family from the Rancho “La Acacia”, Don Herlindo Castro (RIP) and family, and Don Catarino Rosas from the Rancho “El Refugio” and family.

We thank all those who at some point helped us and contributed with valuable suggestions, comments or criticisms, which have been incorporated to improve the project. Their constructive comments, constant help, guidance and practical suggestions inspired us to carry out this work successfully. Finally, we are eternally grateful to our friends and family for their constant support, whose direct and indirect participation was very encouraging.

Section 1:

Summary:

Quercus brandegeei, locally known as Arroyo oak is an endangered (EN) oak tree, narrowly endemic to Baja California Sur, Mexico. Even though a third of its distribution area is within the protected area of the Sierra La Laguna Biosphere Reserve (SLLBR), it faces a high risk of extinction. Climate change, habitat degradation, and overgrazing in the area are driving the decline of the species. Therefore, our main objective is to save *Q. brandegeei* from extinction, ensuring that a new cohort of seedlings grows safely in the field and that conservation and management actions are adopted and executed by local land managers and stakeholders informed, empowered, and supported.

We surveyed 6 sites across the Cape Region and recorded seed production, health status and measurements on 80 parent trees. About 5000 acorns were collected, from which ~1500 seedlings have been propagated for reintroductions and others have been sent to Botanic Gardens for ex situ conservation. We held two Community Festivals for the Conservation of *Quercus brandegeei* in 2022 and 2023 in the community of Santiago with the participation of more than 400 people in total. The project continues to promote outreach to local actors to strengthen collaborations and plan long-term management, conservation and dissemination activities derived from the goals proposed in the Action, Management and Conservation Plan for the species.

Introduction

Quercus brandegeei, locally known as the arroyo oak, is a medium-sized evergreen oak belonging to the *Virentes* clade. It is classified as threatened (EN) on the IUCN Red List of Species, due to the lack of juvenile individuals. Arroyo oak populations are considered to be low with trees 100 years or older. The lack of regeneration can be attributed to both excessive consumption of acorns and trampling by domestic livestock, as well as frequent droughts and the effect of climate change as potential causes of this low regeneration. *Q. brandegeei* is distributed in the Cape Region, an area of approximately 8,500 km², which includes the municipalities of Los Cabos and La Paz.

One of the most key areas for the conservation of *Q. brandegeei* is the Sierra La Laguna Biosphere Reserve (SLLBR). It is a protected Natural Area (ANP) with 112,437.07 ha and is characterized by a complex diversity of habitats that include the sarcocaulle scrub, the only low deciduous forest or dry tropical forest of the peninsula, and in the highest areas the oak groves and the pine-oak forest develop. Finally, there is the riparian vegetation, which is a system of plant communities that are located along the channels of the main canyons. It is here where the populations of *Q. brandegeei* (Figure 1) are distributed, located on the banks of the streams at altitudes not higher than 800 m (Breceda, 1994, CONANP, 2003). SLLBR is a mountainous massif with a maximum altitude of 2,100 m and is the habitat of various threatened and endemic species and qualifies as a Key Biodiversity Area (KBA), as it meets the thresholds of criteria A1a and B1 for *Q. brandegeei*.

In addition to its importance for biodiversity, the arroyo oak provides multiple environmental services such as soil retention, water capture, temperature regulation, and carbon capture. It also provides shelter and food for both wildlife and domestic livestock and even for human consumption in the form of “atole”, flour, and oil derived from its acorns. Some efforts have been devoted to the study of oaks and in particular that of *Q. brandegeei* since little is known about the natural history of populations and their long-term viability (Cavender-Bares et al., 2016, Pérez Morales, 2021, Brinckwirth et al, 2023). Over the past four years, the conservation team for the species has collected data on *Q. brandegeei* to determine specific threats and identify priority actions to save it from extinction.

Our initiative contributes to the implementation of selected goals proposed in the Action, Conservation and Management Plan for *Quercus brandegeei* that we developed and to the commitment of local stakeholders to the conservation of the species. The results of our project can serve as a basis for medium and long-term monitoring and contribute to promoting management strategies to combat threats to *Q. brandegeei* populations and ensure the conservation of the species in the region.

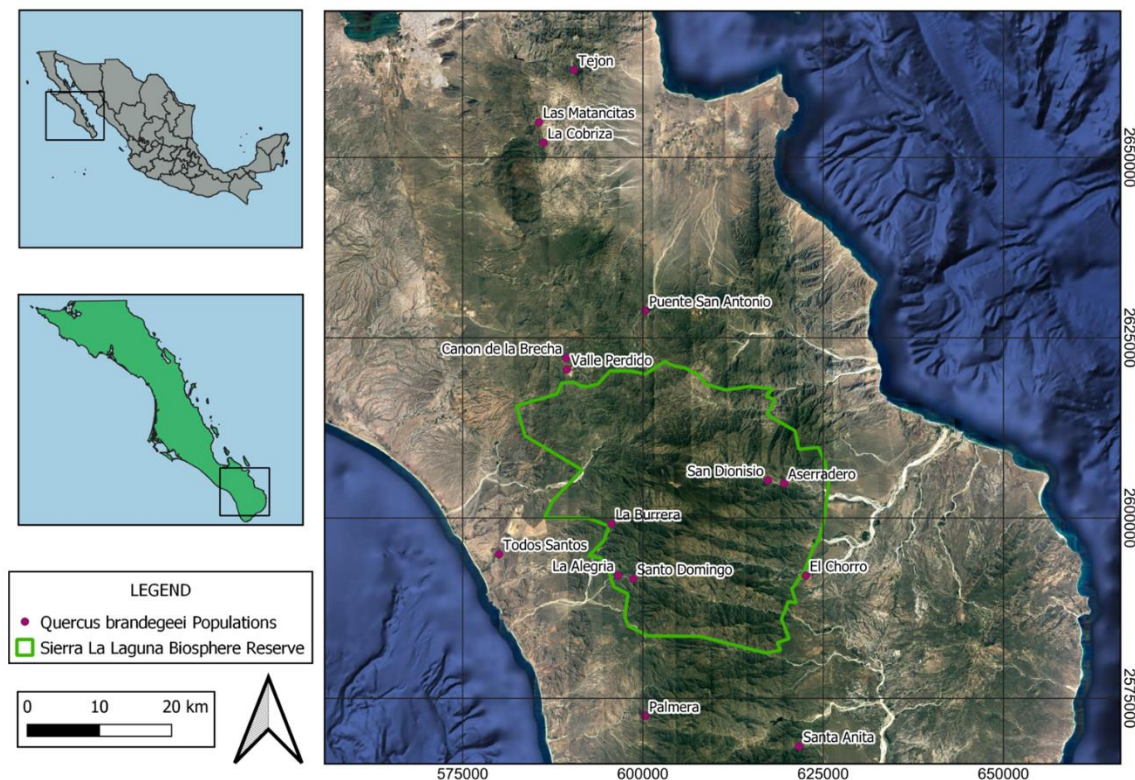


Figure 1. Map of the known populations of *Quercus brandegeei* in Baja California Sur (Own elaboration).

Project members

Daniel Wblesther Pérez Morales

I am a biologist with experience in research, leadership, and conservation with a focus on the use, management, and preservation of natural resources. My research for a master's degree at the Center for Biological Research of the Northwest (CIBNOR) focused on studying the effects of origin on the morphology, germination, and growth of seedlings of the *Quercus brandegeei* species. Currently, I am in charge of developing, managing, and executing conservation actions to protect and save the endangered oak *Quercus brandegeei* from extinction. Since 2021, we have coordinated with stakeholders and local community members a project focused on recovering populations of *Q. brandegeei* through a tree adoption program called "Salvemos al Encino Arroyero."

The Conservation Leadership Program has been the platform to generate new knowledge through an integrated conservation project, where I've acquired and increased skills and knowledge on issues such as GIS management, spatial multi-criteria analysis and project management, as well as creating new collaboration networks and start my professional development as a conservationist.

Mariana Fuentes Zarco

I am a biologist, conservationist, and educational leader. In 2021, I obtained my master's degree in leadership and education within the Teach for Mexico program, which belongs to the global education network Teach for All. My focus is to promote and drive education through empowerment and leadership in low-income students and in communities in remote areas. I have been a collaborator and team leader in conservation projects in Baja California Sur. I participated as a camp manager, providing training in sea turtle conservation techniques to technicians and managers of nesting beaches with the ASUPMATOMA AC association. Currently, I collaborate in the comprehensive conservation project of the endangered oak species *Quercus brandegeei*. I develop and execute multi-grade educational sessions in communities on environmental education, the conservation of *Quercus brandegeei*, and behavior change through workshops and experiential dynamics. Also, I participated in conservation activities such as collecting, propagation and restoration.

Marcos Yoshio Shiba Reyes

I obtained my master's degree in Use, Management and Preservation of Natural Resources at CIBNOR, SC, in November 2019 in La Paz, Baja California Sur. My thesis was focused on monitoring changes in vegetation cover after a tropical cyclone, using satellite images and NDVI. In 2022, I have experience dealing with rural communities. I have knowledge of GIS and Spatial analysis. Previous experience on the study site and the techniques used. I joined the conservation team of the *Quercus brandegeei* species participating in field activities such as measurement, registration, collection, and propagation of the species. Due to my training and experience, I participated in the multi-criteria analysis and evaluation to identify areas to establish *Quercus brandegeei* plantations. Also, I collaborated with the team in propagation and reintroductions activities. I participated in the coordination of the festivals and educational activities.

Juan Refugio Manríquez Rosas

I have been living and working in Sierra la Laguna for 48 years and have extensive knowledge of the area. I completed secondary school and then dedicated myself to working in the fields and in my carpentry workshop. Over the last few years, I have collaborated in the repair and recovery of trails in SLLBR. I participate in community brigades carrying out conservation activities such as the construction of earth and water retention walls. We collect dead wood to prevent accidents (fires) and some wood is used to make advertisements and signage in the protected area. I have developed productive and sustainability projects through the allocation of government funds to build ecological stoves and toilets, as well as the installation and maintenance of photovoltaic lighting in the reserve. I have training in firefighting and first aid in remote areas, and experience in the identification of native plant species and their propagation in nurseries. Experience in the eradication and management of invasive plants. I contributed with my extensive knowledge of the study area to the team regarding the location of the species and their populations. I participated in supporting the team in the construction of exclusion areas, in the planting of seedlings inside and outside the ranches. I was in charge of monitoring and caring for the germination of the seedlings in the greenhouse.

It is important to highlight that the project had the great support of MSc. Christian Silva Bejarano, Plant Ecology Laboratory Technician at CIBNOR – La Paz Unit. Although he was not officially involved in the CLP-funded project, he advised and supported the execution of the project and participated in field activities such as collection, propagation, reforestation, as well as in workshops and communication outreach activities.

Section 2:

Aim and objectives

The overall goal is to implement an integrated Action, Conservation and Management plan for the endangered oak *Q. brandegeei* that is based on scientific and sociocultural data, executed by a diverse and collaborative team of young conservationists, scientists, land managers and stakeholders, and that leverages local skills with our international network of experts.

The main objectives of the project are:

1. Develop a map outlining priority areas for conservation and enrichment planting for *Q. brandegeei* based on a Multiple Criteria Decision Analysis (MCDA).
2. Arroyo oak seedlings growing safely in the field (in situ) for the first time in 100 years, and the ability to continue propagation efforts through a local nursery and trained local staff.
3. *Q. brandegeei* seedlings growing safely in botanical gardens (ex situ) throughout Mexico as an insurance policy for the species.
4. Increased local awareness and capacity to protect *Q. brandegeei* and its threatened habitat, achieved through an environmental education program and the implementation of an integrated Conservation and Management Action Plan.

Changes to original project plan

In general, the most meaningful change was the start date of the project. In general, the global objectives were achieved. Particularly, objective 2 has been partially achieved, since we have faced difficult conditions for planting in some lands in the region, such as shallow, extremely hard and rocky soils. Due to this, the execution time for planting was insufficient. To continue conducting these actions we have relied on the participation of the inhabitants and local groups and associations, who support us in the adoption of seedlings, their planting and irrigation for their survival. 250 acorns of *Q. brandegeei* have been sent to 5 botanical gardens for ex situ conservation. The problems we had when shipping the seeds were their recalcitrance, that is, the seeds do not remain viable for long and the seeds germinate very quickly after being collected, which makes it difficult to send them on long routes. Some germination trays were established in places near the botanical gardens to later take the seedlings. For objective 4 we decided to focus efforts on developing a program of environmental education sessions with an S.T.E.A.M approach for children and adolescents in the communities to encourage and increase awareness about the conservation of *Q. brandegeei*.

Methodology

For the study of *Quercus brandegeei* populations in the Cape Region, a census, measurement and recording of parent trees was conducted for the purpose of collecting acorns and propagating seedlings for the reintroduction. The populations visited (SD, EC, LB, SDO, LM, LC) were selected covering their distribution area (Figure X). The census was conducted by the 4 team members and 1 CIBNOR technician from November 2022 to January 2023, for 12 days, in main periods: morning (6:00 to 12:00 p.m.) and afternoon (15:00 to 18:00 p.m.). During the census and acorn collection, measurements of tree height, DBH and canopy cover were estimated, and GPS coordinates were recorded. These demographic parameters are essential for population viability analysis and assessing the conservation status of the species both in the SLLBR and in the Cabo region. To identify threats affecting *Q. brandegeei* conservation in the area, we conducted field surveys during the intervals between census transect surveys.

Collection of acorns and propagation of *Quercus brandegeei*

Seed management. The harvesting of the fruits must be conducted at a distance no greater than the diameter of the crown directly from the ground to ensure that the seeds have completed their maturation cycle and have good germination power. For this reason, it is not recommended to take the fruit directly from the tree. These seeds must be collected as soon as possible, to avoid damage due to fungi, insects, and rodents. This species presents a germination percentage close to 80%, reaching approximately 50% of germination after 29 days. However, the germination period in this species varies and prolongs depending on the origin, since germinated acorns were observed after more than 250 days have elapsed. One of the most recommended pre-germination treatments consists of leaving the seed submerged in water for a period of 24 hours, in addition, this method helps the selection of acorns through buoyancy tests. This method consists of discarding the acorns that are observed floating in a container with water, since it is an indicator of a possible destruction of the endosperm by insects or rotting by fungi.

Nursery stage. For nursery production, the substrate to be used must be considered; It is recommended to prepare a substrate made up of peat or "peat moss", perlite and vermiculite (50% - 25% - 25%) in tiny amounts. In massive quantities, the preparation of a substrate of one part of earth (50%) and another part of peat moss, perlite, and vermiculite (50%) is recommended, considering not using humus, chicken manure or fertilizers. In addition to the above, with these substrates successful germination percentages have been obtained because they have good moisture, aeration, and temperature retention, in addition to the fact that these substrates do not need to be enriched with any product. The seed must be planted in such a way that the tip is in direct contact with the substrate, additionally it is recommended to take said substrate from areas close to the mother trees, since the species makes associations with mycorrhizae that allows a better development of the plant.

These seeds should be sown as shallow as possible, in such a way that they are not exposed to the air or uncovered by irrigation. Irrigation tasks must be done in such a way that the substrate remains moist during germination but avoiding excesses. The use of a fine drop or moderate irrigation is recommended, with the aim of not leaving the seed uncovered at any time. We use pots to plant this species with 12 x 35 cm, these were filled with the preparation of the moist substrate and placed on a table for germination to avoid contact with the soil. Irrigation must be done in the early hours of the day or in the last hours of the afternoon and must be done every third day.

In September 2023 we visited the communities of Santiago and San Dionisio for the construction of two nurseries to continue implementing conservation actions aimed at the propagation and enrichment of the populations of the arroyo oak *Quercus brandegeei*. During the commission we received the support and collaboration of local inhabitants such as Mr. Víctor Castro, owner of the La Acacia ranch in San Dionisio. In these nurseries, the propagation, care, and monitoring of around 2,500 *Q. brandegeei* seedlings is conducted, from different populations, which will be taken to sites for reintroduction once they reach the appropriate size.

To create a map describing priority areas for conservation and enrichment planting for *Q. brandegeei* based on a multi-criteria decision analysis (MCDA). The study was proposed with the objective of identifying within the framework of a spatial multi-criteria decision-making process, structured according to the analytical hierarchical process (AHP, Saaty, 1980; Saaty, 1990; Hernández-Zaragoza et al., 2019), the areas with the best suitability for establishing a *Q. brandegeei* plantations, selecting the most suitable space in the so-called Cape Region, an extension that includes the municipalities of La Paz and Los Cabos, in the state of Baja California Sur, Mexico. The hierarchical model considers climatic, soil and topographical criteria and sub-criteria that affect the location of suitable areas to establish plantations. The vector files of the five chosen variables were transformed into raster format, they were reclassified based on the requirements of the species, preserving two categories: suitable (2) and not suitable (1) (Table1, 2).



Figure 2. Seeds of *Quercus brandegeei* planted in germination trays.



Figure 3. Seedlings of *Quercus brandegeei* growing in the Refugio's garden, Santiago, B.C.S.

The values of the sub criteria were standardized, weighted, and ordered using matrices of paired comparisons, considering their importance for the conservation of the species (Figure 2 and Table 2). Mapping information on climate, soil, and topography, as well as the opinion of experts and local inhabitants, was used to evaluate the degree of suitability of the land. The implementation of the AHP technique in a spatial environment proved to be useful for incorporating expert knowledge in the decision-making process, for spatial localization and for the quantification of surfaces with different degrees of suitability for the establishment of *Quercus brandegeei*.

Table 1. Ecological characterization of *Quercus brandegeei*.

Characteristics	Description
Species	<i>Quercus brandegeei</i>
Origin	Native of México
Minimum altitude (m)	0.0
Maximum altitude (m)	800
Minimum temperature (°C)	7
Maximum temperature (°C)	40
Minimum precipitation (mm)	300
Maximum precipitation (mm)	600
Climatic group	Type B (Dry) and C (Temperate subhumid with rain in winter)
Soil type	Eutric regosols, eutric fluvisols
Soil depth	Shallow - Soils of shallow depth and little development due to the slope
Texture	Sandy
Plant association	Low Deciduous Forest, Sarcocaulle Shrubland
Uses	Wild and domestic animals consume acorns. Humans (they make flour, coffee, and oil) also consume it.

Table 2. Categorization of the variables used for *Quercus brandegeei*.

Variable	Variable Suitable (2)	Not Suitable (1)
Altitude (m)	0 – 800	801 – 2000
Temperature (°C)	7°– 40°	0°– 6°, 41°– 45°
Precipitation (mm)	300 – 500	0 – 299
Soil type	Regosol - Eutric Fluvisol	Andosol, Durisol, Gleysol, Leptosol, Luvisol, Phaeozem, Planosol, Umbrisol
Climate	Type B (Dry) and C (Temperate subhumid with rain in winter)	Cold, Semi-cold
Land and vegetation use	Low Deciduous Forest, Sarcocaulle Shrubland	Agriculture, grassland

For the adoption and reintroduction campaigns for *Quercus brandegeei* seedlings. During the months of January to June 2023, visits were made to distinct locations to plant *Q. brandegeei* seedlings belonging to the adoption, environmental education, and conservation program “Salvemos al Encino Arroyero”. Data on the origin of the seedling, labeling or marking, planting site and coordinates were recorded. The data is part of the GCCO Global Oak Conservation Consortium network led by Morton Arboretum, with support and collaboration from Botanic Gardens Conservation International (BGCI) and Franklinia foundation. We establish a network of 5 botanic gardens in Mexico for the ex situ conservation of the species. The propagation information and methods have been sent to botanic gardens and communication and contact with the person responsible continues to monitor the propagation and establish live collections for the species.

Finally, with the aim of involving local stakeholders in conservation actions and raising their awareness of the importance of arroyo oak conservation for the dry tropical forest, the riparian ecosystem and the biodiversity of SLLBR, we carried out educational and awareness-raising activities at the San Dionisio community, and at the Santiago Ecological Park where three communities (Miraflores, San Dionisio, La Ribera) surround it during the period of November to December 2022 and 2023. The educational and awareness-raising activities were conducted using simple language and in a participatory manner and were adapted according to the profile of the audiences.

A documentary called "Slavemos al Encino Arroyero", developed by CIBNOR, The Morton Arboretum in collaboration with the local community of Santiago was presented at the 1st and 2nd Community Festival in 2022 and 2023 and at local talks and events on conservation and care of the environment. In addition, awareness-raising activities were conducted with local stakeholders and decision-makers in the Cape region to inform people about the main threats affecting the species, the adoption program, and the importance of the species as a keystone species in the region's ecosystem.



Figure 4. Planting campaign and delivery of adoption certificates in distinct locations.



Figure 5. Sharing knowledge and awareness event with the community “El Ancón” at La Paz, B. C. S.

Outputs and Results

For experts and local inhabitants, the most important criterion to define the establishment of *Q. brandegeei* was precipitation, with a weighted value of 0.45, followed by soil and vegetation use 0.35 and finally topography with a value of 0.14. Table 3 concentrates these values, in addition to the weights assigned to the other criteria considered in the problem hierarchy. The final result of the five variables analyzed shows that for *Q. brandegeei* there are 371,891,022 ha with high suitability, 45,798,295.1 ha have moderate suitability, 13,858,170 ha are in the low suitability category and 625,812,053 ha are lands not suitable for its establishment (Table 4).

Table 3. Weighting assigned by the experts to the criteria and sub-criteria considered in the establishment of *Q. brandegeei* plantations.

Criteria	Weight (W)
Precipitation	0.4543
Land and vegetation use	0.2643
Altitude	0.1367
Soil	0.0729
Climate	0.0718

Table 4. Areas (ha) suitable for the species by municipality.

Species	Suitability	Total (km ²)	Total (ha)	Percentage (%)
<i>Q. brandegeei</i>	High	3,718,910.2	371,891,022.0	35.17
	Medium	457,982.9	45,798,295.1	4.33
	Low	138,581.7	13,858,170.0	1.31
	No suitable	6,258,120.5	625,812,053.0	59.19

Figure 2 shows the suitability map for *Quercus brandegeei* plantations developed using multiple criteria analysis. The areas with high suitability and with the largest surface are distributed in the northeast and center of the municipality of La Paz, in areas close to streams and in areas with elevations between 300–500 meters. In the municipality of Los Cabos, the areas with high suitability are located in the center, southwest and southeast, where there are streams and vegetation associated with low deciduous forest predominates between 150–450 meters.

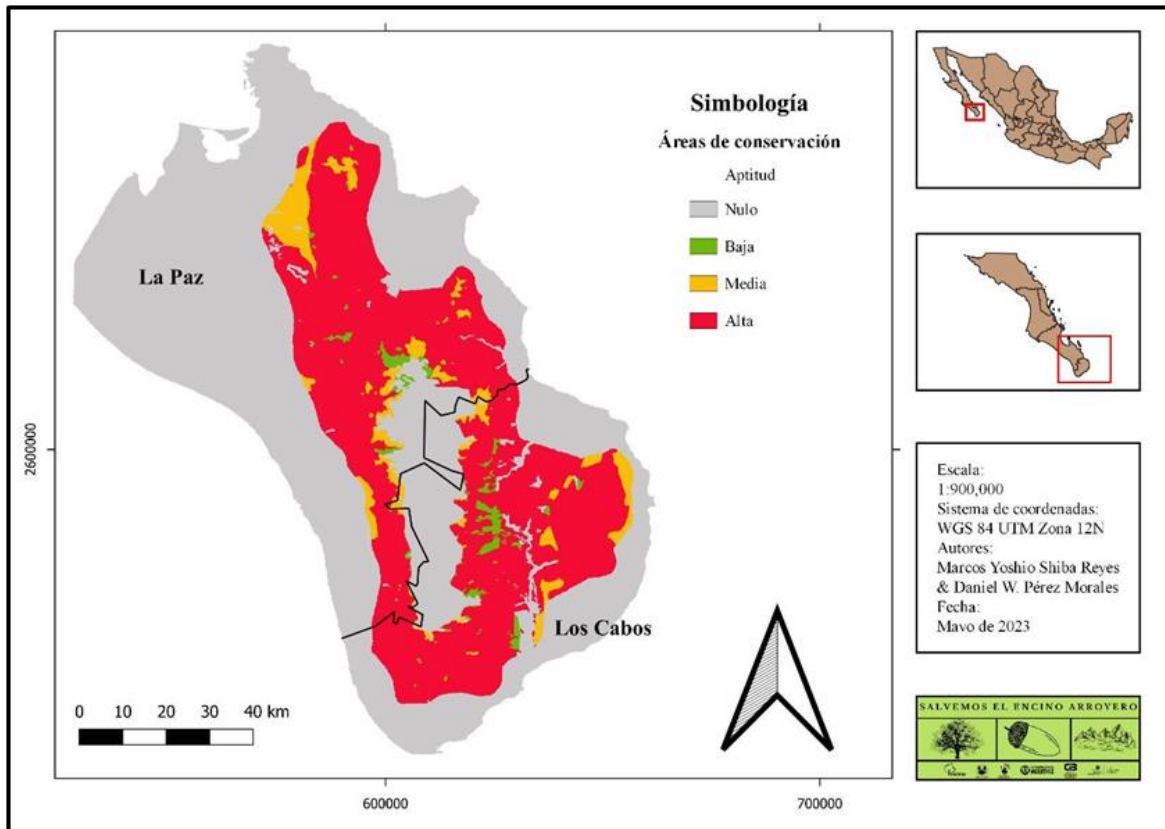


Figure 6. Map of suitability for the establishment of *Quercus brandegeei* in the Cape Region, Baja California Sur (Own elaboration).

The prioritization analysis conducted for the establishment of *Quercus brandegeei* offers a valuable framework for decision-making and resource allocation. By considering ecological, socioeconomic, and climatic factors, it allows identifying priority places where restoration efforts can have the most significant impact. However, it is crucial to recognize the limitations and challenges inherent in the process and continually adapt the analysis based on new knowledge and data. Successful restoration of suitable areas requires a comprehensive approach that integrates scientific knowledge, stakeholder engagement and adaptive management strategies.

Results from literature research and interviews with local inhabitants indicate that *Q. brandegeei* populations are distributed in isolated patches in the lowland riparian vegetation of the Cape Region and within an elevation range of no more than 8000 m. Most communities are not fully aware of the effects associated with the loss of species, particularly oaks such as *Quercus brandegeei*, however, they recognize that it is an important species and that it must be protected, it has an immense value for the local population. Acorn production is a concern, due to its use to feed domestic animals. In this regard, respondents provided relevant information for the conservation of the species, indicating that not every year is a year of acorn production, this depends on the presence of wind and rain. They also mentioned that it is necessary to produce and reintroduce seedlings in areas fenced or protected from livestock and other consumers. In addition, it is necessary to find suitable sites for planting them, such as sites with sufficient water and soil, such as ravines with water or with the presence of humidity or near streams.

Information about the *Quercus brandegeei* Conservation Project and its significance to the biodiversity of the Cape Region and the SLLBR and the importance of preserving natural resources was disseminated during presentations, talks and educational activities. More than 400 local people attended the presentations on the project and awareness-raising activities and sessions with local communities at the 2022 and 2023 community festivals. Among them, 60 students answered questionnaires on the importance of *Quercus brandegeei* in the Cape Region and its environmental perception.



Figure 7. Awareness event with the community at the Festival of *Quercus brandegeei* at Santiago, B. C. S.

A presentation on the project and the importance of the Arroyo Oak was held during the event to celebrate the 30th anniversary of the SLLBR Protected Natural Area decree, where ANP officials, decision makers and the local community were present. Another poster presentation on the project and the importance of *Q. brandegeei* as a key species for biodiversity conservation was held at the National Assembly of Botanical Gardens of Mexico in October 2023, reaching more than 200 attendees, students, and national researchers from universities, institutions, and botanic gardens.



Figure 8. CLP Team at the First Community Festival of *Quercus brandegeei*, Santiago, B. C. S.



Figure 9. Talk of the *Quercus brandegeei* conservation project at the 30° Anniversary of the Sierra La Laguna Biosphere Reserve.



Figure 10. CLP Team at the Second Community Festival of *Quercus brandegeei*, Santiago, B. C. S.

Communication & Application of results

The main activities and results of the project were communicated to the local stakeholders especially through the presentations realized at the Ecological Park of Santiago and the two Festival realized in the park. It was a great opportunity to interact personally with the local community, decision makers in the region and park managers. We also used brochures and local newspapers to disseminate our objectives and to raise the awareness of visitors and local community living surround the SLLBR.

The main activities and results of the project were communicated to local stakeholders, especially through the presentations held at the Santiago Ecological Park and the two Community Festivals held at the park in 2022 and 2023. It was a wonderful opportunity to interact personally with the local community, decision makers in the region and managers of the park and the SLLBR. We also used local brochures and newspapers to spread our objectives and raise awareness of visitors and the local community living around the SLLBR.

The creation of an official logo gave an identity to the Project (Figure 11) and through a Facebook page we were able to build a communication channel with people in general. As a result, the Project have now more than 80 followers. It represents a great channel to engage with a range of stakeholders across

scales (local to international) and disseminate to them the existence of the arroyo oak and its extinction risks, and to raise awareness about the importance of conserving the species and its habitat at the Cabo Region. In addition, media articles and mini documental were published on the Morton Arboretum web site to communicate the results of our project to the international community. For the scientific community, we presented posters in academics events and the results, like the MCDA, to create the map of *Q. brandegeei* will be published in a scientific journal.



Figure 11. Official logo created for this project.

Monitoring and Evaluation

We used a Gantt Chart to monitor the project's activities during the period established by the team members. It was a great tool to assess the execution of the project's activities on time and to evaluate if the objectives purposed have been achieved. For the fieldwork activities, we also evaluate its effectiveness by the number of localities surveyed in the Cape Region and the number of *Q. brandegeei* groups recorded. To assess the effectiveness of the education and awareness activities, we asked the local students to respond to a questionnaire before the education activities and some months after its execution. We believed it would be a useful tool to evaluate if the education activities provoke changes in the environmental perception and knowledge of the students.

Achievements and Impacts

A Multi-Criteria Decision Analysis (MCDA) was developed, and a map was prepared for the selection of optimal areas for planting *Quercus brandegeei*. Two members completed intensive online GIS training to develop a Multi-Criteria Decision Analysis (MCDA) and prepare a map for selecting optimal areas. The analysis is part of the action plan for the species where reintroduction work is designated in the region.

Through the project activities we were able to record at least 80 parent trees from 6 different populations and record new areas of presence of the species in the Cape Region. Currently, a new generation of *Quercus brandegeei* is established in the Cape region and is part of the adoption and conservation

program for the species called “Salvemos al Encino Arroyero”. 1,700 seedlings have been planted, in fenced gardens, orchards and within exclusion plots, to prevent the impact of herbivory and animal trampling in locations.

The project was able to establish contact with representatives of 5 botanical gardens to send seeds for propagation. We achieve information and maintain monitoring on the propagation and establishment of 250 acorns in ex-situ sites of the country.

We successfully held the 1st and 2nd Community Festival for the Conservation of the Arroyo Oak (*Quercus brandegeei*), with about 250 attendees at each event. A talk about the conservation project was given to 60 attendees at each festival. Two presentations have been made about the species conservation project in meetings with oak specialists and the Mexican Association of Botanical Gardens (Ensenada, B.C., and Guanajuato, 2023). The Action, Management and Conservation Plan for *Quercus brandegeei* was prepared. Presentation of the mini documentary “Salvemos al Encino Arroyero” produced in collaboration with CIBNOR, Morton Arboretum and habitants of the community was highlighted the video is uploaded to:

mortonarb.org/science/projects/integrated-conservation-arroyo-oak/.

The good relationship between the project team and stakeholders is another key achievement of our project and of huge importance to reach our objectives and overall aim. The awareness and education activities developed with the local community, visitors and SLLBR managers provided a good opportunity to get people engaged in the conservation of the arroyo oaks and to identify potential partners for any project-related initiatives in the region.

Capacity Development and Leadership capabilities

Through the development of this project, team members had the opportunity to gain experience that a conservation project is much more than collecting field data and publishing the results to the scientific community. Real conservation actions depend deeply on the local community and decision makers, who in most cases have divergent interests and motivations. To achieve the goals of this project, we developed skills to use the collected data to achieve conservation impact and to influence park managers and decision makers and to change the perception and attitudes of the local community and visitors. We improved our ability to talk and work with diverse groups of people with different opinions and interests and developed skills to adapt our plans to changing situations. We all grew personally and developed leadership and management skills and concluded that the recognition of our strengths and weaknesses, trust, respect, and passion are the magic formula for a team to achieve success with a conservation project.

Section 3:

Conclusions

The Cape Region's arroyo oaks are emblematic trees of great cultural, biological and ecosystem value. Due to their intrinsic conditions and anthropogenic disturbances, they are threatened. Their conservation and sustainable management are a legacy for current and future generations, hence the interest in developing activities for their protection and sustainable use.

This team has advanced in the knowledge of the areas of suitability for *Quercus brandegeei* plantations based on a multicriteria analysis and the increase of ex situ collections of the species in the country through collaboration with Botanic Gardens. In addition, the techniques of collection, propagation, and reintroduction of seedlings in the region have been perfected.

The interest of the group is not only research, but mainly to propose and advance with conservation and sustainable management actions. To this end, it was proposed to develop the Action, Conservation and Management Plan for *Quercus brandegeei* which is based on the principle of the exchange of knowledge and transdisciplinarity. We have managed to form a solid network of protectors of the species under the "Salvemos al Encino Arroyero" Program, through which more than 1,500 oaks have been adopted in 26 ranches in 12 locations, nurseries have been created where 5,500 juveniles have been produced, and dissemination materials have been developed on the biological value of the species and the results of the collaboration. The program has been successful, thanks to the transdisciplinarity and the respect and exchange of knowledge.

Problems encountered and lessons learnt

Community awareness and dissemination activities, such as the First and Second Encino Arroyero Community Festival, which was a complete success. This great result was possible thanks to the collaboration of the authorities, both municipal and communal, of Baja California Sur. We held meetings to plan the activities, exchanged ideas and experiences, adapting the activities that were conducted at similar events and listening to the preferences and tastes of the people.

The collection and propagation of acorns has been effective, since the team members have field experience in data recording, collection, and propagation techniques.

The recalcitrance of the seeds was a factor that complicated the delivery of the seeds. Because the seeds must remain stored, refrigerated, otherwise their germination capacity may be affected. We consider that to achieve this objective, contact and approach with the botanical gardens must be made a couple of months in advance to guarantee delivery on time.

It is important to correctly schedule the activities, considering the time of the administrative, legal, and banking processes that are essential for the institutions. Maintain effective communication with team members to avoid delaying processes and optimize project activities.

One of the main lessons learned during the project was that without the support provided by the SLLBR managers and a good relationship with the stakeholders, we would not have been able to succeed in our project. The support provided by them was of enormous importance for the good development of the field work and for the awareness and education activities with the local community and visitors to the ANP. The results of these activities will have an essential impact on the conservation of the species in the medium or long term.

In the future

The next steps of the project are to:

Publish The Action, Management and Conservation Plan of *Quercus brandegeei* in the Cape Region.

Continue monitoring of *Quercus brandegeei* populations in SLLBR and in the Cape Region.

Continue holding the *Quercus brandegeei* Community Conservation Festival in the Santiago community.

Create an NGO to implement the project and develop a fundraising strategy to ensure the long-term sustainability of the project.

Expand education activities with local communities in other locations that were not involved during this project.

Implement an education and adoption program to train local students as monitors. It will be especially important to improve and innovate education and awareness activities, to continue conservation actions in the future and motivate the local community to get involved in conservation.

Publish a peer-reviewed journal article based on the Multi-Criteria Decision Analysis (MCDA) and map created for selecting optimal areas.

Monitoring the activities and conservation work of *Q. brandegeei* in the Botanical Gardens (Post project activity).

Financial Report

In Table 5 is the summary sheet of the financial report of this project.

Table 5. Full account of income and expenditure.

Itemized expenses	Total CLP Requested (USD)*	Total CLP Spent (USD)
PHASE I - PROJECT PREPARATION		
Communications (telephone/internet/postage)	380.00	326.00
Field guide books, maps, journal articles and other printed materials		
Insurance		
Visas and permits		
Team training	450.00	257.78
Reconnaissance	1,480.00	1288.89
Other (Phase 1)		
EQUIPMENT		
Scientific/field equipment and supplies	668.00	638.00
Photographic equipment		
Camping equipment		
Boat/engine/truck (including car hire)		
Other (Equipment)	3,390.00	3364.30
PHASE II - IMPLEMENTATION		
Accommodation for team members and local guides	1,440.00	1466.67
Food for team members and local guides	480.00	535.56
Travel and local transportation (including fuel)	1,300.00	977.78
Customs and/or port duties		
Workshops	2000.0	1783.33
Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	700.00	777.78
Other (Phase 2)	1,250.00	1250.00
PHASE III - POST-PROJECT EXPENSES		
Administration		
Report production and results dissemination		
Other (Phase 3)	1,400.00	2275.50
Total	14,938.00	14,941.58

Section 4:

Appendices

CLP M&E measures

Output	Number	Additional Information
Number of CLP Partner Staff involved in mentoring the Project	02	
Number of species assessments contributed to (E.g. IUCN assessments)	00	
Number of site assessments contributed to (E.g. IBA assessments)	01	10090 KBA - Sierra La Laguna
Number of NGOs established	0	
Amount of extra funding leveraged (\$)	\$5000	Franklinia Foundation
Number of species discovered/rediscovered	0	
Number of sites designated as important for biodiversity (e.g. IBA/Ramsar designation)	01	10090 KBA - Sierra La Laguna
Number of species/sites legally protected for biodiversity	04	4 sites located within the polygon protected in SLLBR.
Number of stakeholders actively engaged in species/site conservation management	06	
Number of species/site management plans/strategies developed	01	Action, Management and Conservation Plan of <i>Quercus brandegeei</i>
Number of stakeholders reached	500	Festivals, workshops, plantations Other stakeholders have also been reached through our messages at media and social channels
Examples of stakeholder behavior change brought about by the project.	02	-The organizational capacity of the community, government and institutions for the Encino Arroyero community festival in 2022 and 2023 - Decision makers are adopting, planting and caring for stream oaks.
Examples of policy change brought about by the project	0	
Number of jobs created	0	

Number of academic papers published	01	On going
Number of conferences where project results have been presented	02	Meeting of GCCO oak specialists (Ensenada, B.C. 2023) and Annual Assembly of the Mexican Association of Botanical Gardens (Guanajuato, 2023)

Newspaper and media articles relating to the project

BBC News World - México: el misterio de los robles centenarios de Baja California Sur (y el secreto para salvarlos de la extinción)

Site link: <https://www.bbc.com/mundo/noticias-60233341>

First Community Festival of Conservation of the Arroyo Oak, *Quercus brandegeei* 2022.

BGCI Web Link: <https://www.bgci.org/news-events/first-community-festival-of-conservation-of-the-arroyo-oak-quercus-brandegeei-2022/>

International Oak Society Link: <https://www.internationaloaksociety.org/content/first-community-festival-conservation-quercus-brandegeei-2022>

The Newsletter of the International Oak Society, Volume 27, No. 1, 2023:

https://www.internationaloaksociety.org/sites/default/files//files/oak_news/ios_newsletter_2023_1.pdf

“Salvemos al Encino Arroyero” A short documentary about the Conservation project to save the Arroyo Oak (*Quercus brandegeei*). The goal is to promote participation of local ranchers in the *Adopt a Tree Program* we are conducting. The video can be seen here (the video is uploaded at mortonarb.org/arroyo). Click the cc button on the time bar for english subtitles.

Second Community Festival of Conservation of the Arroyo Oak, *Quercus brandegeei* 2023

<https://www.loscabos.gob.mx/por-segunda-ocasion-en-los-cabos-se-realizara-el-festival-comunitario-salvemos-el-encino-arroyero/>

<https://www.loscabos.gob.mx/gobierno-de-los-cabos-impulsa-acciones-para-la-conservacion-del-encino-arroyero-arbol-endemico-de-b-c-s-en-peligro-de-extincion/>

Project social media channels on Facebook



Informative triptych was created to raise awareness about the *Quercus brandegeei* species (first picture) and poster with the results of the project (second picture).



Relevant photographs:
Photos from fieldwork and awareness activities



Visit to towns in the Pacific, North and Gulf. Measurements, marking and data collection



Registration and planting of Quercus brandegeei seedlings.



*Registration and planting of *Quercus brandegeei* seedlings.*



Construction and assembly of structures for the nursery in San Dionisio.



Transplanting seedlings into pots for growth and development.



*Seedlings of *Quercus brandegeei* growing in the Refugio's garden, Santiago, B.C.S.*



Planting campaign and delivery of adoption certificates in distinct locations.



*Talk sharing about the conservation project of *Quercus brandegeei* at Santiago, Baja California Sur.*

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Address list and web links

Integrated Conservation of the Arroyo Oak in the Cabo Region, Mexico

https://mortonarb.org/science/projects/integrated-conservation-arroyo-oak/?utm_medium=direct&utm_source=url
www.facebook.com/proyecto.encinoarroyero/
proyecto.encinoarroyero@gmail.com

Distribution list

Final copies of this report will be sent to:

Centro de Investigaciones Biológicas del Nooreste (CIBNOR)
Area Natural Protegida Reserva de la Biosfera Sierra La Laguna (SLLBR)
The Morton Arboretum
El Grupo de Conservación Global de Encinos GCCO Mesoamérica
Dirección de Ecología de Los Cabos.