



Quercus ilex in the Madres-Coronat massif.



Highest Altitude Population of *Quercus ilex* L. in France

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ABSTRACT

In the valley of the upper Conflent, in southwestern France not far from the Spanish frontier is the Madres-Coronat massif. With an area of 600 hectares (1,500 acres), it harbors a small, three-hectare (7.5 acres) population of holm oak (*Quercus ilex* L.), the highest occurrence (1,840 m/6,035 ft) of this species in France and indeed in Europe. This article describes the growing conditions of this exceptional population, which because of its dynamism is increasing in size from year to year.

Keywords: holm oak, *Quercus ilex* L., Madres-Coronat, altitude, hardiness

In a paper presented at the 6th International Oak Society Conference in Puebla, (Mexico) in 2009, I described several marginal French populations of holm oak, either natural or naturalized. At the time I had to postpone consideration of a population that is noteworthy because of its altitudinal location, being the highest in France and indeed in Europe. It is located in the department of the Pyrénées-Orientales, which unites the Pyrénées and the Mediterranean Sea at the edge of Spanish territory. These trees are located in the massif of Madres-Coronat, which varies from 400 to 2,469 m (1,300 to 8,000 ft) in altitude, located only 60 kilometers (35 miles) from the ocean.

This forest harbors a community where *Quercus ilex* is associated with Scots pine (*Pinus sylvestris* L.), downy oak (*Quercus pubescens* Willd.), common juniper (*Juniperus communis* L.), savin (*Juniperus sabina* L.), and the slender broom (*Genista cinerea* (Vill.) DC.)

These dominant evergreen forests constitute only 3% of the total area of the massif, which is to say 600 hectares (1,500 acres), and stand on south-facing slopes with calcareous soils. *Q. ilex* occurs up to 1,840 m (6,035 ft) in altitude; this exceeds the altitude given three years ago (1,560 m) by 300 meters (985 ft).

On rocky calcareous soils, but also on schists in another sector of this forest, other old-growth or post-pastoral populations can be observed up to 1,300 meters (4,500 ft) in altitude. At higher altitudes, these populations encounter heaths of secondary, pastoral origin dominated by Andorra broom (*Cytisus purgans* Spach). The high cliffs harbor a Pyrenean endemic plant, the Pyrenean alysum (*Alyssum pyrenaicum* Lapeyr.).

This site is also of remarkable interest due to the presence of the bearded vulture (*Gypaetus barbatus* L.); a breeding pair of this species has been living in the area for the past three years. This raptor has a very specialized dietary regime, feeding on marrow from the bones of dead animals once they have been dissected by other vultures. The Pyrenean desman (*Galemys pyrenaicus* E. Geoffroy) and the Spanish moon moth (*Actias isabellae* Graells) are also found here.

The utilization of this forest consists since time immemorial, of both grazing and harvesting of forest products. Vestiges of these practices can still be found in the form of watering troughs for sheep. Administrators in fact tend to favor forestry and pastoralism, which allows the maintenance of open areas appropriate for certain plant and animal species.

The geology is distinctive: old mines of red marble can still be found. This was used regionally for ornamentation of the portals of religious edifices between the eleventh and fourteenth centuries.

As regards climate, average annual rainfall where these holm oaks are located is 780 mm (30.7 in) at an altitude of 1,560 m (5,120 ft). At 1,640 m (5,380 ft) it is 850 to 900 mm (33.5 to 35.4 in) annually.

In this massif there is a kind of climatic corridor that is dried by a north wind, and which endures a weak moisture regime in the path of the wind. The clouds hardly linger there and the average annual rainfall in this sector is only 550 mm (21.7 in) at 1,060 m (3,480 ft), which makes it one of the driest places in France. By way of comparison, Colmar, in Alsace (Northeast France), is the French city with least precipitation, having only 530 mm (20.9 in) average annual rainfall.

The average annual temperature here is 10.15 °C (50.27 °F); the average of the minima for the coldest month is 0 °C (32 °F), while that of the maxima of the warmest month is 24 °C (75 °F). As a side note, the maxima exceeded 40 °C (104 °F) in 2003.

The forested massif has not always had its present aspect. The restoration of the mountain terrain undertaken by the forestry service was a result of laws passed in 1860 and 1862, during the Second Empire. It consisted, and still consists, of a struggle against erosion and for regularization of water regimes, accomplished by methods of reforestation and means for channeling excessive rain. The Pyrénées-Orientales were affected by these measures following the recognition of intense deforestation and violent erosion, from the high demand for firewood and industrial fuel, which reached its apogee during the nineteenth century.

The holm oak populations of this massif were cut back in short cycles during the nineteenth century. Later, law ensured protection of these trees, allowing them especially to bear seed and hence to recolonize the territory.

Lately, the dynamism of the holm oak populations has been particularly noteworthy. The climatic conditions, which are basically arid, but depending on the time of year can be somewhat moist, put the oak in a position of virtually no competition; the relatively weak cover of Scots pine does not hinder its dissemination by the local fauna.

The holm oak was formerly very much esteemed for charcoal, and its heavy, hard wood was hardly ever used for other purposes. Climate changes observed for several years now argue in favor of using this oak to stabilize Mediterranean soils as well as for higher purposes (turnery, paneling, and parquet flooring). It is difficult to season, but this problem can be remedied by curing after two years of soaking; it then assumes a lovely aspect comparable to marble.

It also has a role in ornamental horticulture. Thus, urban forestry in French cities is making greater and greater use of the holm oak. Most of these come from Italian nurseries, sometimes with problems of winter susceptibility to frost stemming from the location of the propagation site and/or of provenance. The horticultural profession would do well to follow practices of American nurserymen, who pay attention to provenance for adaptation as much as to the conditions of the planting site.

This high altitude Pyrenean origin, as well as that in the Cévennes (at 900 m/2950 ft, beneath the Aigoual massif, also mentioned at the 6th IOS Conference in Mexico in 2009), constitute an excellent reservoir of hardy holm oaks.

During the winter of 2010, a holm oak from the Cévennes planted in a one liter container, in the middle of a garden without protection, survived a temperature of -15 °C (5 °F) with nightly frosts for a whole week without the slightest damage.

With ongoing climate change, the holm oak seems to offer a paragon of adaptability in France, most evident in the Rhone corridor and in the Cévennes. A detailed study of its dynamics should be undertaken and it could constitute an excellent indicator of the evolution of our vegetation under a climate which tends, on average, towards increasing heat, with potentially greater and greater irregularities in the moisture regime throughout the year.

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Photographers. Title page: Thierry Lamant (*Quercus ilex*). Photos p. 174: Thierry Lamant.