Chapter 4.2
Adaptive Management on Sustainability of Cork Oak Woodlands

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ABSTRACT

The cork oak woodland production systems result from the integration of conflicting activities in the same space creating the need of constant search of equilibrium between its components in order to achieve sustainability. In a climate change environment, associated with recent modifications in rural societies, adaptive management concepts are needed so as to maintain cork oak woodland systems sustainable. Nowadays/Currently cork oak woodlands are facing disturbances that are affecting the production system sustainability both by intensification of the activities undercover- that leads to a lack of regeneration and consequent disappearing of the crown cover, loss of cork production and site degradation mainly by soil loss-, or by the abandonment that conducts to an invasion of shrubs and other oaks increasing the competition (reducing cork production) and the risk of forest fire. Only adaptive management techniques associated with growth models and decision support systems, constructed in knowledge based monitoring system, are able to prevent cork wood land decline with the adoption of management practices focused in long term objectives. For the present study it was selected a set of permanent plots according with site quality and stand age and structure. Simulation studies results indicates that cork oak woodland system sustainability (both economical and ecological) is supported in regeneration events associated with the shrub control techniques without soil mobilization with strong dependency of cork prices and

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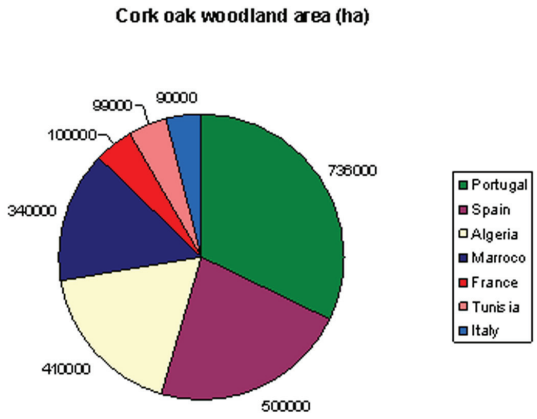
valuation of carbon sequestration, especially in the less productive soils. Without modification of actual funding policies and the valuation of carbon sequestration, the system faces increased risks of decline due to the maintenance of actual non sustainable management practices by the stake holders driven by their financial needs. This study is particularly relevant regarding that woodlands dominate the landscape of the south-western Iberian Peninsula, occupying approximately 3.1 million hectares in Spain and 1.2 million hectares in Portugal.

Figure 1. Cork oak area distribution (left). Mean annual production (right) (Source: Portuguese National Institute of Statistics (INE))



INTRODUCTION

Relevance of Cork Oak Woodlands

Woodlands dominate the landscape of the south-western Iberian Peninsula, occupying approximately 3.1 million hectares in Spain (Pulido *et al*., 2001) and 1.2 million hectares in Portugal (DGF-IFN, 2001). The forest system woodland is mostly dominated by Mediterranean evergreen oaks such as cork oak (*Quercus suber* L.) and holm oak (*Quercus rotundifolia*).

Cork oak woodlands occupy an area of 2 275 000 ha worldly and spotted as seen in Figure 1. World mean annual cork production is 340000 tons distributed according to Figure 1.

As it can be seen in Figure 1, Portugal cork oak woodland area represents about 33% of world area and 54% of mean annual world cork production. According to the United Nations Statistic Division, Portugal leads world cork exports (mainly manufactured cork products) with around 60% of the 1399075090 € generated by the exports in 2005.

Cork Oak Woodland Production System and its Multifunctionality

Cork oak woodlands are complex systems with the conjunction of production activities that share the same growing space in a landscape characterized by its site variability, especially at the soil/climate/topography levels. The trees are the base of these woodland production systems and are responsible for the ecological characteristics that are fundamental to the sustainability of all activities occurring at stand level. The ecological role of the trees by: (1) radiation and water vapor intersection are responsible for the specific microclimatic conditions found in this low density stands (Montero, *et al.*, 1998); (2) savanna like precipitation intersection and redistribution create areas in the stand with precipitation amounts above the total rainfall that are fundamental for water storage enhancement (David, 2000; David *et al.* 2002; Montero, 1988; Montoya, 1985, 1986); (3) The spatial distribution of the trees creates a high rugosity, reducing wind speed thus reducing plant transpiration and ecosystem water consumption (David *et al.* 2002; Montero et al., 1998); (4) the large and deep root systems of cork oak trees enhance the nutrient cycle at soil surface level with minerals absorbed in deeper and levels of the soil profiles and with the incorporation of organic matter in the soil that is responsible for a higher cation exchange capacity (Montero et al., 1998). These ecological functions of the trees create the