

Mature Forests

Frequently asked questions



LIFE RedBosques

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Presentation

Unaltered forests, i.e. those free from any human footprint are extremely rare in the world, and are probably extinct in the Mediterranean area. Nevertheless, there are some remaining pockets ('stands' as they are known in forestry jargon) of the ecological structures and processes characteristic to this type of mature forests. These are usually located in steep and inaccessible places where management has been impossible or unprofitable. Since the 1950s, however, with the drastic reduction in the use of firewood and more recently, the timber market crisis, forest maturity is gradually seen to be recovering in certain locations. The **LIFE RedBosques** project aims to contribute to the task of identifying, describing and showcasing these singular enclaves, precious not only for their scarcity but also for the original biological communities they harbour and the ecological processes they maintain, as well as their role in promoting human wellbeing.

This document offers a compilation of the questions most commonly asked regarding forest maturity, by professionals and the general public alike. These questions are arranged by subject, and the answers are based on the scientific literature and the contributions of a large group of experienced subject-matter experts.

With this document, we hope to contribute to the respect and appreciation of these last remaining strongholds of our primeval forests.

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The meaning of mature forest

Are there virgin forests in Spain?

In Western Europe, as in the Mediterranean basin, forests that have not been altered in some degree by humans, known as virgin or 'primary' forests, no longer exist, while only small extensions of mostly unaltered temperate forests remain in the Carpathians and boreal forests in Scandinavia and Russia (<http://www.intactforests.org/data.ifl.html>).

This, of course, does not rule out the existence of local enclaves, or 'stands', that are preserved in a highly natural state, understood as areas in which groups or woods with a light human footprint, at least as far as harvesting is concerned, are found. However, in certain forest types such as juniper or holm-oak woods, subject to intensive use, it is extremely unusual if not impossible to find these conditions.

Mature 'forest' or mature 'stand'?

A forest is said to be mature when, after existing for a great length of time owing to the absence of high-intensity disturbances, it contains a mosaic made up of every phase in the silvogenetic cycle, from the earliest to the final stages of senescence, thanks to its low disruption dynamic. Such a forest necessarily covers a large extension to accommodate a mosaic of stands undergoing different phases of growth.

A mature stand consists of one sector of a forest with a small human footprint in which ecological succession has progressed to the final stages of maturity, characterised by structures such as standing and fallen deadwood, high heterogeneity, and an abundance of its distinctive biodiversity.

Is a stand with large, very old trees a mature stand?

Large old trees are but one of the attributes pertaining to mature stands. In many cases, forests containing large trees are the result of periods of management followed by neglect. For instance, woodlands formerly pollarded or charcoaled, or dehesas, which as soon as harvesting is abandoned are rapidly colonised by scrub and new growth. Scrublands, tree stumps sprouting new growth, trees showing signs of drastic pruning, cork oaks scarred by cork harvesting, are all unequivocal signs of forestry practices from the past. These are formations containing a few elements of maturity (old trees) but generally lacking trees in other stages, although these may, in time, reappear.

What is the difference between a mature stand and an old-growth stand?

As the successional process unfolds, the forest undergoes several stages of evolution, which become mingled in space forming a mosaic. The cycle is considered to begin with the opening of a clearing in the forest allowing the regeneration and establishment of young plants. A growth stage follows until the canopy is closed again, from which moment the competitive exclusion of plants that are less tolerant to shade takes place, finally reaching a state of maturity when the canopy is made up of several species and the vertical spaces are gradually occupied. This state of maturity, owing to trees' great longevity, may continue for hundreds of years. As the trees reach the limits of their longevity, and begin to decay and die, the forest enters the senescence stage. Old stands, therefore, are those reaching the limits of their longevity and imminent senescence. One of the traits of forest maturity is the presence of very old large trees.

Is there greater biodiversity in a mature stand than in one that is not mature?

As mature forests contain stands in all stages of the silvogenetic cycle, they generally offer greater landscape diversity. Stands that are managed, as any ecosystem subjected to medium-intensity disturbance, may contain a notable diversity of species. Mature stands, however, support a **different** and significantly greater **diversity** of lichens and fungi, as well as insects **specialised in decomposing dead wood**. In addition, given the scarcity of this habitat type, the species associated with mature stands are proportionally more likely to be under some degree of **threat**.

What size should a mature stand be?

In principle, a mature stand should cover an extension that is sufficient for all of the silvogenetic processes associated to maturity to develop. This, in turn, depends on the longevity of the species and the quality of the site, which will determine the rate of change from each stage to the next.

In practice, however, as mature stands today are very rare **singularities**, a minimum extension cannot be specified.

Can a naturalised plantation become mature stand?

A forest plantation can never be considered a mature stand. To acquire all the elements and processes that make up a mature forest, it is necessary for all the species **that belong to their natural habitat** to be present, to ensure that every ecological process occurs. **Continuity over a long period of time** is also essential, in other words the forest must have existed as such for a long time, a condition that no artificial body of trees fulfils.

Nevertheless, depending on management, the degree of naturalisation and their age, tree plantations are able to develop some of the features of mature stands.



Management in mature forests

Are mature forests 'unkempt' forests?

No. Some of the features of mature forests may surprise those who are not familiar with forest ecology, simply because we are not used to seeing mature forests. The vast majority of the forests we know in Europe have undergone transformations through use.

The presence of fallen trees, decomposing logs and standing deadwood, along with greater complexity which may appear disorderly, is often associated with abandonment or poor condition of the forest. However, large pieces of dead wood are the **result of natural processes** that only occur in fully mature forests in which trees reach their limit of longevity and die. This deadwood, and other signs of forest maturity, play a vital role within the ecosystem, facilitate nutrient recycling and safeguard the long-term endurance of the forest.

Are mature forests unmanaged woodlands?

Planned non-intervention is a **valid management option**. In many ecosystems, the best forestry management option is to eliminate hazards or stress factors and allow ecological processes to do their work. This is not to be confused with the absence of management through abandonment or lack of funds.

Overall, non-intervention is the best management option for mature forests. By contrast, wood plantations or young woodlands springing up after the abandonment of a rural environment, which currently cover large homogeneous areas, benefit most from forestry management techniques aiming to strengthen resilience to disturbances and enhance adaptation to climate change by increasing heterogeneity and diversity.

Are all interventions in a mature forest negative?

Old-growth and mature stands require management that consists in monitoring the healthy condition of the habitat and in reducing hazards or stress factors, while avoiding intervention in the stand itself.

In certain cases, in stands that are in the process of maturing, intervention may be advisable to reach **conservation targets that should be made explicit**, such as improving the populations of threatened species that are natural to old forest environments, providing through forest management the necessary attributes of maturity (greater quantities of deadwood, opening clearings, etc.).

Should all forests be managed as a mature forest?

Mature stands account for a very small surface area, estimated at around 2% of Mediterranean forests, and probably considerably less on the Iberian peninsula. It is not a matter of managing the entire forest mass as a mature forest, as each of the stages in the silvogenetic cycle are equally essential, and moreover, forest harvesting is important to the local community.

It is simply a question of **protecting the last remaining enclaves** where the best-preserved conditions of natural growth and maturity are found, and include in their planning and management - in protected spaces and in woodland ordering schemes - the aim of maintaining and increasing any extension that may reach mature status in the future.

Is intervention advisable to accelerate the state of maturity?

In old-growth stands, where all the signs of maturity are present and senescence has set in, there is no need for active intervention. Other forests, including woodland dedicated to the production of resources, may benefit from active management to re-establish certain features of mature stands more rapidly than allowing nature to unfold.

However, active intervention in a mature or maturing forest **must be fully justified**. As a general rule it is viewed as preferable (and more efficient) to allow nature to take its course, even though some natural processes seem slow on a human scale. Under certain conditions, there may be some justification for accelerating some of those processes, for example, the need to boost the population of certain threatened species (e.g. saproxylic coleoptera) may call for spot actions to increase the provision of deadwood; or a scanty regeneration rate may advise clearings to be opened up if they are not present naturally.



Harvesting in mature forests

What do we mean by mature stands not being harvested: just logging? Can there be any harvesting in a mature forest?

Is any forestry possible in mature stands?

The stages of maturity and senescence are only reached in the absence of harvesting. In fact, existing mature stands usually correspond to remote or abrupt areas that have long ceased to be profitable for harvesting. In most cases, once identified, their management is maintained without changes.

Leaving these spaces of natural growth to evolve freely, exempt from logging or woodcutting and safeguarding them from all human impact, is expected to lead to the recovery of the attributes and processes that are inherent to mature forests, although this is a slow and as yet little known process.

Extractive practices entail the removal from the system of one or more of its elements. Hence, if ecological processes are to be allowed to operate without interference in mature stands, the latter must remain fully untouched. Strictly speaking, visitors should be reduced to small numbers and restricted to clearly-marked designated routes.

In the presence of livestock... are mature stands impossible?

Herbivory is a necessary ecological process in the natural life of forests. Therefore, the presence of **wild herbivorous animals** in mature forests is essential. In smaller stands, however, or in the absence of predators, herbivora may cause an imbalance strong enough to prevent regeneration and the proper development of ecological succession.

Livestock farming, in principle, is incompatible with advanced stages of maturity, although at a very low density the structure and dynamic of the ecosystem may simulate the ecological role played by large wild herbivores.

Biodiversity in mature forests is particularly fragile; is it compatible with public uses?

Recreational use of mature and old stands is a powerful tool for education and promoting environmental awareness. These spaces are therefore especially adequate for **quality public use**, preferably on a low-density scale and restricted to clearly-marked paths, in specific stands and subject to specific rules so that no disruption is caused to the maturity status (presence of nitrophyllous species, disturbance to wildlife, etc.). In some particularly sensitive stands it may be advisable to curtail or discontinue public use.



The value of mature stands

Can mature or old-growth stands yield economic benefits?

The conservation and maintenance of mature stands offers landowners a range of financial and management tools that they would otherwise not have access to. On the one hand, formulas may be found to compensate for a loss of yield —particularly logging— from these woodlands, such as subsidised non-logging agreements. On the other hand, aid may be granted in relation to the measures envisaged in the Rural Development Plans to promote sustainable forestry management.

Some protected areas summon subventions with the aim of improving socio-economic development within their areas of influence, which may include funding for maintaining or enhancing the conservation status of those habitats.

Other possible strategies are the transfer of harvesting rights to foundations, associations or administrations, or custody agreements, with or without the provision of direct income but involving other benefits and management aids.

What is the value of mature or old-growth stands for society?

Forests provide many **services**: they protect the soil, control the water cycle and contribute to climate control, among others. But old-growth stands are also a valuable **asset** for the rich and exclusive biodiversity they sustain. In addition to this, they are of enormous scientific interest on account of their sparseness, and the opportunity they offer to learn about the ecological processes at work in forests, which can be used as a benchmark to measure the conservation status of other forests.

Unmanaged stands are also a **silvicultural reference** for productive forests. They provide insights into how the ecosystem behaves in the absence of forestry intervention, and at the same time provide a model on which to develop more nature-friendly forestry techniques.

Lastly, mature forests offer many benefits to society, mainly relating to their contribution to people's health and wellbeing.

What is the value of mature or old-growth stands for forest landowners?

Old-growth stands are found almost without exception in woods whose exploitation is unprofitable. Their economic yield is therefore very small, if not negative, and generally no profitable felling activity can be expected.

However, they can offer **alternative** benefits: their value lies in their difference to other woodlands, and their distinct features render them a potential source of complementary income in currently unprofitable woodlands (e.g., nature tourism or educational and scientific aims) for some landowners, in particular those engaging in social projects with Town Councils or nature conservation organisations.

Are there other values, other than financial, of interest to forest landowners?

For a large proportion of forest landowners, economic benefit is not the main force driving their forestry activities. Aspects such as attachment to the land and a sense of responsibility for property that should be handed down in good condition to future generations often play a key role in decision making. In the present context of climate change, in which a greater incidence of disturbances, such as drought, is already patent, management focusing on risk reduction (encouraging diversity, heterogeneity, etc.), thus maintaining estates in good condition, represents a project for the future of these lands and a stimulus for landowners to adopt active management.

What can we learn from old-growth stands that is applicable to other woodlands?

The identification of the characteristics and processes pertaining to the mature stages of a forest (i.e., big trees, dead wood, complex vertical and horizontal undergrowth layers), and their relation to values that are of interest to managers (biodiversity, resilience against disturbances, carbon storage, etc.) is of enormous interest to research and to silviculture.

Old-growth forests provide references for silvicultural practices that imitate natural processes, and add value to forest husbandry by bringing new and profitable uses for timber much appreciated by society. For instance, from old-growth stands we can learn the duration of the various stages in the silvogenetic cycle throughout the different types of Mediterranean habitats and climates, the role of forests as carbon sinks and how this varies with age, the ratio of large trees that is needed to maintain stable populations of certain fauna and flora species of interest, the characteristics these stands need to display to become a suitable refuge and source of food for these species, the amount of standing and fallen deadwood and the extension needed to maintain a stable community of saproxylic fauna, the type and quantity of deadwood stumps and decomposing deadwood necessary to increase biodiversity among certain groups of threatened species.

What role do they play with regard to climate change?

Mature forests contain greater diversity of species and their structure presents greater variety. This makes them more resilient (more capable of recovering from disturbances), and better prepared for adapting to climate change, forest fires or pests. In addition, as they contain a large proportion of big, long-lived trees, they retain carbon from the atmosphere for long periods of time, thus acting as important carbon sinks.



Disturbances (fire and pests)

Do mature stands represent a greater fire hazard?

Aside from meteorological conditions (wind, temperature and relative humidity), which are the dominant factors in the spread of forest fires, the likelihood of fire depends fundamentally on the amount of vegetation available that is potentially combustible (biomass) and all its vertical and horizontal continuity. The size of the combustible matter is another determining factor: small biomass is more readily combustible than large logs.

The spatial distribution of biomass is therefore a key factor: large heterogeneous extensions of young and dense growth are highly

In the event of fire in an old-growth stand, is intervention necessary?

In ideal conditions, fire is one of many disturbances occurring in nature, especially in Mediterranean ecosystems, and forms part of the cycle of natural disruptions. Today, however, old-growth stands are so rare as to be considered **irreplaceable singularities**, and it is necessary to take action to prevent their disappearance.

Furthermore, it is imperative to take certain precautions in the fire-fighting methods used in order to minimise damage (for example, avoiding or limiting the use of heavy machinery) and plan for prevention and protection measures efficiently.

Inflammable, as are continuous vertical structures allowing fire to climb from the ground to the treetops.

There are several circumstances in old growth stands that **mitigate the fire hazard** as compared with younger (and often unmanaged) forests. On the one hand, the nature of the combustible substance: in general, vegetation in mature stands contains more moisture which makes it less inflammable than scrubland, and likewise the combustibility of large decomposing logs is poor. On the other hand, both vertical and horizontal spatial heterogeneity (with clearings and openings in the canopy) cause breaks that hinder the advance of a forest fire. Their structural characteristics (horizontal and vertical continuity and the amount of biomass), botanical characteristics (mixed woody species, mesophytes) and topographical features (isolation, few visitors) strengthen their resistance to forest fires.

Lastly, the mere presence of old and mature stands is proof of their greater resilience against forest fires: these are very often enclaves that thanks to their unique location have survived forest fires through the centuries.

Is the maturity of a forest possible in an environment subject to forest fires?

This will depend on the recurrence and intensity of the fires. In a major fire in which the tree population has been completely destroyed, ecological succession will recommence and the features of maturity will be lost. Forest fires that are recurrent likewise prevent the attributes of maturity from developing. In the case of low intensity forest fires, certain components of the ecosystem are revitalised (the herbaceous, shrubby and regenerated layers) but the main characteristics of maturity that take much longer to establish remain (big trees, large portions of deadwood), and the stand will soon recover its features of maturity. In the Mediterranean area, where forest fires are recurrent, the process leading to maturity may be interrupted at frequent intervals, which is why in many Mediterranean forest habitats it is hard to find old-growth stands or woodlands in an advanced state of maturity.

Do mature stands increase the risk of pests?

In forestry terms, pests are associated with loss of profit in productive woodlands. Pests consist of demographic explosions of certain species of insects, mainly bark beetles that bore galleries on live tree trunks, usually when the trees are weak, causing the death of the tree and, hence, profit loss.

This type of phenomena is characteristic to large homogeneous forest formations with low populations of fauna, and forests weakened by unfavourable environmental conditions (prolonged drought, forest fires, heat waves).

Mature or old-growth stands can **withstand pests** that attack productive woods, thanks to their considerable biodiversity and structural complexity which hinder the expansion of pests. The existence of many ecological niches causes the balance between phytophagous insects and predators to stay within the limits beyond which the phytophage population may become a pest: i.e., the communities of phytophagous organisms liable to become 'pests' are controlled by communities of their predators.

Does the presence of deadwood in the forest increase the risk of pests?

Large quantities of deadwood do not increase the hazard, as the insects that feed on deadwood are different from those that attack living trees. It is relatively rare that boring insects, such as bark beetles, should attack living trees unless these have been weakened by other agents such as prolonged drought or fire.

It may also occur that during a major disturbance (wind or fire) a large quantity of deadwood is produced, which may become the source of pests liable to attack living trees. In such cases the hazard is short-lived because such insects only attack fallen trees while they are relatively green.

To sum up, in an old growth stand, in addition to finding species liable to become pests, we also find a rich and varied community of predators that depend on the mature stages of the forest to fulfil their life-cycle.



Stands of reference for the Natura Network 2000

Old-growth stands and an evaluation of the conservation status within the Natura 2000 Network

What is the difference between a mature stand and a stand of reference?

Stands of reference, in any given forest habitat, are those stands closest to maturity as is possible to find within the region. In some forest habitats, owing to the intensive use they have been subjected to for centuries, the stands of reference may not possess all the characteristic signs of maturity, but are the most mature samples available in the forest.

Stands of reference are an essential tool in determining the conservation status of habitats of Community interest, as required by the Habitats Directive.

The Habitats Directive requires European Union member States to evaluate the conservation status of Habitats of Community Interest, which, obviously, includes forests.

Old-growth stands are a basic reference for evaluating conservation status: they represent the type of structure and function of forests in advanced stages of the silvogenetic cycle in the absence of human disruption; they show us the state that forests would reach without intervention or moderate- to high-intensity natural disturbances.

For a forest habitat to be considered, as a whole, to possess 'favourable conservation status', it should contain within its area of distribution samples of all the different stages of the forest cycle (and their associated biodiversity), and should therefore comprise a sufficient extension of stable old-growth stands or old woodland.

In the identification of old-growth stands, what is the commitment of the Administration?

In principle, once their identification is complete, the long-term permanence of mature stands should be safeguarded. Several options are available. If the stand is located within a protected space, no further protection than that already provided may be necessary, especially if the stand is mapped and is explicitly present on planning documents (e.g., nature reserves or similar areas).

When the stands are not under the protection of any legal figure as protected spaces, some Administrations have declared these stands under a specific legal figure ("Singular Woodlands" in Aragon; "Naturally Developing Stands" in Catalonia). Another option is to include these stands in the forest ordering plans as reserved areas. When the stands are located on privately owned land, it is necessary to reach an agreement, such as a Land Custody contract, with the landowner.

