

Forest products

The Mediterranean forest produces **quality sawn wood, firewood, beams and poles as the main products of forest management**. But it can also become an important **source of resources for agricultural and livestock exploitation**, thus improving the economic performance of other activities. The use of **forest products**, such as leaves for livestock feed, **BRF, biochar, crops on wooden beds or biofertilisers**, allows improved profitability of the entire use of farms.

■ Biomass of the different tree fractions depending on the species and size of the tree

Four fractions of the aerial biomass of a tree can be distinguished, from which different products of forest use are obtained: **trunk, branches >7 cm, branches <7 cm and leaves**, as we will see in the next section. The proportion between components varies greatly between forest species. In **Figure 1** we see the biomass values for four of the species that can be used in the area where Polyfarming is carried out: holm oak, downy oak, Aleppo pine and poplar. Aleppo pine and holm oak dedicate proportionally less biomass to the trunk and more to the branches, especially those smaller than 7 cm, than poplar and, especially, downy oak. From the information of the **Ecological and Forest Inventory of Catalonia**, we have obtained equations for the weight of the trunk, branches

>7 cm, branches <7 cm and leaves depending on the size of the tree for the four previous species. **With these equations we have determined how the different fractions vary for the four species depending on the size of the tree (Figure 2)**. There are obvious **differences between sizes**, but also important differences **between species in the different fractions**. The trunk values are slightly higher for holm oak but vary similarly between species. Holm oak also has higher values of branches >7 cm for the lower diameters, but later it is reduced and the poplar increases the most. In the case of branches <7 cm and leaves, the values are higher for holm oak and, to a lesser extent, for Aleppo pine than for poplar and downy oak.

■ Products generated from the different fractions of the tree

There are many **main products that the Mediterranean forest generates** with forest thinning: **depending on the species, quality sawn wood, firewood, beams or poles are produced**. These products come mainly from the thickest trunks or branches. But the remaining fractions of the tree

can also become an important source of resources for agricultural and livestock use. Some of these resources, those developed in the Polyfarming system, are shown in **Figure 3** and are described below.

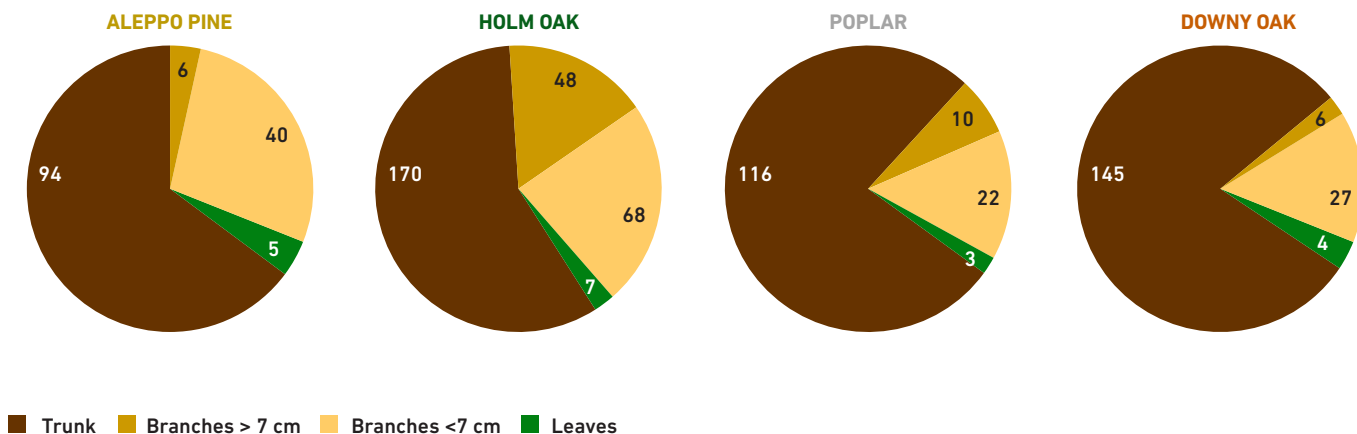


Figure 1. Distribution of aerial biomass in the different components of the tree (trunk, branches > 7 cm, branches <7 cm and leaves) for a standard tree with a normal diameter of 20 cm of four Mediterranean species: Aleppo pine, poplar, holm oak and downy oak. The numbers in each compartment indicate the absolute weight values (in kg of dry matter per tree).

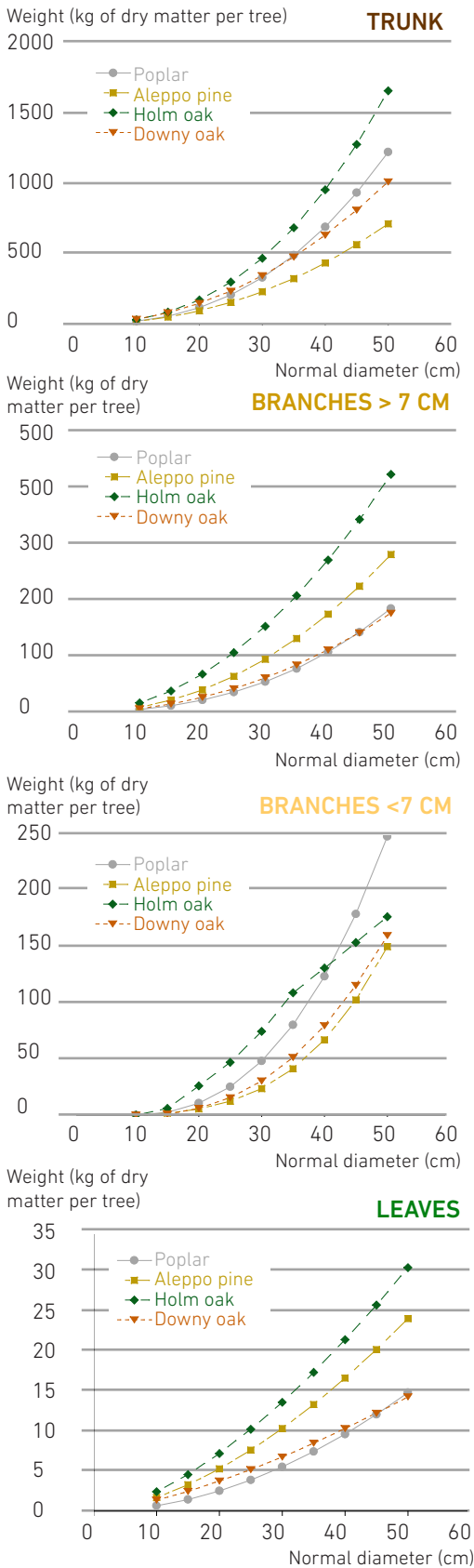


Figure 2. Weight (kg of dry matter per tree) of the different fractions of aerial biomass: trunk; branches > 7 cm; branches < 7 cm, and leaves, depending on the size of the tree (normal diameter, in cm) for the four species considered: poplar, Aleppo pine, holm oak and downy oak.

- **Logs.** They are the main products of forest exploitation and, in many cases, the only ones. Depending on the species and quality of the trees, they are obtained from the **trunks, firewood, wood, beams and sticks.**

- **Branches larger than 7 cm.** Larger branches can also be used to produce firewood. But the logs coming from felling and that are not suitable for other uses can be used to bury them under the soil of the orchard and the fruit trees, so-called **crops on wooden beds.** For this technique, it is preferable to use logs with dimensions greater than 20 cm that allow larger volumes of buried wood to be obtained.

- **Branches smaller than 7 cm.** Branches smaller than 7 cm contain soluble or barely polymerised lignin, which is the basis for the formation of a highly reactive humus. These branches are the base material to produce two products that improve agricultural soils: (i) **BRF**, which is obtained by crushing these freshly cut branches; and (ii) **biochar**, which is produced from the pyrolysis of dry branches. In the first case, a stable humus is obtained that improves the soil's structure and water retention capacity. In the second case, charcoal is produced that improves the physical properties of the soil.

- **Leaves.** The green leaves of trees that have just been cut can be a perfect complement to the **livestock feed**, especially in winter when felling is done. A tree species that is perfectly adapted to this use is the **holm oak**, as well as other hardwoods that **do not lose their leaves in winter.** In contrast, oaks and other deciduous species cannot be used for livestock feed, because they do not have green leaves in winter. In the case of pines, it is not possible to combine cutting in winter with consumption by animals, because they do not eat the needles.

- **Forest floor.** The humus of the forest floor is the basis for obtaining microorganisms. These microorganisms allow the production of **biofertilisers**, which serve to nourish and strengthen orchard plants or fruit trees without blocking the biological processes that occur in healthy soil.

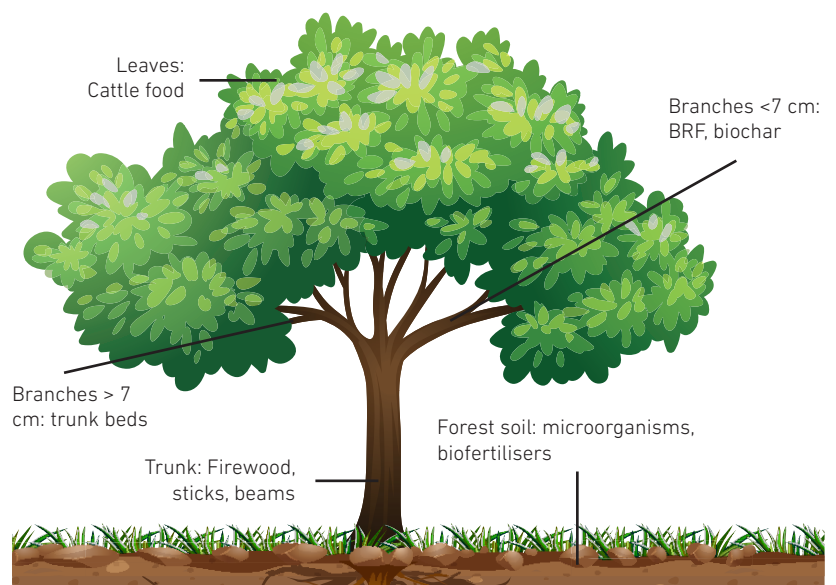


Figure 3. Scheme of the different products obtained from the different fractions of the aerial part of the trees after a forest harvest.