

The effects of fire on cork oak

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Abstract

Forest fire occurrences have increased in Portugal during the last decades. In particular, cork oak forests have been increasingly affected by wildfires, following land abandonment and shrub encroachment. We analysed fire preferences at the regional level for Algarve, and the effects of fire and topography on landscape changes (1958-2002) in a study area (11 000 ha) in Serra do Caldeirão (Algarve), where cork oak is the dominant tree species. We further quantified the effect of a large wildfire (from 2004) on the survival of cork oak trees at the study area, and related survival with plot, tree and fire severity variables.

At the regional level we observed that shrublands and eucalyptus are preferred by fire. Over a period of 45 years at the landscape level, we observed that shrublands have been the most persistent patch-type and are expanding since 1985 at the expense of cork oak forests and montados. Fire is promoting the replacement of forests by *Cistus* shrublands and maintaining the shrublands, particularly in drier areas (southern exposures). *Cistus* shrublands are very flammable and the seeds regenerate well after fire, thus the persistence of shrublands can be supported by a positive feedback mechanism (the more fires, the more shrubs). In addition, other studies have shown that cork oak seedling recruitment seems to be particularly difficult in shrublands.

At the tree level, factors affecting post-fire survival can be divided into the ones related to individual resistance to fire (bark thickness and tree size), fire severity (bole char height), topography (slope and exposure) and understory management (shrub cover). Old trees (large DBH) in southern exposures, with thin bark and dense understory shrub cover are particularly susceptible. In accordance with the results for landscape changes, we observe that the presence of shrublands, especially in drier sites, promote lower cork oak survival.

Many factors that influence post-fire mortality are the same that influence the incidence of diseases and other factors of stress. Fire is adding to other factors of mortality (e.g. climate change, fungi, wounds, bad management practices) and probably facilitating the action of these factors: synergistic effects? Present climate change models project an increasing frequency of droughts for Mediterranean-climate regions. Under such trends, fire frequency will likely increase and soil erosion will worsen: conditions for cork oak forests recovery will get harsher and shrublands will likely keep on expanding.