

Inventory, Use, and Distribution of Genus *Quercus* in La Estacada, Municipality of Tixtla, Guerrero, Mexico

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Introduction

Quercus forests are located in the mountain areas of Mexico and occupy 5.5% of the country's surface. The oaks are in decline, owing to their exploitation for charcoal which has considerably reduced their distribution. Some of their former range has been converted into agricultural and pasture lands, often leading to erosion. In the state of Guerrero, considering the importance of oaks for firewood, it is necessary to study in depth their diversity and distribution through intensive regional collection.

Background

Within Mexico, there are 186 species of *Quercus* with a wide distribution. In Guerrero, the knowledge of this genus has increased remarkably in the last decades (Martínez 1978, Soto 1982, Gómez 1989, Valencia 1995). It is estimated that 29 species are found in this southern state. The state's central region stands out in its diversity of oaks, 26 of the total number of species being found there. Although the number of species in Guerrero seems conservative, the importance of some of them is due to their restricted distribution in which populations with rare individuals are found, and to the fragility and threatened status of some of their habitats, as is the case with *Q. corrugata* Hook., *Q. insignis* M. Martens & Galeotti, *Q. rubramenta* Trel., *Q. crispifolia* Trel. and *Q. nixoniana* S. Valencia & Lozada-Pérez.

Ortíz (1991), Monroy (1991) and Bustamante (1991) have referred to the use of oaks as fuel and have suggested strategies for much saving of energy as fuel and the improvement of the lumber industry with the objective of reducing the felling of trees. Similarly, Arias (1996) analyzes the use of wood for obtaining energy in Guerrero. The author concludes that the wood is employed in the preparation of food, the heating of water, the heating and lighting of living spaces, for sweat baths ('baños de Temaxcal'), as well as small manufacturing industries such as brick makers, tile manufacturers, ceramic workshops, lime makers, mezcal distillers, bakeries and restaurants.

Other studies mention the importance of oaks for the supply of firewood in different regions of the state (Cárdenas 2000, Carreto 2001, Gadea 2002). Among the floristic and vegetation studies, Reyes and Morlet (2006) report in the ejido Carrizal de Bravo, 15 species of oak and 4 indeterminate species, while Velásquez *et al.*, (2004) report for the area between Chilpancingo and Tixtla 12 species, 2 affinities and one specimen without identification. In particular for the community of La Estacada, Barrera (1998) did an ethnobotanical study of the medicinal plants in which she reports the use of *Q. acutifolia* Née and *Q. conspersa* Benth. for medicinal purposes; Godines (1997), in her study of edible plants, reports the alimentary use of *Q. castanea* Née and Candela (2001) focused his study on the diversity of the Tropical Deciduous Forest in the region.

Objective

To create an inventory, to know the use, distribution and the ecological importance, as well as to estimate the rate of extraction of the genus *Quercus* in the community of La Estacada within the municipality of Tixtla, Guerrero.

Methodology

Collections were made throughout the study area, in the areas of clear dominance by oak groves as well as the ecotone zones with Tropical Deciduous Forest. The physiographic characteristics were obtained and data were recorded to obtain the value of importance (VIE) of the species that form the *Quercus* forest. For this activity, 12 15×15 meter parcels distributed in the four quadrants of the study area were selected. The data for obtaining the values of importance were processed in accordance with Brower and Zar (1980). With the help of aerial photographs, distribution maps for the species were elaborated. The map locating the *Quercus* forest and uses of the soil and vegetation were also constructed.

The field trips usually were done with local inhabitants to whom questions about forms of use as well as about family expenditures and sale of oak wood could be asked.

Results

The community of La Estacada and its surroundings are in the Sierra Madre del Sur between the population centers of Tixtla and Chilpa (Figure 1). It is part of the named region Hydrologic River Basin of Balsas as well as Political Region of the Center of Guerrero. It is between 17° 33' 26" and 17° 36' 42" latitude north and 99° 16' 20" and 99° 20' 0" longitude west at altitudes from 1,500 to 2,160 meters above mean sea level with an area of approximately 2,418 hectares.

List of Species

Seven species and one affinity were recorded. Three of these belong to the section *Quercus* (white oaks) and five to *Lobatae* (red oaks).

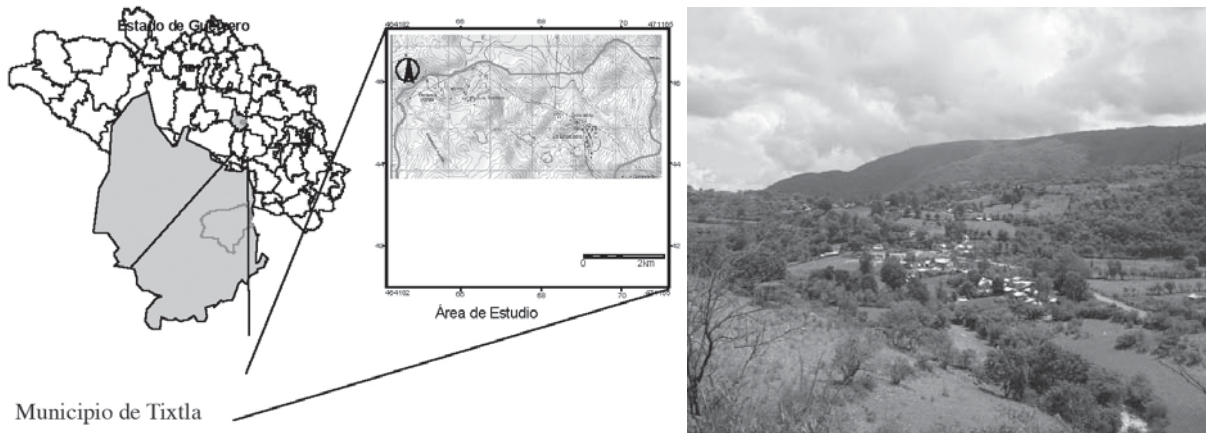


Figure 1: Location of the study area

Section *Quercus* (white oaks)

Series

CIRCINATAE

Species

Q. liebmannii
Q. magnoliifolia

GLAUCOIDEAE

Q. glaucoides

Section *Lobatae* (red and black oaks)

Series

ACUTIFOLIAE

Species

Q. acutifolia
Q. conspersa

CASTANEAE

Q. castanea
Q. aff. castanea

SCYTOPHYLLAE

Q. scytophylla

Economic Importance of the Oaks of La Estacada

The analysis of the open-ended interviews and the surveys, as well as the direct observations, indicate that oak wood has a great economic importance for the community's inhabitants. The dry firewood is sold by units known as "cargas" (loads) which are equivalent to 24 logs and altogether weigh from 38 to 40 kilograms. Their commercial price is around MX\$30.00 (1.76 US dollars). The other form is as "carga de monte" (woodland load) which weigh on average 80 kilograms and cost MX\$60.00 (3.52 US dollars). The number of *cargas* that each family sells varies from one to 20 per month (5 to 10 m³) which is equivalent to from 36 to 720 *cargas* annually, with an economic income of MX\$21,600 annually. Citizens of La Estacada sell this resource to bakeries, restaurants, and brick makers of Tixtla, Chilapa, Almolonga, Chilpancingo, Mazatlan and Tierra Colorada as well as outside individuals that solicit the sale. The oaks in larger demand are: *Q. liebmannii* Oerst. ex Trel. and *Q. magnoliifolia* Née owing to their caloric capacity and characteristic of giving off less smoke than the others. The

lack of economic resources is the reason that forces the campesinos to sell their oaks. There does not exist a community management or control over the harvesting of wood since each *campesino* has assigned an area which is his to exploit. Each landowner decides the quantity, the season and the fate of the lumber. Official campaigns of reforestation do not exist and the regulation is not monitored. All the species of *Quercus* have different uses for the inhabitants. They appear to base their popular nomenclature on the characteristics of the wood.

Use of Soil and Vegetation

The type of vegetation predominant in La Estacada is *Quercus* forest which covers 1,569.4 hectares, corresponding to 64.9% of the total area of the community. Following it in importance is the area dedicated to seasonal agriculture, 499.19 hectares, which corresponds to 20.6%. The principal cultivars are: maize, squash, pachayota and garbanzo beans for their own consumption, though, sometimes, the inhabitants sell them outside of the community.

Floristic composition

In general, the oaks of the study area are distributed in elevations between 1,650 and 2,160 meters above mean sea level with a semi-hot, sub-humid climate, in which develop soils that are in color black, reddish and yellowish (luvisols, litosols and rendzinas). Oaks are found in flat lands, slopes, hillsides and on hill tops and in ravines where the most important factors which limit their distribution are altitude and humidity. The *Quercus* forest is composed floristically of species of *Asteraceae*, *Fabaceae*, *Mimosaceae*, *Poaceae* and *Lamiaceae* among the most important families (Figure 2).

The ecotone *Quercus* Forest intercalated with Tropical Deciduous Forest occupy 160,09 hectares, which represents 6.6% of the total area, where the species of *Q. liebmannii* Oerst. ex Trel., *Q. magnoliifolia* Née, *Q. acutifolia* Née, *Q. glaucoides* M. Martens & Galeotti, *Lysiloma acapulcense* (Kunth) Benth., *Ipomoea arborescens* (Humb. & Bonpl. ex Willd.) G. Don, *Dodonaea viscosa* Jacq., *Bursera bipinnata* (DC.) Engl., *Cercocarpus macrophyllus* C.K. Schneid., *Acacia pennatula* (Schltdl. & Cham.) Benth., *Pistacia mexicana* Kunth, *Eysenhardtia polystachya* (Ortega) Sarg. etc. predominate.

The Tropical Deciduous Forest occupies 114.45 hectares, equivalent to 4.7% of the total area. The representative species are: *Actinocheita potentillifolia* (Turcz.) Bullock, *Pistacia mexicana*, *Rhus galeottii* Standl., *Toxicodendron radicans* (L.) Kuntze, *Annona squamosa* L., *Oreopanax peltatus* Linden ex Regel, *Ostrya virginiana* (Mill.) K. Koch, *Tabebuia rosea* (Bertol.) A. DC., *Ceiba parvifolia* Rose, *Cordia* sp. *Bursera* aff. *fagaroides* (Kunth) Engl., *Bursera ariensis* (Kunth) McVaugh & Rzed., *B. bipinnata*, *B. glabrifolia* (Kunth) Engl., *Ipomoea arborescens*, *Arbutus xalapensis* Kunth etc. Other zones of minor importance are areas of “acahuales” (fallow land), the bodies of water devoid of material and human settlements.

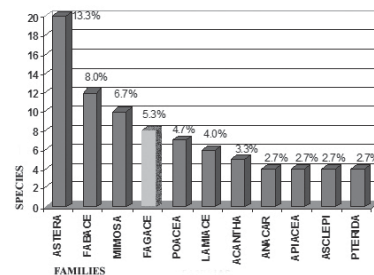


Figure 2. Main Families in the *Quercus* Forest.

Distribution of the genus *Quercus*

The oaks are distributed in almost all the study area with the exception of *Q. scytophylla* Liebm. (see Figure 4) which is distributed uniquely in the northeast and east part of La Estacada. Apparently the altitude (2,160 meters above mean sea level) is a limiting factor for the distribution of this species. Additionally it was observed that the dominant soil (luvisol) retains a greater quantity of moisture during the year. This condition may be related with the fact that the trees of this species do not lose their leaves in the season of low water (estiaje) in contrast with the other species.

Q. glaucooides M. Martens & Galeotti has a very restricted distribution. Uniquely it is found in the north part of La Estacada, sharing habitat with other arboreal species typical of tropical deciduous forest such as: *Lysiloma acapulcense*, *Dodonaea viscosa*, *Bursera* sp., *Brahea dulcis* (Kunth) Mart., *Ipomoea arborescens*, *Salvia* sp., *Rhus galeottii*, *Q. liebmannii*, among others. It occurs on the soil type known as rendzina: rocky with little humus with some drier zones. Probably the type of rock and soil would be the factors which restrict this species (see Figure 3).

The species *Quercus magnoliifolia* and *Quercus liebmannii* are those which display the higher Value of Ecological Importance (VIE), 108.16 and 49.21 respectively (Table 1). Ecologically they are more adapted to tropical conditions. Their distribution in these environmental conditions is favored markedly. It is observed that these species are also those which are more utilized in the homes and are commercialized.

There exist other species that show a high VIE and which are found sharing the habitat of the oaks, such as *Lysiloma acapulcense* (10.57), *Cercocarpus*

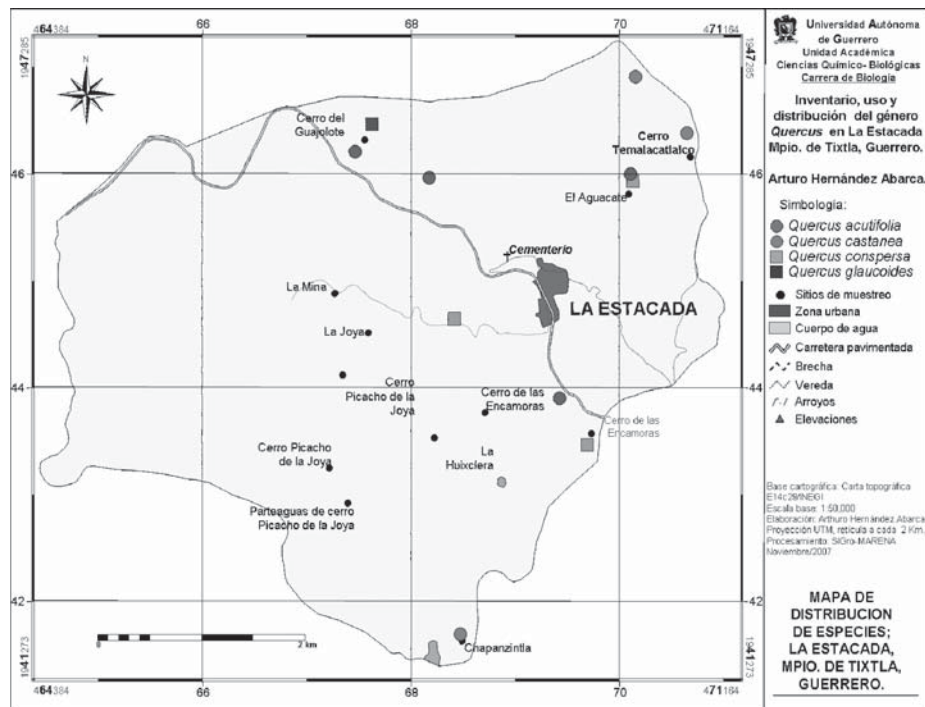


Figure 3: Distribution map for the species of *Quercus*.

macrophyllus (10.16), *Rhus galeottii* (9.97), *Mimosa pigra* L. (9.66), *Bursera bipinnata* (5.33), *Acacia pennatula* (5.23), among others, which altogether as a vegetative community play an important function ecologically: retaining humidity, preventing erosion, stabilizing local weather conditions and providing habitats for other plants and animals.

Conclusions

The oak forest is composed of seven species and one variety. Their habitats are basically tropical and are mostly deciduous. They are located from 1,600 to 2,200 meters above mean sea level on hills, ravines, steep escarpments, in shallow and deep soils: vertisols, luvisols and rendzinas. One important section of territory is encountered in the ecotone with tropical deciduous forest. The most important species ecologically are: *Q. magnoliifolia*, *Q. liebmanni*, *Q. acutifolia*,. and *Q. aff. castanea*.

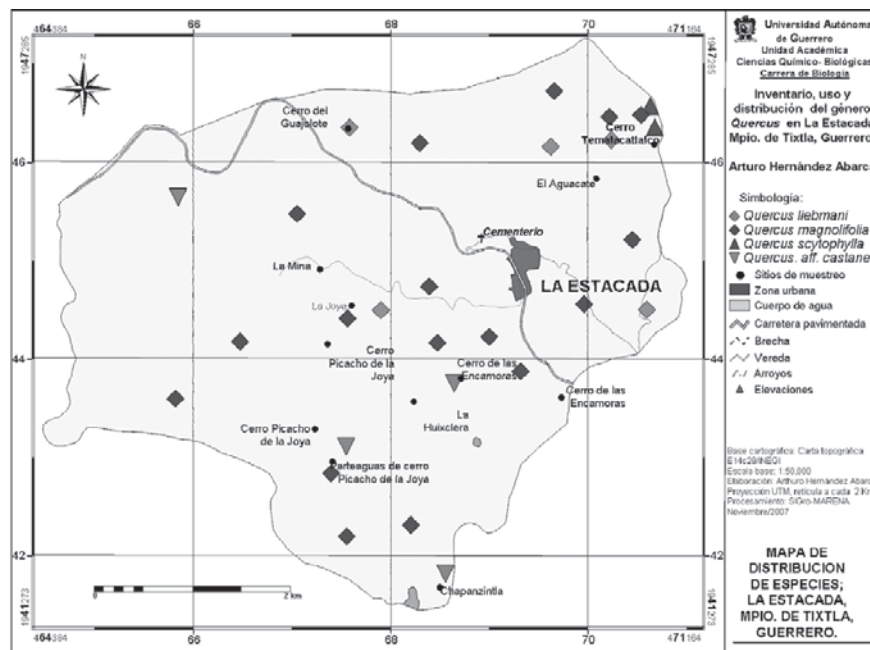


Figure 4: Distribution map for the species of *Quercus*.

The oaks in the locality have diverse uses. The wood is employed in the construction of houses, the handles of tools, posts for fences, a “chinacle,” or wooden screen, and in the elaboration of chairs for assembly. *Q. liebmanni* is utilized to cure diarrhea. *Quercus acutifolia* and *Q. conspersa* (Figure 5) are reported for curing burns, dealing with scorpion stings, and reducing deafness. *Q. castanea*, *Q. magnoliifolia* and *Q. scytophylla* (Figure 6) are used in the feeding of pigs and goats. *Q. castanea* is the only one reported for human consumption.

All the species have uses as fuel for which *Q. liebmanni* and *Q. magnoliifolia* are preferred. The oaks supply the demand for energy for the heating of dwellings, for the preparation of foods and the obtaining of economical resources through the sale of firewood.

Thanks to Allen Coombes for assistance with review and translation.



Fig. 5. *Quercus conspersa*

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Fig. 6. *Quercus scytophylla*

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Table 1. Value of Ecological Importance of trees and shrubs in the *Quercus* forest in the community of La Estacada, Guerrero

| Species | Num. ind. | DA | DR | FA | FR | Co.A | Co.R | VIE |
|-------------------------------------|-----------|------|-------|-------|-------|--------|--------|--------|
| <i>Quercus magnoliifolia</i> | 132 | 4.89 | 53.22 | 11.00 | 17.74 | 75.06 | 37.20 | 108.16 |
| <i>Quercus liebmannii</i> | 36 | 1.33 | 14.51 | 8.00 | 12.90 | 43.92 | 21.80 | 49.21 |
| <i>Quercus acutifolia</i> | 6 | 0.22 | 2.42 | 3.00 | 4.84 | 13.50 | 6.70 | 13.96 |
| <i>Quercus aff. castanea</i> | 4 | 0.15 | 1.61 | 2.00 | 3.22 | 17.40 | 8.62 | 13.45 |
| <i>Lysiloma acapulcense</i> | 6 | 0.22 | 2.42 | 4.00 | 6.45 | 3.50 | 1.73 | 10.57 |
| <i>Cercocarpus macrophyllus</i> | 6 | 0.22 | 2.42 | 3.00 | 4.84 | 5.80 | 2.90 | 10.16 |
| <i>Rhus galeottii</i> | 10 | 0.37 | 4.03 | 3.00 | 4.84 | 2.20 | 1.10 | 9.97 |
| <i>Mimosa pigra</i> | 5 | 0.19 | 2.02 | 3.00 | 4.84 | 5.70 | 2.82 | 9.66 |
| <i>Quercus glaucooides</i> | 5 | 0.19 | 2.02 | 1.00 | 1.61 | 9.03 | 4.50 | 8.13 |
| <i>Bursera bipinnata</i> | 3 | 0.11 | 1.21 | 2.00 | 3.22 | 1.91 | 0.94 | 5.33 |
| <i>Acacia pennatula</i> | 3 | 0.11 | 1.21 | 2.00 | 3.22 | 1.60 | 0.80 | 5.23 |
| <i>Quercus scytophylla</i> | 2 | 0.07 | 0.80 | 1.00 | 1.61 | 5.30 | 2.62 | 5.03 |
| <i>Actinocheita potentillifolia</i> | 4 | 0.15 | 1.61 | 1.00 | 1.61 | 2.80 | 1.40 | 4.62 |
| <i>Pistacia mexicana</i> | 2 | 0.07 | 0.80 | 2.00 | 3.22 | 1.20 | 0.60 | 4.62 |
| * Espina de Judio (S/l). | 2 | 0.07 | 0.80 | 2.00 | 3.22 | 0.20 | 0.10 | 4.12 |
| <i>Rhus terebinthifolia</i> | 4 | 0.15 | 1.61 | 1.00 | 1.61 | 1.61 | 0.80 | 4.02 |
| <i>Diphysa floribunda</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 3.70 | 1.83 | 3.81 |
| <i>Eysenhardtia polystachya</i> | 3 | 0.11 | 1.21 | 1.00 | 1.61 | 0.91 | 0.50 | 3.32 |
| <i>Dodonaea viscosa</i> | 2 | 0.07 | 0.80 | 1.00 | 1.61 | 1.00 | 0.50 | 2.91 |
| <i>Quercus castanea</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 1.55 | 0.77 | 2.78 |
| <i>Galphimia glauca</i> | 2 | 0.07 | 0.80 | 1.00 | 1.61 | 0.51 | 0.25 | 2.61 |
| **Fresnillo (S/l). | 2 | 0.07 | 0.80 | 1.00 | 1.61 | 0.30 | 0.15 | 2.51 |
| *** Undetermined species | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 1.00 | 0.50 | 2.51 |
| <i>Ipomoea arborescens</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.64 | 0.31 | 2.31 |
| <i>Arbutus xalapensis</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.40 | 0.20 | 2.21 |
| Asteraceae (S/l). | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.40 | 0.20 | 2.21 |
| <i>Prunus capuli</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.20 | 0.10 | 2.11 |
| <i>Bursera aff. fagaroides</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.20 | 0.10 | 2.11 |
| <i>Brahea dulcis</i> | 1 | 0.04 | 0.40 | 1.00 | 1.61 | 0.11 | 0.05 | 2.06 |
| TOTALS | 248 | 9.19 | 99.92 | 62.00 | 99.92 | 201.64 | 100.00 | 299.93 |

Source: Fieldwork, March 2007 – November 2007, La Estacada, Guerrero

DA: Absolute Density. FA: Absolute Frequency. Co.A: Absolute Cover. DR: Relative Density. FR: Relative Frequency. Co.R: Relative Cover. VIE: Value of Ecological Importance

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