

Biodiversity conservation assessment to protect two micro-endemic oaks from western Mexico: *Quercus cualensis* and *Q. tuitensis*

Maribel Arenas-Navarro^{1,2}, Jhenifer Reyes-Galvez^{2,3}, Javier Piña-Torres⁴, Guillermo Huerta³, Andrés Torres-Miranda³

¹ Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México (UNAM), México. ² Instituto de Investigaciones en Ecosistemas y Sustentabilidad (IIES), UNAM, Michoacán, México. ³ Escuela Nacional de Estudios Superiores Unidad Morelia, UNAM, Michoacán, México. ⁴ Instituto de Ecología A.C., Xalapa, México.

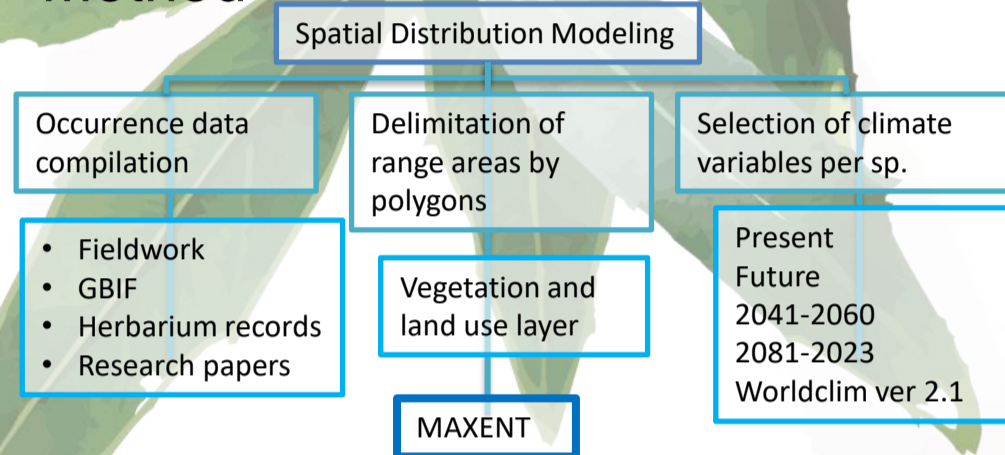
Introduction

Oaks (*Quercus*) are recognized as a key species, play vital ecological roles across several ecosystems. In Mexico, oaks mainly inhabit temperate forests, although they can also be found in scrublands, dry forests, and humid tropical mountain forests. In western ranges from Mexico (Jalisco), at least 30 oak species have been recorded [1], considered a high richness and endemism center for red oak (*Lobatae* section) [2]. The 2020 IUCN evaluation classified *Q. cualensis* as endangered and *Q. tuitensis* as vulnerable. However, neither species is protected under Mexico's standard norms, leaving them vulnerable to threats like deforestation, land use change, and climate change.

Objective

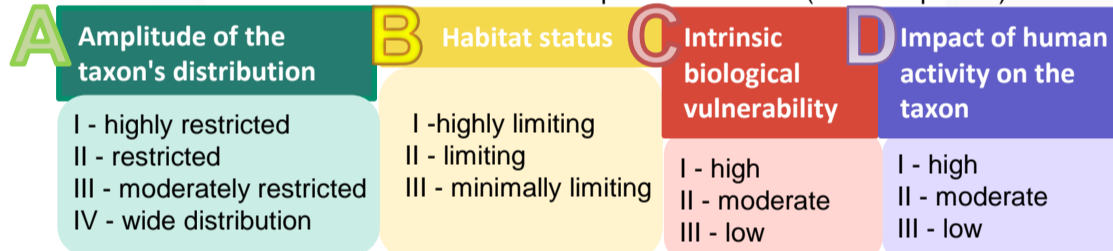
The objective of this study was to carry out the extinction risk assessment method through the robust analysis of its current distribution (ecological niche modeling) and their projection to different climate change scenarios (optimistic and pessimistic), along with intrinsic and anthropogenic threats. This analysis will facilitate its inclusion in the Mexican standard norms.

Method



Extinction Risk Assessment Method

The Official Mexican Standard 059 (NOM-059) is the regulatory instrument that identifies the species or populations in Mexico at risk through the application of the Extinction Risk Assessment Method for wild species in Mexico (MER in Spanish).



Categories

- P Endangered
- Pr Under special protection
- A Threatened
- E Probably extinct in the wild

Study area

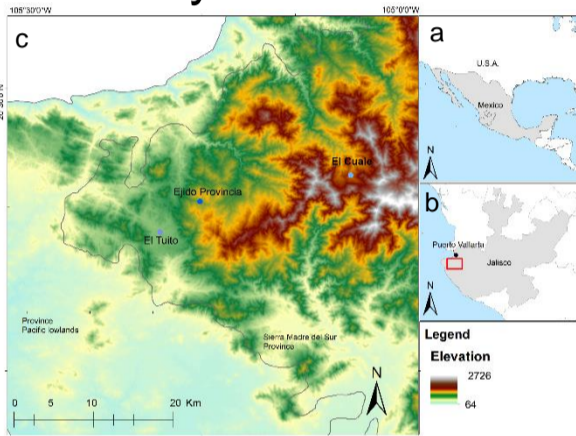


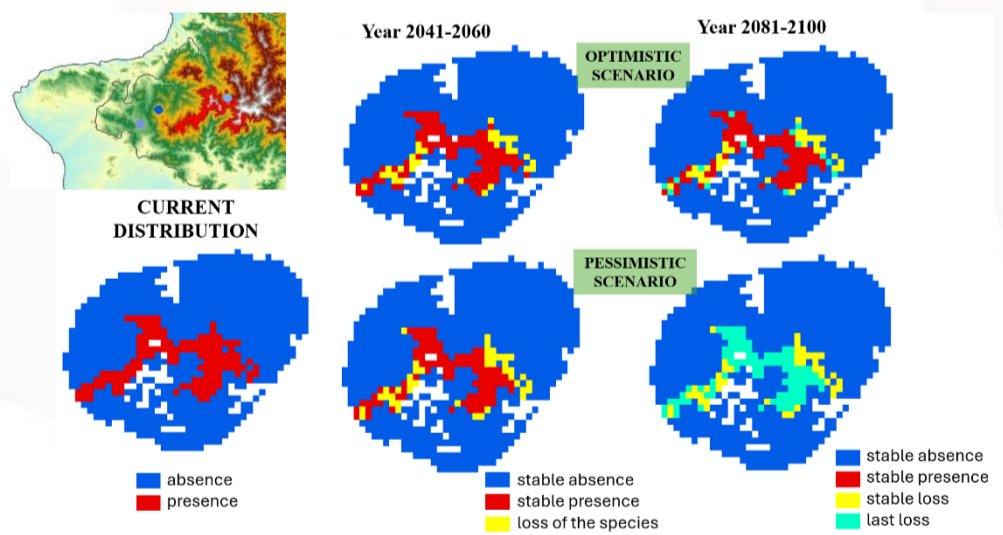
Figure 1. (a) Location of the Serranías Meridionales of Jalisco (Jalisco Southern Sierras) in Mexico, (b) Jalisco state and the Serranías Meridionales of Jalisco (SMJal), (c) Study area along the SMJal.

Results

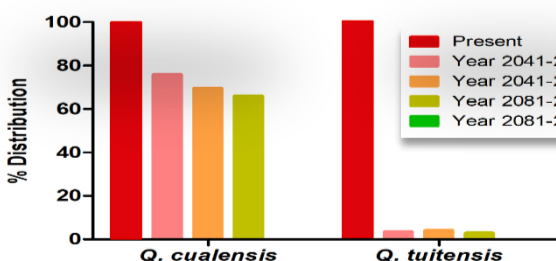
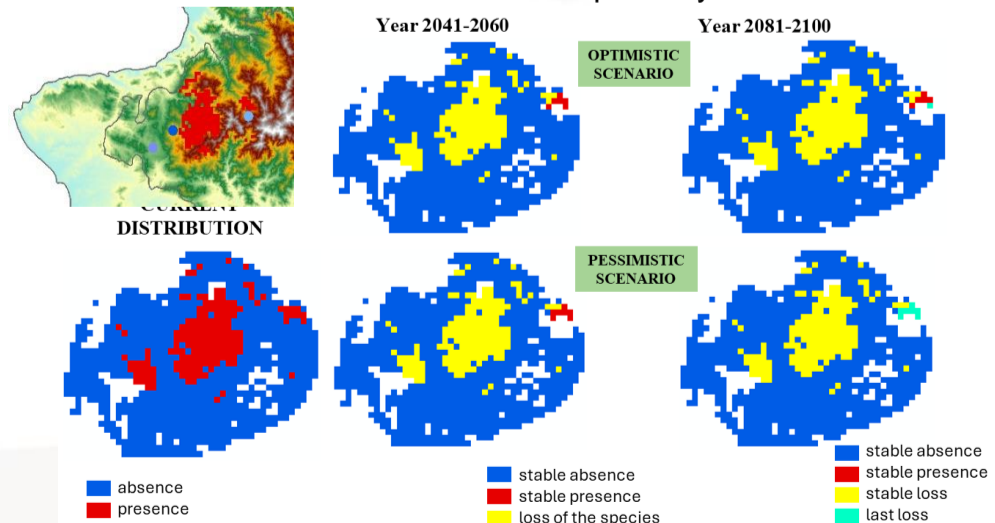
The risk method analysis determined that *Q. cualensis* and *Q. tuitensis* species are in danger of extinction due to the reduced habitat and recent anthropogenic pressures such as the reactivation of an old gold mine and the illegal extraction of pine wood in the forests. These two species have very small distribution areas (between 125 - 154 km² respectively), and with the climate change models, they reduced their environmental suitability by 100 % in pessimistic scenarios, even though these species inhabit different environments but with very narrow tolerance ranges.

	<i>Q. cualensis</i>	<i>Q. tuitensis</i>
A. Amplitude of the taxon's distribution	0.81	0.81
B. Habitat status	0.78	0.78
C. Intrinsic biological vulnerability	0.26	0.26
D. Impact of human activity on the taxon	0.5	0.4
	2.35	2.1

Q. cualensis L.M.González 1800 - 2300 m Pine-oak forest



Q. tuitensis L.M.González 980-1400 m Tropical dry forest



Both oak species need protection. As a first step into conservation actions, we established educational strategies in the local schools with kids and adults about the importance of endemic species in the region, the importance of preserving species with local knowledge, and a legal framework to achieve their long-term protection.

We thank to S. Valencia-Á. for species identification. We especially thank to the people of the Ejido Provincia and El Cuale. We acknowledge the International Oak Society for the grant for the project "Protection and conservation actions through the extinction risk assessment method for five endemic Mexican oak species" to MAN and CTM.

References
 [1] Arenas-Navarro et al. Environmental filters determine the distribution of tree species in a threatened biodiversity hotspot in western Mexico. (2020). Botanical Sciences, 98(2), 219-237. DOI: 10.17129/botsci.2398
 [2] Torres-Miranda A, Luna-Vega I, Oyama K. 2013. New approaches to the biogeography and areas of endemism of red oaks (*Quercus* L., Section *Lobatae*). Systematic Biology 62: 555-573. DOI: 10.1093/sysbio/syt021