
ECOLOGY OF OAK WOODLANDS IN THE SIERRA MADRE OCCIDENTAL OF MEXICO¹

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Introduction

Oak woodlands are found in all Mexico, except the Yucatan state. The *Quercus* genus is characterized by having a wide adaptation variability, and it can be found in temperate, subtropical, tropical and semi-desertic regions as dominant or complementary species in association with other woody species.

Mexico is well known as a country with a very high biodiversity, and the Mexican forests have different pine-oak associations, with more than 200 species of classified oaks (Bejar, H.G., 1982); however, the precise number of oak species in Mexico is not exactly known.

The *Quercus* species are classified in several selections, and three selections have been documented in Mexico: The erythrobalanus (lobatae) or red oaks, composed of 53 species which represent 49% of the known Mexican *Quercus* species; lepidobalanus or white oaks, with 52 identified species; and the intermediate oaks (red-white oaks), the smallest group with 3 known oak species that correspond to the protobalanus and represent three percent of the identified oaks in Mexico (Zavala, Ch. F., 1991). This taxonomic section has a small distribution in North Baja California and close islands, and it is considered the transition group between the red and white oaks (Valdez, T.V. and Aguilar, e. Ma. L., 1983). At the present time, subgenus cyclobalanopsis has not been documented in the Mexican forests.

Oak Distribution in Mexico

Some oak species can be found in a wide range, growing in many Mexican states; meanwhile, other species grow in different environmental conditions within the same state. Other endemic species grow in special environmental conditions.

Some examples of oak species that have a wide range of variability are: *Quercus rugosa*, a white oak documented in 22 Mexican states; and red oaks *Q. castanea*, *Q. candicans*, *Q. laurina*, growing in 20, 18 and 17 states, respectively; *Quercus laeta*, classified as a white oak can be found in 16 states; at the same time, *Q. crassifolia* and *Q. obtusata*, a red oak and a white oak, respectively, are represented in 15 states.

Zavala (1991) describes the following species which each grow in only one state: *Q. agrifolia* exists in Baja California; *Q. benthami*, *Q. bogueroanae* and *Q. crispifolia* can be found in Chiapas State; the environmental conditions in Nuevo Leon State are adequate to grow *Q. cupreata* and *Q. durani*; *Q. undulata* exists in Coahuila State; *Q. ocarpa* is found in Jalisco State; *Q. brandegei*, *Q. devia* and *Q. cendrocencis* are found in Baja California; *Q. duratifolia*, *Q. monserratisensis* and *Q. paxtalensis* are documented as endemic species of the Chiapas State.

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In contrast, some states exhibit a great variability of oak species. For example, Jalisco State has the highest species diversity. It has been determined that this state has the environmental conditions to grow 41 oak species. Michoacan State follows in number of species with 31 oak species. The states of Durango and Veracruz have 30 and 28 species, respectively. In each one of the states of Chiapas, Mexico, Hidalgo and San Luis Potosi exist 26 oak species.

Studies in Nuevo Leon and Oaxaca States reported 25 oak species. And the states with more than 20 oak species documented are Chihuahua, Puebla, Guerrero and Sonora. In contrast, the states of Tabasco, Campeche and Quintana Roo have only *Q. oleoides* (white oak). At the same time in the state of Tlaxcala have been found seven oak species.

Zavala, Z. R. (1991) mentions that in Durango State the most common oak species are *Q. arizonica*, *Q. intricata*, *Q. crassifolia*, *Q. hartwegii*, *Q. chihuahuensis*, *Q. cordifolia*, *Q. grisea*, *Q. emoryi* and *Q. juniperus*. These species are associated with pine species such as: *Pinus cooperi*, *P. duranguensis*, *P. chihuahuana*, *P. teocote*, *P. leiophylla*, *P. engelmannii*, *P. herrerae*, *P. cembroides*, among other species.

Climate and Soil Condition of Oak Woodlands

The soil where these species are established is podsollic, brown and 20-25 cm deep. The humus is grey and the pH is strongly acid. In general, these soils have lower amounts of nitrogen, phosphorus and potassium. In addition, Perez O. de las Paz C. (1982) mentions that in Durango are found *Q. convallata*, *Q. sideroxyla*, *Q. potosina* and *Q. obtusata* (red oak). These species exist in association with other genera such as *Pinus*, *Alnus* or *Juniperus*. These species are found at altitudes from 2400m - 2600m. The temperature varies from 14°C to 18°C.

The state of Michoacan is very important from the point of view of forest production. A great diversity of forest species can be found in this state. The *Quercus* spp. that grow in this forest range are *Q. crassifolia*, *Q. candicans*, *Q. rugosa*, *Q. castanea*, *Q. obtusata*, *Q. laurina*, *Q. conspersa*, and *Q. resinosa*. These oaks are found in mixed stands or pure stands with *Pinus michoacana*, *P. pseudostrobus*, *P. douglasiana*, *P. lawsonii*, *P. pringleyi*, *Alnus firmifolia*, *Carpinus caroliniana*, *Clethra mexicana*, *Arbutus xalapensis*, *Acacia pennatula* and other species. The soils where these species are growing are volcanic andosols and podsollic, with 6.7 to 6.92 pH. The climatic conditions are semiarid and subhumid with abundant rain in the summer season. The annual precipitation mean is 1335 mm and the average temperature is 16°C. The altitude is 1700m to above 2000m (Bello, G. MA. and Bejar, M. G., 1982).

Valdez, T.V. and A. E. Ma. L. (1983) reported that in the state of Nuevo Leon are established the following oak species: *Q. fulva*, *Q. gregii*, *Q. hypoxantha* and *Q. sideroxyla*. These species are found associated with *Pseudotsuga* spp., *Abies* spp., *Juniperus* spp., *Cupressus* spp., *Populus* spp. and other genera. These oak species are found in other states. For example *Q. fulva* is found in Nayarit, Chihuahua, Durango and Sinaloa, also *Q. gregii* grows in Coahuila, Tamaulipas, San Luis Potosi, Durango and Hidalgo. At the same time, *Q. hypoxantha* grows in Coahuila and San Luis Potosi. *Q. sideroxyla* is found in Chihuahua, Durango, Zacatecas, Aguascalientes, Guanajuato and San Luis Potosi.

These oak species grow at altitudes from 2500 m to 3470 m. The mean precipitation is above 1000 mm per year. The temperature is from 5.8°C to 10.8°C.

In summary, the high oak species diversity in Mexico requires detailed studies in order to know the best management practices for the oak woodlands nationwide.

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Quercus canbyi Chipinique Park, Nuevo Leon, Mexico- Elevation 3000'
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