Objectives of forest management

The forest is the main element of the territory in Mediterranean mountain regions. **Forest management is based on improving at least one of the following aspects of the forest**: the fuel model, biodiversity, wood quality and forest stability. All these objectives have common characteristics, which are the reduction of tree density and the formation of trees with a larger trunk and crown diameter.

Objectives of forest management

In many Mediterranean mountain areas, the forest is the main element of the territory and the potential source of resources. At the time of application of a cut there are two fundamental questions that the forest manager must answer: 1) how many trees should be cut?; 2) which trees should be cut (or which trees will remain)? The answer to these questions mainly depends **on what the objectives of the intervention are**. These objectives must be specified in the improvement of at least one of the following four aspects of the forest: **the fuel model, biodiversity, wood quality and forest stability.**

(i) **Improvement of the fuel model**. The goal is to **reduce forest vulnerability to fires**. For the analysis of this vulnerability it is important to define the type of vegetation or fuel stratum that characterises the structure of a forest plot: a) **crown fuel**, formed by the dominant or co-dominant tree canopies; b) **scale fuel**, which is not part of the crown and includes small trees or shrubs; c) **surface fuel**, which consists of shrubs whose height is less than 1.5 h, grasses and dead remains. **The objective is to create structures in which fire spreads through the surface fuel but limits fire spreading to the canopies**. This reduces mortality during a fire. This mortality will be even lower for trees with larger diameters. The most important intervention to achieve this objective is the **thinning of the stand**, as well as the **selection of resprouts** within the same individual for resprouting species. This intervention reduces the risk of fire rising to the canopy and favours the formation of larger trees, which are more resistant to fire. Examples of **structures with different degrees of vulnerability to fire** are shown in **Figure 1**.

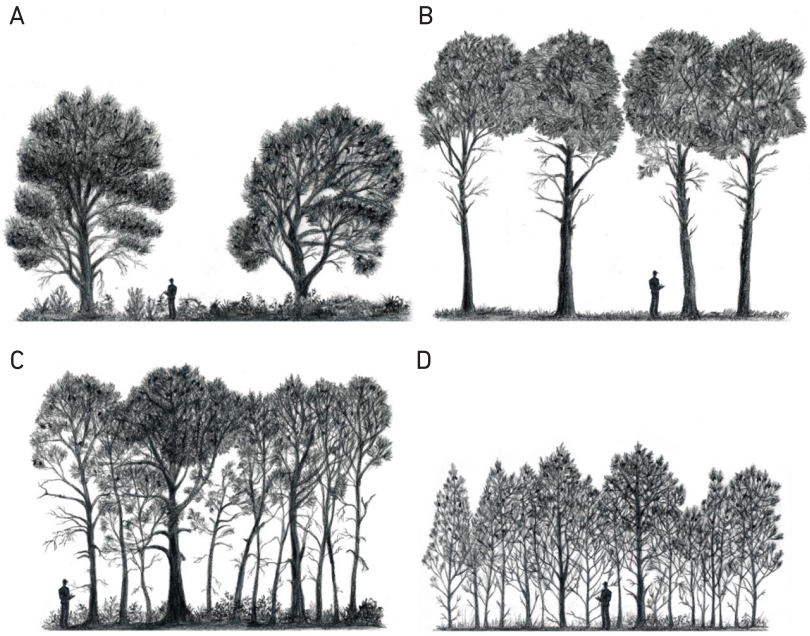

Figure 1. Example of structural types of *Pinus halepensis* forests according to their vulnerability to crown fires: low (A, B) or high (C, D). Credit: Patterns of fuel types and crown fire potential in Pinus halepensis forests in the Western Mediterranean Basin. Alvarez et al. (2012). Author of the illustration: José Luis Ordóñez, CREAF.

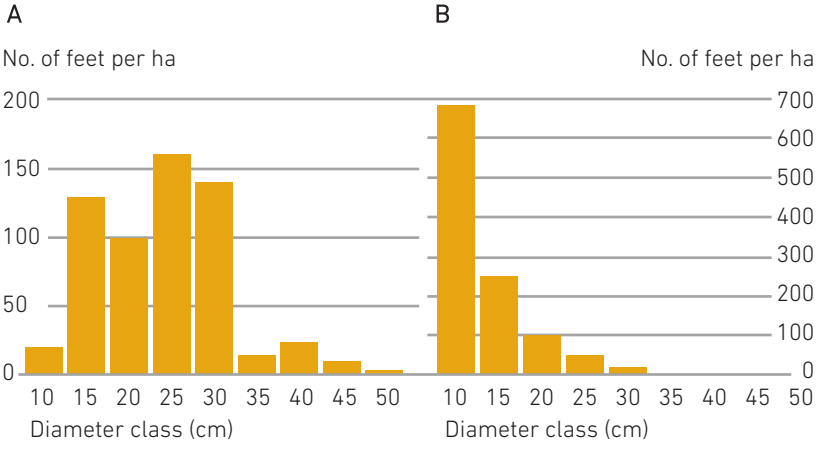

Figure 2. Examples of diameter distributions of two highly contrasted plots: **A**) plot with significant presence of large trees that helps to improve the abundance of cavity-occupying birds; and **B**) typical plot of Mediterranean forests, with many small trees and very little presence of large trees. For each diameter class the total number of trees per hectare is indicated.

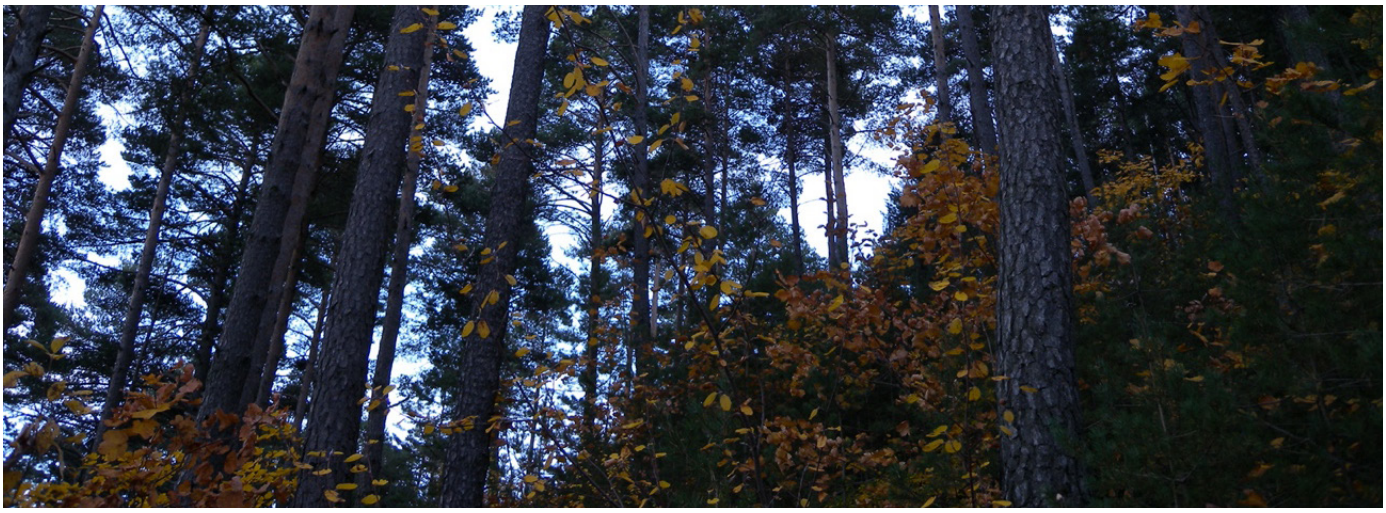

Figure 3. Well-formed pine forest, L'Espà, Berguedà. Photo: Lluís Comas/Carles Batlles.

(ii) **Improvement of biodiversity**. In the Mediterranean forests there is generally a great lack of large trees, old trees and senescent trees, which are necessary to improve the richness and abundance of fauna associated with their cavities (birds, mammals, etc.). In general, these types of **trees**, **of interest for the conservation of biodiversity, are very scarce in Mediterranean forests** and should be prioritised over production trees without representing a risk of loss of quality production. **Figure 2** present an example of the distribution of diameters of a plot of interest to the fauna: its differential characteristic is the presence of trees whose diameter is greater than 30 cm. This same figure represents a much more frequent plot, with a large number of young trees and no trees larger than 30 cm.

(iii) **Improvement of wood quality (in the long term)**. This objective tries to **achieve large trees with well-formed trunks** (straight, cylindrical and with few branches), which allow quality wood to be obtained (**Figure 3**). This characteristic of shape **is the opposite of the characteristics sought in the biodiversity conservation** objective that prioritises trees with more irregular shapes and the presence of different types of cavities.

(iv) **Improvement of forest stability, resistance to diseases and drought**. The **presence of well-developed crowns** is one of the most important health indicators of a tree. These well-developed crowns are usually obtained by decreasing the density of individuals. In many cases, the response to diseases or disturbances such as drought is related to the density of trees in the forest. Thus, there are many examples that drought resistance increases in cleared holm oak forests with lower resprout densities in relation to the same type of forest without clearing (**Figure 4**).

The common characteristics of these objectives are the **reduction of tree density (or of resprouts in resprouting species**), and the favouring of the formation of trees with a **larger trunk diameter** and a **larger crown diameter** (variables that, on the other hand, are directly related).

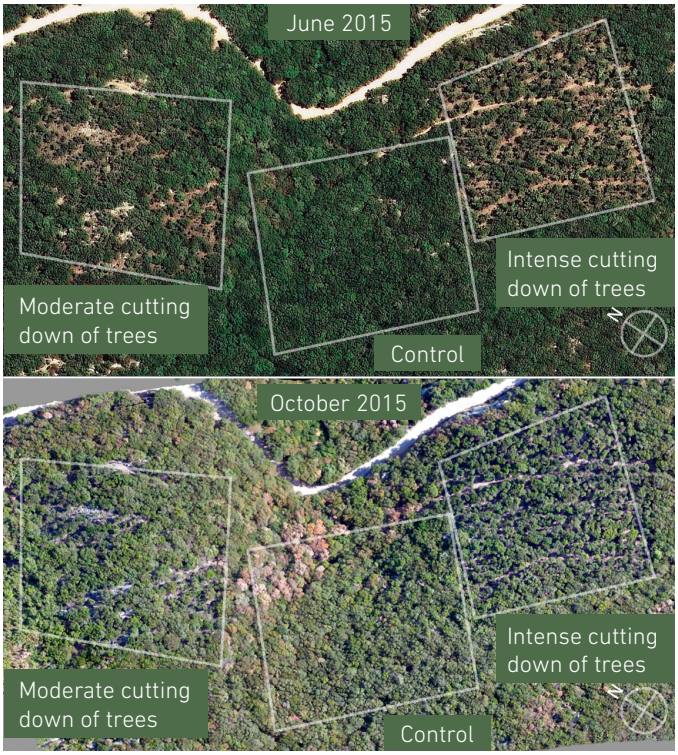

Figure 4. Result of three forest management treatments in a holm oak grove during a period of extreme drought in the summer of 2015 in Requesens (La Junquera, Girona). The control forest that was not cut down and therefore had a higher tree density than the one that withstood the drought the worst, with 10% of trees affected or dead. Author: Eduard Pla, based on images from the ICGC.