
MANAGEMENT AND SILVICULTURAL PRACTICES APPLIED TO PINE-OAK FOREST IN DURANGO, MEXICO¹

by

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Study Area

Durango state is located in the northwest region of Mexico. It is surrounded by Chihuahua state in the North and Northeast, Coahuila and Zacatecas in the East, Jalisco and Nayarit in the South, and Sinaloa in the West (Inegi, 1988; Zavala, 1985). It has an area of 11,964,800 hectares.

Half of Durango territory is located on the Sierra Madre Occidental with a 125 km width, 425 km length and mean altitude of 2500 m. The remaining area is located on the altiplanicie (high plain) Mexicana. The lowest altitude record is registered at Tamazula, Durango, with 250 m and the highest record reaches 3,300 m at the Huehuento Mountain.

According to the broad diversity in climatic and physiographic conditions throughout the state, Durango is divided into four regions, each one with characteristic types of vegetation. These physiographic regions are:

1. The Quebradas Region - It is characterized by its tropical type of vegetation (deciduous tropical forest and semi-deciduous tropical forest). It is located on the west side of the Sierra Madre Occidental, in an altitude range from 27 to 500m; with a warm and subhumid climate and a summer rainy season. The annual mean precipitation is 1250 mm in this region (Zavala, Z. 1982, Gonzalez, S. 1985).

2. The Mountains or Central Region - It involves the highest elevations of the Sierra Madre Occidental, and it is mainly covered by coniferous forest (pure pine forest, mixed pine-oak forest, and grassland-shrubs forest). The mean altitude is 2600 m; there are some mountains higher than 3000 m. It presents a temperate-cold climate with a very intensive rainy season in the summer. The annual mean precipitation varies from 500 to 1200 mm. There are many forest species growing throughout this region; however, the most important genera in this area are: *Pinus*, *Quercus*, *Cupressus*, *Abies*, *Pseudotsuga*, *Juniperus*, and *Arbutus* (Gonzalez, S. 1985, Zavala, Z. 1982 and Rzendowski, J. 1981).

3. Valleys Region - It involves great plains that form extensive valleys along the east side of the Sierra Madre Occidental. The most important types of vegetation growing in this area are grassland-oak Juniper forest and grassland-shrubs communities. The common

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genera in these areas are: *Quercus*, *Juniperus*, *Pinus*, *Arctostaphylos*, *Arctos*, *Populus*, *Salix*, *Acacia*, *Prosopis*, *Echinocactus*, *Coriphanta*, *Yucca*, *Boutelovua*, *Aristidia*, and *Eurphybia*. The annual mean precipitation varies from 700 mm to 400 mm and the rain takes place during the summer season.

4. The Semiarid Region - It is located at the East of Durango state. It involves different types of desert vegetation and the main genera are: *Acacia*, *Cactus*, *Agave*, *Bursera*, *Mimosa*, *Larrea*, *Parthenium*, *Yucca*, *Celtis*, *Dasyilirion*, and *Fouquieria*, *Forestieria*. It is formed by long prairies with an altitude from 1100 to 2100 m. The climate is warm and dry with a mean temperature about 23°C. The annual mean precipitation ranges from 150 to 500 mm and the rainy season occurs in the summer. It has a dry season during seven to nine months.

The Oak Forest

In Durango state, the oak type of forest is located not only on the Mountains of the Central Region mixed with pine species, but it also forms a narrow transition zone between the pine-oak forest and the tropical forest at the west side of the Sierra Madre Occidental. There are other oak species on the transition zone at the east side of the Sierra Madre; they are mixed with *Juniperus*, *Arctostaphylos*, *Arbutus*, and pinyon pine.

In Durango state, the oak forest grows in a temperate-cold climate with an intensive raining season occurring in summer. It is mixed with *Pinus*, forming mixed pine-oak forests in the mountains regions. There are small areas with a temperate and semi-dry climate in the East of the Mountain Region where oak species are growing mixed with some forest species such as *Arbutus chiapensis*, *A. xalapensis*, *Juniperus monosperma*, *Arctostaphylos pungens*, *Pinus cembroides* (pinyon pine) *Pinus engelmannii* and some grassland species as *Boutelovua* spp.; *Aristida*, etc. There are also a few oak species in the Quebradas region growing mixed with tropical species within a warm and humid climate (Rwendowski, J. 1981). According to the altitude, *Quercus* grows on a range of 600m to 2400 m in the Quebradas Region and 2000m to 2400 m in the middle part of Durango State.

Quercus emoryi, *Q. virens*, *Q. macrophylla*, *Q. arizonica*, *Q. intrinseca*, *Q. crassifolia*, *Q. hartwegii*, and *Q. cordifolia* are deciduous species growing as trees or as small shrubs.

At the Quebradas Region and a small area in the Mountain Region, the main oak species is *Quercus macrophylla*, mixed with tropical species such as *Acacia pennatula*, *Ipomea arborences*, *Bursera* spp., and some conifers like *Pinus michoacana*, *P. oocarpa*, *P. lumholtzii*, *P. tenuifolia*, *P. douglasiana*, and *P. leiophylla*.

There are other types of forests stands (grassland-oak-juniper forest) in the transition zone and the dominant species are: *Quercus cordifolia*, *Q. emoryi*, *Q. chihuahuensis*, and *Q. macrophylla* mixed with *Juniperus monosperma*, *Pinus cembroides*, *P. chihuahuana*, *P. lumholtzii*, *P. engelmannii*. This type of forest is located in the Valley Region forming a transition zone with the Mountain Region.

In the Mountain Region, within the pine-oak forest, the more common *Quercus* species are: *Quercus arizonica*, *Q. durifolia*, *Q. sideroxyla*, *Q. rugosa*, *Q. laxa*, *Q. omissa*, *Q. nigra*, *Q. obtusata*, *Q. resinosa*, and *Q. castanea* growing mixed with *Pinus duranguensis*, *P. cooperii*, *P. herrerae*, *P. ayacahuite*, *P. teocote*, *Arbutus xalapensis*, *A. chiapensis*, *Alnus* spp., *Cornus* spp., *Prunus* spp., *Abies duranguensis*, *Picea chihuahuana*, *Cupressus arizonica* and *Pseudotsuga* spp.

Silviculture and Management Practices of Pine-Oak Forests

The silvicultural treatments applied to pine-oak forests are focused upon conifers (*Pinus* spp.). Selection thinnings and regeneration cuttings are applied to mixed pine-oak stands based on age, density and stand conditions.

Ecological restrictions are considered to protect soil, wildlife and natural resources associated with oak woodlands.

At the present time, girdling of oak trees is a common management practice to establish natural pine regeneration and protect the soil. However, the results of this practice are not well documented.

The management practices applied to grassland-shrub oak forests are detrimental to natural vegetation. Cattle overgrazing and fuelwood consumption for domestic use are contributing to soil erosion and resulting in a low-quality shrub-oak forest.

Conclusions

According to the scarce studies conducted on oak woodlands, there is an urgent need for basic studies on the biology, ecology and management practices of Mexican oak species, as well as the effects of silvicultural practices such as girdling and harvesting operations on the ecology of pine-oak forests in Durango.

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