CAREFOREST

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e-book

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01.

Biodiversity

1 DIVERSITY OF LIFE INSIDE THE FOREST

We all know forests! Be it the ones we used to explore with our grandparents as kids or those we saw in documentaries.

Forests have always looked large, lush, leafy and exotic to us. Recent data show that **30% of the planet's terrestrial coverage is occupied by forests,** which is equivalent to several football pitches, **39 million** to be exact! But even considering these numbers, we know that the forests on our planet have been degrading: scientists estimate that an area equivalent to one football pitch is lost every second!

Forests are spaces of beauty and undeniable natural heritage, contemplation and learning. These are complex places, and much more than just a set of trees. Forests hold a structure of communication networks, interactions and dependencies, with thousands of inhabitants. Like our life on Earth, forests end up working as big “green cities”! They have large factories producing food and energy. For the health and stability of this "city" there are even mechanisms that promote its balance, through the predation of the sick and more fragile individuals. Natural selection will make the most able and the most resistant prevail! It is this sort of “green city” that keeps the planet as we know it and, above all, is responsible for human life on the planet.

But do we really know what a forest is?

What is a forest? How is it established and which organisms constitute it?

Forests can be defined and valued in different ways, depending on the vision and perspective of those who are characterizing it. A forest can be a source of raw materials such as wood, a natural space with native species, a space planted with exotic species, an ecosystem full of biological diversity, a carbon sink, a source of multiple ecosystem services or, in a most correct approach, a **combination of all these views.**

Ecosystems

Defining a forest may not be simple, but we can consider **it as an ecosystem made up of diverse dynamic strata, which can range from the soil we step in, to the treetops, typically with great biological diversity, trees, shrubs, with or without water sites.** But what is an ecosystem?

An ecosystem is nothing more than a combination of the **different physical, biological components and their interactions,** which are present in each environment.

Forests or forest ecosystems have not remained the same over time, even when men did not walk or live among them! Their composition has been changing for millions of years. Many forest species, both plants and animals, have already become extinct, giving way to others that have adapted to changes in the Earth's structure and climate.

How is a forest born? The answer lies in ecological successions!

The birth of a forest can be a slow process that lasts thousands of years, however, to the time scale of the human being, we can watch this birth, in a less complex way. Just think about what happens after a forest fire or the transformation that occurs to an agricultural field after being abandoned!

▷ See more.

Diversity of forests

Forests, regardless of human action, developed in very different ways depending on their location on the planet. If you ever travelled to a different country, you must have noticed that forests and trees are not exactly the same as those you have always known. Even within your country, you may be able to notice these differences, because a simple change in climate affects the distribution and diversity of species. A humid place with a lot of precipitation will never be ecologically similar to a dry area, where it only rains for a few weeks a year; the same happens in a place that is more than a thousand meters above sea level compared to an area located close to the sea. These **climatic factors** create the differences between a tropical forest and a desert; between a temperate forest of resinous (e.g. pine, fir and cypress) and leafy (e.g. oaks, birches, beech) species and a mangrove, where plants spend a large part of their lives in the water.

So, we can agree that the formation and diversity of forests depends on several factors that are not exclusively biological, but can also be **abiotic,** such as **temperature, light, atmospheric pressure,** as well as other **meteorological phenomena, such as wind and rain.**

Forest and biodiversity, an essential link

From the experiences we make and the travels we do, we have already concluded that forests have a diversity of living beings, they are a true repository of biological diversity, also known as biodiversity! **Biodiversity** is the term attributed to the fabulous **diversity of life forms that exist in nature and to the interactions between them.** Diversity can be found in something as small as a gene (genetic diversity, which is responsible for each individual within the same species being different from his brother or cousin), to the diversity of large living systems, such as forests, soils or oceans, including all species of bacteria, fungi, animals and plants. It is biodiversity that makes life on Earth possible and it is thanks to biodiversity that we are able to stand here today and be just like we are! But we will discuss the importance of biodiversity in human life a little later…

Man has been manipulating and using biodiversity to fulfill his needs, whether for food or to support his quality of life and activities. With this manipulation, landscapes and ecosystems were changed, and forests are no exception. In recent decades, man has been creating **forests that are dominated by a single species, making them exclusive to the production of a certain raw material, such as wood, paper or oil.** Examples of this type of forest exploitation are **monocultures of eucalyptus, pine and palm tree.** Although at first glance we might be led to think that these plantations can reduce logging activity on native forests, if we look more closely, we see that this is not always true! Intensive production requires huge expanses of free land and is cultivated with aggressive techniques that resort to soil disturbance and artificial fertilization. We can find lots of individual plants in tiny areas, so it is easy to understand that these monocultures have a negative impact on the balance of the ecosystem, from soil to water, either due to demand for consumption or to contamination with chemicals, pesticides and herbicides. In this type of artificial forests, **biodiversity is practically non-existent,** contrary to what happens in forests that did not have human intervention - native forests. Thus, the benefit of monoculture forests is mainly economic and, sometimes, they can even be a significant threat to the survival of the animal and plant species that lived there previously.

Life inside the forest

Looking away from these monoculture forest **exploitations,** life within a native forest is very agitated, and includes many different forms of life! Forests are home to around **80% of terrestrial biodiversity, and we know there are 60.000 different species of trees. The concept of species refers to a set of organisms that can reproduce and create fertile offspring.** For example, while Amanita muscaria is a species of mushroom, the fox (Vulpes vulpes) is a different species, in this case a mammal; these two species are not able to reproduce with one another. Different species can live together in the same **habitat,** that is, the environment within an ecosystem that brings together the ideal conditions for them to live, feed and reproduce. In forests we can also find more peculiar areas, equally essential for some species, as is the case of dead trees, which constitute a **micro-habitat,** i.e. a smaller area with very particular characteristics that provides shelter and food for specific species such as some beetles, e.g. the stag beetle (*Lucanus cervus*), mushrooms (e.g. *Trametes versicolor*), woodpeckers (e.g. *Dendrocopus major*), bats (e.g. *Nyctalus leisleri*) and amphibians (e.g. *Bufo spinosus*).

The biodiversity of a forest can be measured by the number of different species that exist in it. In the scientific world, about 1.5 million species are classified and known, but many millions are yet to be discovered, especially if we focus on the communities of invertebrates and microorganisms. Biologists are one of the groups of professionals who research these communities and who are responsible for describing biodiversity as well as the interactions between species, the environment and human communities - this is what constitutes the study of **ecology!**

It's all connected!

Inside a forest nothing appears by chance and "nobody lives alone"! There is a very close link between all the organisms that allow the ecosystem to function in a balanced and healthy way. However, with the deeper intervention of man in forests, we have been witnessing complex situations that call into question the functionality of ecosystems and the survival of animals and plants.

▹ See more.

A Europe full of forests

Forests have dominated Europe's surface for thousands of years, covering up to **80% of its land area.** Many, many years ago, if we were a squirrel, we would certainly be able to go from the North to the South of Europe, jumping from branch to branch, always on the trees! Nowadays, the territory has changed, and the appearance of European forests is now more dependent on how humans manage them, leaving just a few patches of pristine forest.

Currently, forest coverage in Europe does not exceed 43% (but these numbers include extensions of monocultures). The world scenario is much more negative, with just about 31% of coverage. We only need to think about the great impact of tropical forest destruction to get a picture of the reduction of forest land globally.

The diversity of forest ecosystems in Europe has been studied and evaluated by experts from the European Environment Agency, which brought together in different categories the different types of European forests - **“European Forest Types”.** In this classification, they were able to establish 14 categories of forests, which were determined by the differences in biodiversity of each one. Among these various forest types, we can find, for example, boreal, alpine, conifer, birch and oak forests, and deciduous forests, but also forests made up of introduced species (forests more related to the production of raw materials).

Regardless of the type of forest we are referring to, it is undeniable that these are fundamental to human life thanks to **their provision of ecosystem services!** Services? Provided by forests? Yes, that's what we will learn next!

2 DEVELOPMENT

FORESTS AND CLIMATE CHANGE HOW DO FORESTS HELP TACKLE THE CLIMATE CRISIS

WHAT IS CLIMATE CHANGE? A SILENT THREAT

Biodiversity and forest ecosystems, however resilient they have been for centuries, now they face threats at a far greater rate than nature's regenerative capacity. Man's present way of life and his activities are pushing forests to a limit that is already endangering many species, habitats and human life itself on Earth.

▹ See more.

HOW CAN FORESTS HELP THE PLANET?

A well-managed and preserved forest can help man reverse some of the effects of climate change and minimize his ecological footprint. Just think of all the ecosystem services that forests provide and how we, humans, are fully dependent in order to have a balanced and healthy life.

▹ See more.

What do we get from ecosystems?

A help you cannot see

Even if you have never visited a forest, your life is dependent on a large part, of what the forest gives, produces and protects! This help is often silent, invisible and free! How can the presence of insects influence our life? And is the wood of the trees only a raw material with commercial value?

▹ See more.

A heavy footprint!

The European Union (EU), where we live, uses almost 20% of the Earth's biocapacity, despite **being inhabited by only 7% of the world population!** If we use the scale of the planet Earth, these numbers mean that everyone consumed at the same rate of the average european citizen would **need 2.8 planets to continue living.**

We call this type of impact an **ecological footprint.** This concept tells us how much natural resources we are using, which corresponds to the total productive area we need to produce everything we consume, such as wood, fibers, food, fresh water, accommodation, roads and buildings, as well as the ability to absorb what we produce, i.e. the sequestration of the carbon dioxide produced. In 1970 our planet was able to fully respond to the needs of the global population, but only about 50 years later we are already needing 1.7 planets to supply our needs!

Our reliance on natural resources can translate into different types of footprints, depending on the resource used. One of the most significant is **carbon footprint,** which represents **about 60% of the EU's total ecological footprint.** The carbon footprint measures gas emissions from burning fossil fuels and cement production. These emissions are converted into forest area, which has the capacity to purify and sequester these emissions. It is because of this that it is important to understand what type of forests the planet (still) has, because the capacity to **retain carbon depends on the age of the forest, its type of human management,** as well as **its composition and species richness.**

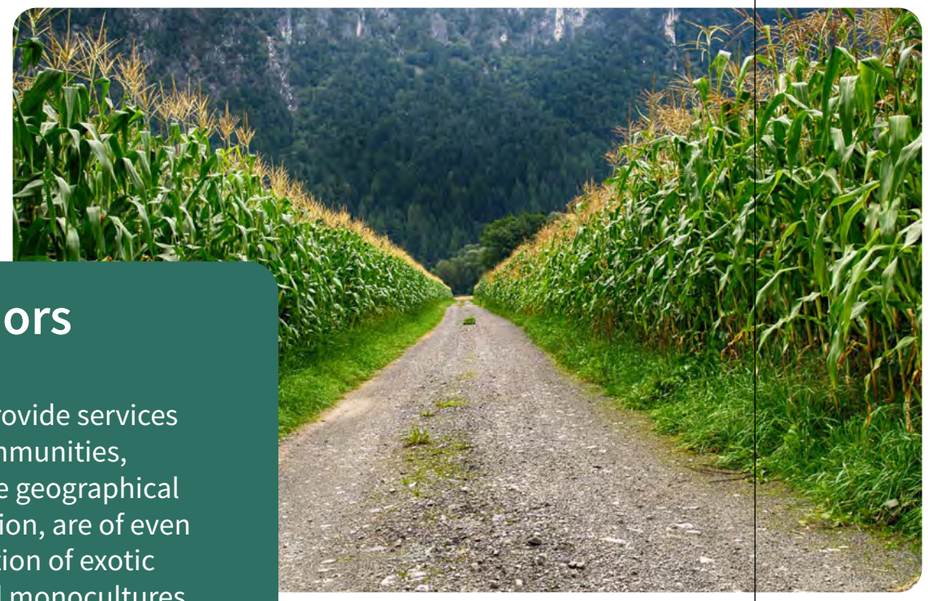
A well-managed forest is a more resilient forest

Forest management has evolved over time and although initially it had the main purpose of producing wood, today this management is increasingly oriented towards multiple uses. That means the production of wood can and should be combined with the production of mushrooms, fruits and with recreational activities, for example.

Sustainable forest management involves modern methods and practices which goal is to maintain and enhance the forest's social, ecological and economic values for the present and future generations! A well-managed forest, by presenting a balanced and functional ecosystem, will not only be more profitable, by adding several features, but also more resistant to all types of threats!

Forest and Agriculture

For centuries, farmers have been managing forests and their agricultural production, extracting the best from them. They have been using forest resources to boost agricultural production, for instance by collecting nutrient-rich substrate, leaves and branches for animal feed, and by collecting and burning wood to produce energy. Another advantage of building farms next to forest areas close is the ability to harvest fruits, berries and seeds from forest species that have medicinal or therapeutic properties, such as elderberries (*Sambucus nigra*), a spontaneous species in European forests and a very versatile plant, as all its parts can be used, from bark, root and leaves, to flowers and fruits. In Colonial America, the elderberry was nicknamed "the medicine cabinet" due to its multiple uses! In Europe it is also used to boost the immune system through the production of syrups, infusions or drinks.
Another example is the use of chemical substances present in wild species for their ability to repel pests. The maceration of nettle (*Urtica dioica*) leaves with water, for example, produces an excellent repellent against mites and aphids that would otherwise harm various agricultural crops. The synergies created between agricultural and forest systems result in activities such as **agroforestry,** where we can see animals grazing under the cover of trees which fruits can also be sold (e.g. cork, oak and chestnut trees). Agroforestry systems generate opportunities for **sustainable forest management, allowing farmers to obtain income** whilst increasing biodiversity as many species depend on both systems - agriculture and the forest. In a more systematic way, **forestry** emerged as a form of complex forest management, and in this case, we assume forest production in systems that may or may not be monocultures.



Native forest corridors

If forests, in general, manage to provide services and goods to different human communities, **native forests,** which preserve the geographical and genetic identity of a given region, are of even greater importance. The introduction of exotic species in forestry production and monocultures are, as previously discussed, a serious problem for biodiversity. Nevertheless, the total conversion of these areas of artificial forests (created by humans) into native forests is a utopian idea - not in ecological terms, because nature always finds a way, but in economic terms! However, just like the interspersed mosaics of agricultural landscape and forest landscape, the **creation of patches or corridors of native forest** between monoculture areas is a strategy that has already been tested in many countries, as is considered a good practice of sustainable forest management that allows the maintenance of forest production economy.

The native species planted in these green corridors, which cross production territories, are essential to allow wild animals to move between more disturbed territories and more natural forest areas. With this type of strategy, we can benefit not only the territory, but also the production area itself, making it more resilient to climate change and other threats, whilst improving water quality and mitigating the impact of droughts or floods.

Green energies

The academic community of scientists, technicians and researchers has been studying **alternative, renewable energy** sources over the years in order to replace our high consumption and dependence on fossil fuels.

Renewable technologies are considered to be a **“clean source” of energy,** as they are able to lessen the impact of their use on the environment, producing relatively few side effects. By using renewable energy sources, it is possible to keep our lifestyle and our needs while reducing greenhouse gas emissions and global warming. We call this **sustainability!**

Renewable energy production concerns the use of energy that is naturally generated in the environment and that includes energy from **solar, geothermal, hydraulic and wind power sources.**

The European union, where we live, has committed itself to be the first carbon **neutral region, by 2050.** With this decision, states not only commit themselves to pollute less and less, but also to offset the entire footprint. In reality, the transition to green energy has followed a positive path and, in 2018, in the European Union, energy consumption from renewable sources accounted for **18.9% of the energy consumed!**

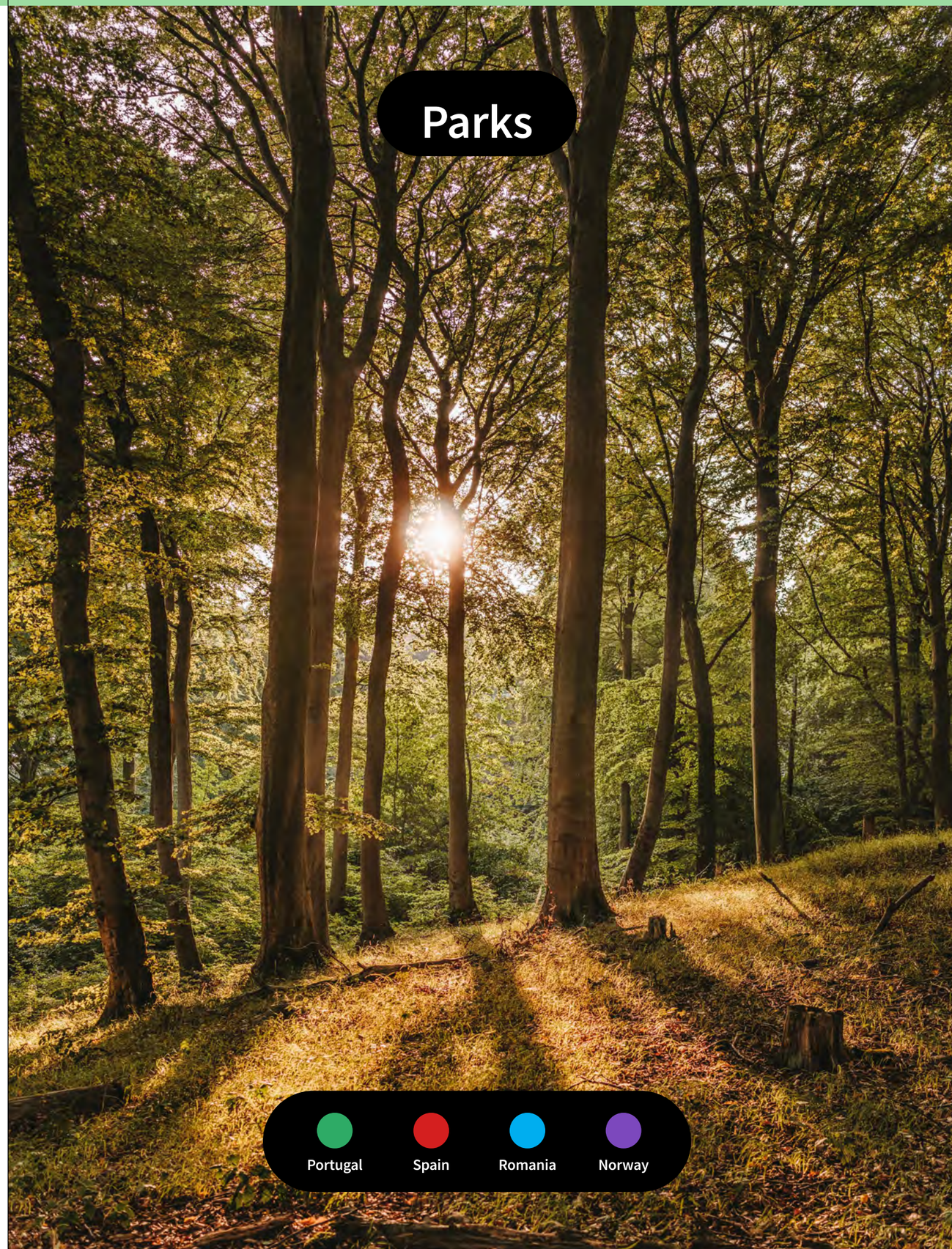
Electric power produced by wind and sun is the most significant in the European union, with solar energy growing every year. In the European Union, electric power generated by the sun went from in 2008 7.4 TWh to 115.0 TWh in 2018.

3 PROMOTING THE PROTECTION AND UNDERSTANDING THE VALUE OF FORESTS

HUMAN COMMUNITIES AND THEIR FORESTS

In the face of this increasingly real loss of forest areas and the resulting loss of ecosystem services, essential to our lives on Earth, it is crucial that global and local political and social strategies begin to be adopted to counter the effects of climate change.

▹ See more.



Tree plantation and restoration of weakened forest

Portugal
Spain
Romania
Norway

How society and young people can contribute to forest conservation!

Earlier in this chapter, we realized that humans are closely linked to forests and biodiversity, either through the direct use of biological resources or by benefitting from various ecosystem services. The choices we make every day can have a strong impact on the natural world and its future. Now we will move on to analyse which behaviours we can adopt, which decisions we can take, and also know what is being done in Europe to decrease the ecological footprint on forests and biodiversity.

Forests and biodiversity have no political or administrative barriers. For a forest or a group of fauna, crossing borders between countries is not a problem, unless there is a physical barrier such as a mountain or a big waterline! Therefore, what a country or region does for its ecosystems may mean life or death to the species that inhabit there as well as to those that migrate and use these territories as a part of their route or as a place for nesting, feeding or resting.

Similarly, what each person does in their city, town or village has an impact on the entire ecosystem. We will show you ways to reduce that impact and to make a positive contribution to the recovery and conservation of that same ecosystem!

Research, be proactive, be a part of it!

Participation in community actions to recover degraded forest areas has already been mentioned as a form of conscious and consequent environmental activism. Thus, looking for forest or natural reforestation and conservation projects can be an important first step.

Projects or national programs

Portugal

Spain

Romania

Norway

It is important to note that, regardless of differences in national law, anyone, be it a group of friends or an organization, **can influence and contribute to forest conservation and local and regional biodiversity.** Public opinion is a fundamental force to raise awareness and to influence political decision-making. If you think about it, much of the effort to protect biodiversity and forests has emerged from environmental non-governmental organizations at the international level. These NGEOs exist with the purpose of **building and promoting the common good;** they team up with communities, governments and companies. Being part of one of these NGEOs can be an excellent opportunity **to contribute to the local empowerment of the community, to stimulate community awareness for environmental issues, to help shape national and international politics and to contribute to the development of sustainable management strategies for the use of resources or technologies.**

Change can start at home!

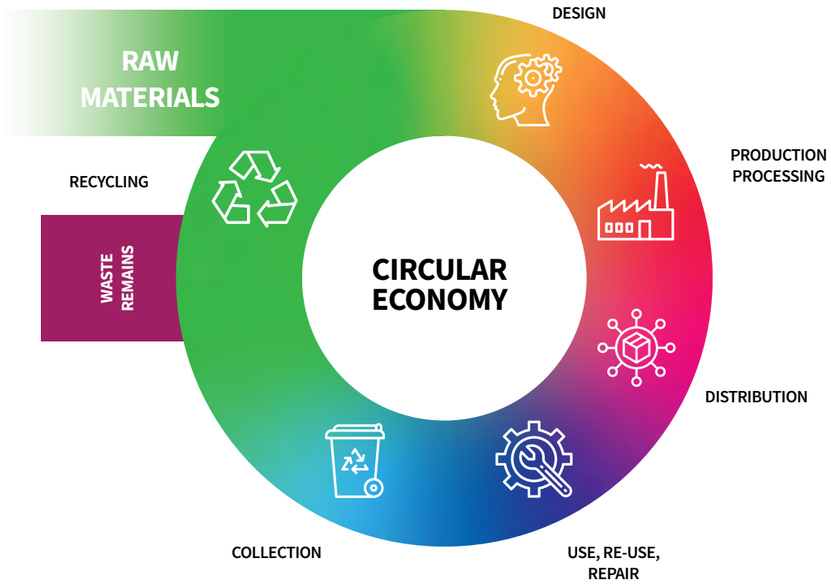
What a country or region does for its ecosystems may define the death or life of the species living there, as well as of all the others that migrate and use these territories as a place of passage, nesting, feeding or rest. Similarly, what each person does in their own town, village and even within their own home will have an impact on the entire ecosystem.

▹ See more.

Circular economy - an important aid in stopping climate change

Reuse, transform, sharing and recycling not only of materials but also of energy - the basic principles of a circular economy - are some of the strategies to reduce our ecological footprint and the impact we have on the planet.

▹ See more.



4 WHAT IS THE IMPORTANCE OF POLICY MAKERS AND STAKEHOLDERS IN FOREST CONSERVATION?

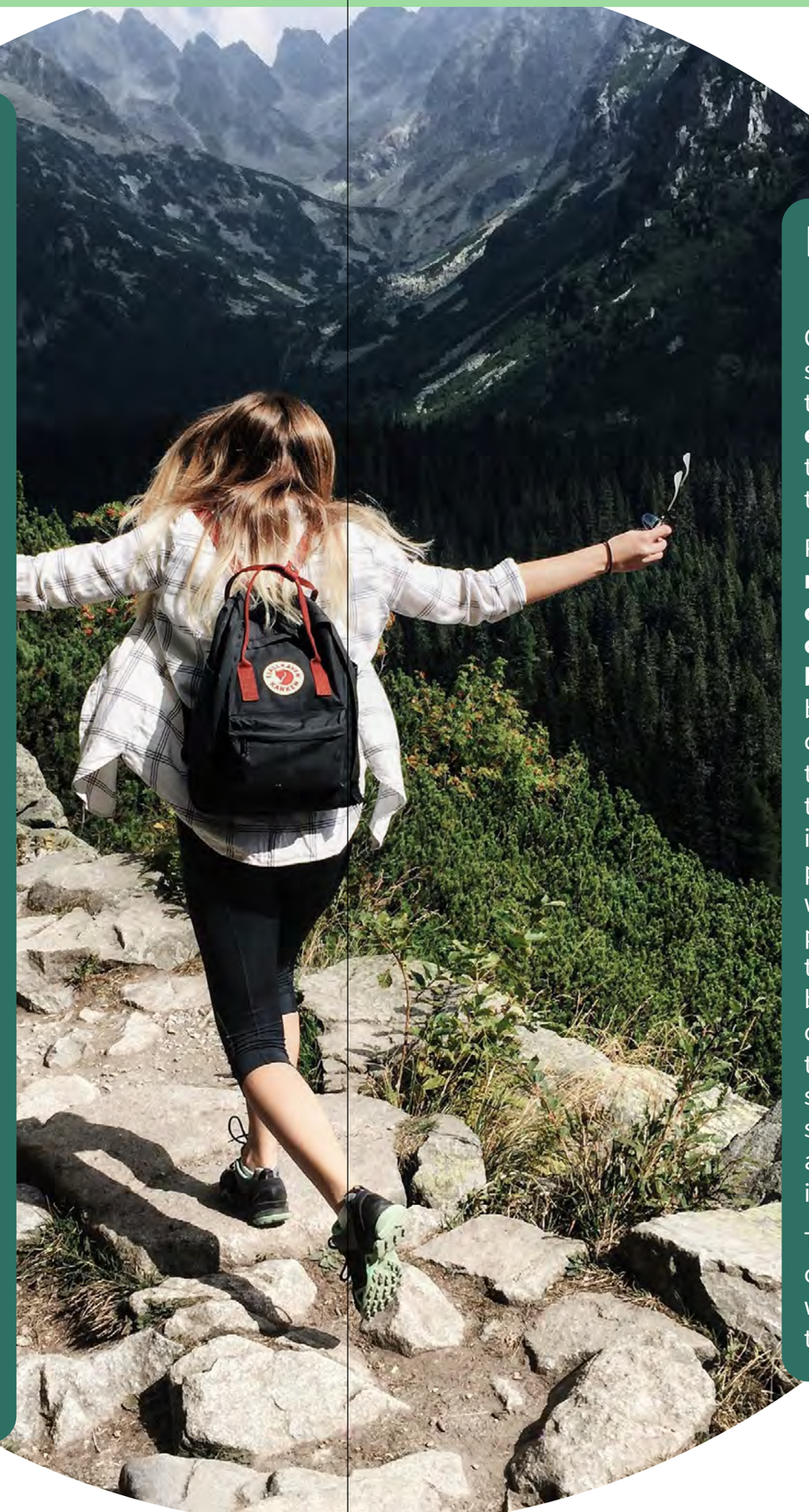
WHAT ROLE CAN POLICY MAKERS, COMPANIES AND INSTITUTIONS PLAY IN FOREST CONSERVATION?

Forests and forest ecosystem conservation involves **reducing the ecological footprint of companies and of public and private policies.** As we have already seen, a circular economy is a strategy with multiple benefits beyond the decrease of CO2 emissions. By recycling components and promoting policies and strategies to minimize the impact of industrial processes such as mining, we can decrease water and soil pollution and consequently avoid the destruction of ecosystems. By reducing production and use of plastics, we prevent them from ending up in the ocean, contaminating wildlife, food chains and humans. Many of these strategies will generate new employment opportunities in the material conversion industry and by offering new services. They will be fundamental to the battle against climate change, but they will also be an essential transformation for our future to be more sustainable and prosperous.

The power of education

An environmentally educated and aware community will be the one that can most easily act on behalf of forests, rivers, oceans and their green spaces. It is this educated and proactive community that will be essential at choosing informed policy makers, who take correct and sustainable actions.

▷ See more.



Valuing and certifying are ways to protect

Several of the global objectives for sustainable development (SDGs) are related to the **implementation of national and international strategies for the certification of forests and forest ecosystems.** These strategies aim to help communities and forest owners to manage their forests, whether natural or planted, in a more effective and sustainable manner.

The potential for tourism of a well-managed and conserved forest is far superior from that of a degraded area. However, the pressure that tourism can put on a forest can be very negative and work in the opposite direction, with habitat degradation and a strong fauna and flora disturbance. Thus, the big challenge is to create **sustainable nature tourism** strategies that can be economically viable.

The promotion of nature tourism can be a way to finance conservation initiatives by local governments, with restoration projects and/or with the creation of reserves and/or special protection areas where tourism can be reduced and controlled. Thinking globally, the creation of **these sustainable and certified ecological tourism** destinations can be a way to protect these forests from biological invasions and illegal deforestation.

Governments and large businesses, due to their strong involvement in trade, must take a decisive role in the conservation and sustainable management of these forest ecosystems. It is up to these decision-makers to play an active role in **waste reduction,** in **food production that does not compromise ecosystems,** in the **development of partnerships and fairer working conditions.** It is also essential that governments and companies work to **reduce emissions of polluting gases,** giving preference and supporting projects and programs of good forest and agricultural practices, encouraging forest certification and other **“green policies”,** preferring products and raw materials operated with this type of production.

Pay for what the forest offers!

One approach that has recently begun to be studied internationally as a way of offsetting the environmental footprint is the **payment for ecosystem services.** However, in the case of forests, if these services are free of charge, how could we pay for them?

Payment for ecosystem services is an **environmental management strategy used to encourage conservation and environmental restoration, channelling money to compensate for certain behaviours.** This payment should be made by the beneficiaries of ecosystem services (a company, a community, or even the whole society in general) to the owners of these forests directly, for example through an additional fee or under the form of an indirect payment (e.g. the certification of a certain product, which adds market value to it). In a practical way, using an example: this strategy defends that a payment should be made to the owner of a large oak tree forest because he keeps it healthy and intact, being able to retain water, capture carbon, among other services. Another possibility is to compensate the owner for maintaining his native forest by supporting production and certification of products such as mushrooms or other fruits that will have a higher market value than those produced in an industrial way.

These mechanisms to support forests rewarding their owners for the services they provide to communities will be explored in the next chapter which is dedicated to the **forest economy!**

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02.

Economy

1 ARE EUROPEANS CONNECTED TO THE FOREST? STILL TODAY?

As you have seen, some 40+ percent of the European land area is covered with forests or other woody growths, and this area has been growing rapidly for more than a century. All over Europe. Even if forests mainly are located in the rural and more scarcely populated areas, their omni-presence imply that a large percentage of us Europeans have some kind of daily, or at least periodically occurring, encounter with trees, woods and forests. At the minimum as an ornamental element in our daily vista, more often as something one passes by, passes through, or stops to visit for any number of reasons. Still, only a select few of us actually spend our day earning our living, working and/or living in the forest.

Does this imply we are no longer connected to our forests? **Most probably not.**

Task for the class to do: To make an account of how many of you have relatives that are forest owners or who's job involves active forest contact, e.g., because they work in recreation or tourism.

One way of looking at people's general connection to forests, is how ownership to forest land is distributed in a population. Among other things, this enables us to show how people may connect to forests through having forest owners in their families. It is estimated that more than **16 million individual Europeans own forest** (be that tiny, small, large or estate sized properties, used for pleasure, firewood, fibers, or other). The total European population amounts to some 750 million in 2020. Simple calculation tells us that some 2,2 % of us Europeans are personal forest owners. 2,2 % is not a very large share, still it is more or less on par with the number of people who own farmland.

But, if we hitch it up a notch or two by further **estimating** the number of households that include at minimum one forest owner, another picture will emerge: An accepted estimate for the average household-size in Europe is **3,1 persons per household.** Using that figure, we suddenly see that closing in on 7 % of the European households are forest owning households. If we play a little further with the numbers, we could try to estimate the number of persons or families that have forest owners as close relatives (e.g. counting as far as to our grandparents and first cousins). We have no strong figures to base this assumption on, but it was not that far back in time when most Europeans had their homes and livelihood in the primary sector; in a subsistence economy based upon farming, forestry, and fisheries, so we would probably find ourselves looking at a level of around 25%. Or even somewhat higher. This example shows how close a large part of the European population may be connected to forests and to forestry.

For sure, such estimates will differ strongly, depending on which countries we choose to look at and if we look at urban or rural settings. Still, the table shows the number of forest owners as percentage of the total population in a selection of European countries (the ones where data was accessible). And what we can observe is exactly this kind of variation between the countries – from Finland, Lithuania, and Latvia at the top end, where 6-7 % of the population directly own forest, down to countries like Netherlands, United Kingdom and Greece, where only very few own forest (less than 0,2 % of the population).

Good statistics often are hard to find – so also in this respect. Still, we have used only highly conservative estimates, with the purpose to show that even if forestry is not an activity that directly involves very many in Europe, through the ownership structures, through family ties and household constellations, and strongly affected by how we also use forests for leisure and recreation, rather large parts of the European population have a much closer connection to forests than one would guess at first glance.

Later on, we will get back to the element of ownership, looking a bit more on the structures: who owns what, where and for what purpose. Just now, we only wanted to show you this piece of information to be able to say: Yes, folks. Even today we Europeans are quite tightly wound up with our forests. The forests are important to us, no matter what.

2 FOREST OWNERSHIP

We have showed you that a large part of us Europeans actually may be surprisingly closer connected to our forests than we would initially think. In this section we will provide more input about the general ownership structures of the European forests **(number of owners per country)**, and a little about the typologies (what kinds of forest owners do we find). Be aware that data are not always directly comparable between countries and that data are still missing for several countries. We present the data we have "as is", to give a picture of the situation. In the previous section we saw in a table that the percentage of owners varies much – from 6-7 percent down to less than one percent – across Europe. Here, we want you to take note of the apparent lack of data from the eastern parts of Europe. This partly has to do with no data available (yet), but also is a consequence of having had a system of state/public ownership for a very long period, and thus it being not common for people to own forests. Still, this doesn't prevent them from accessing forests and per se for using them.

We will show you detailed information about the forest owners. Why? Well, because forest-owners among themselves are vastly differing. From the large-scale forest estate owner who employs many to do the work in his forest, to the small-scale farmer-forester who spends her days between working on the farm and working in his forest. Often to a low income. And finally, the huge numbers of micro-scale owners. People who own properties of forest that are too small to be of any economic importance – but still add up to a relatively substantial volume, thus becoming important when we discuss the roles of forests in the European societies.

Socio-Economic profiles

We know that the 16+ million individual owners differ very much across Europe. Often due to historical reasons, as today's ownership patterns reflect traditional ownership structures for land and property. In most European countries, this used to mean that a few persons/families/institutions owned/controlled most of a country's natural resources, like land and forest. Various social processes over the last 2–3-hundred-year period have changed these traditional structures. This is observable, e.g., regarding countries in the former Soviet-influence area where some governments lately have used forest land as a means for compensating people for "unjust" treatment during the communist period. Resulting in a large number of new forest owners who generally each own only tiny areas– and who often have no previous history as forest owners/managers.

In other countries, easy observable in the north of Europe, we can trace a long history of self-owning landowners (often as combined farmers-foresters). But in these countries, typically laws regarding inheritance has resulted in land-units becoming divided up among descendants, also here creating large numbers of small-scale forest-units. The figure below shows us how owners are distributed according to the **size of their forest properties.** Even if most of us may look upon Norway as a land of active forestry, we still see that out of the ca 170.000 forest properties that exist, only about 2 % are larger than 250 Hectares – a minimum size for keeping a positive and continuous income-stream from your forest. It also shows that the most numerous owner-group are the micro-owners, each holding less than 2,5 hectares. In fact, ordinary forest statistics usually exclude this group as the size is regarded as to small for any kind of production relevance. In other words, in a country like Norway, around 30% of the forest owners are not even counted as their property is too small.

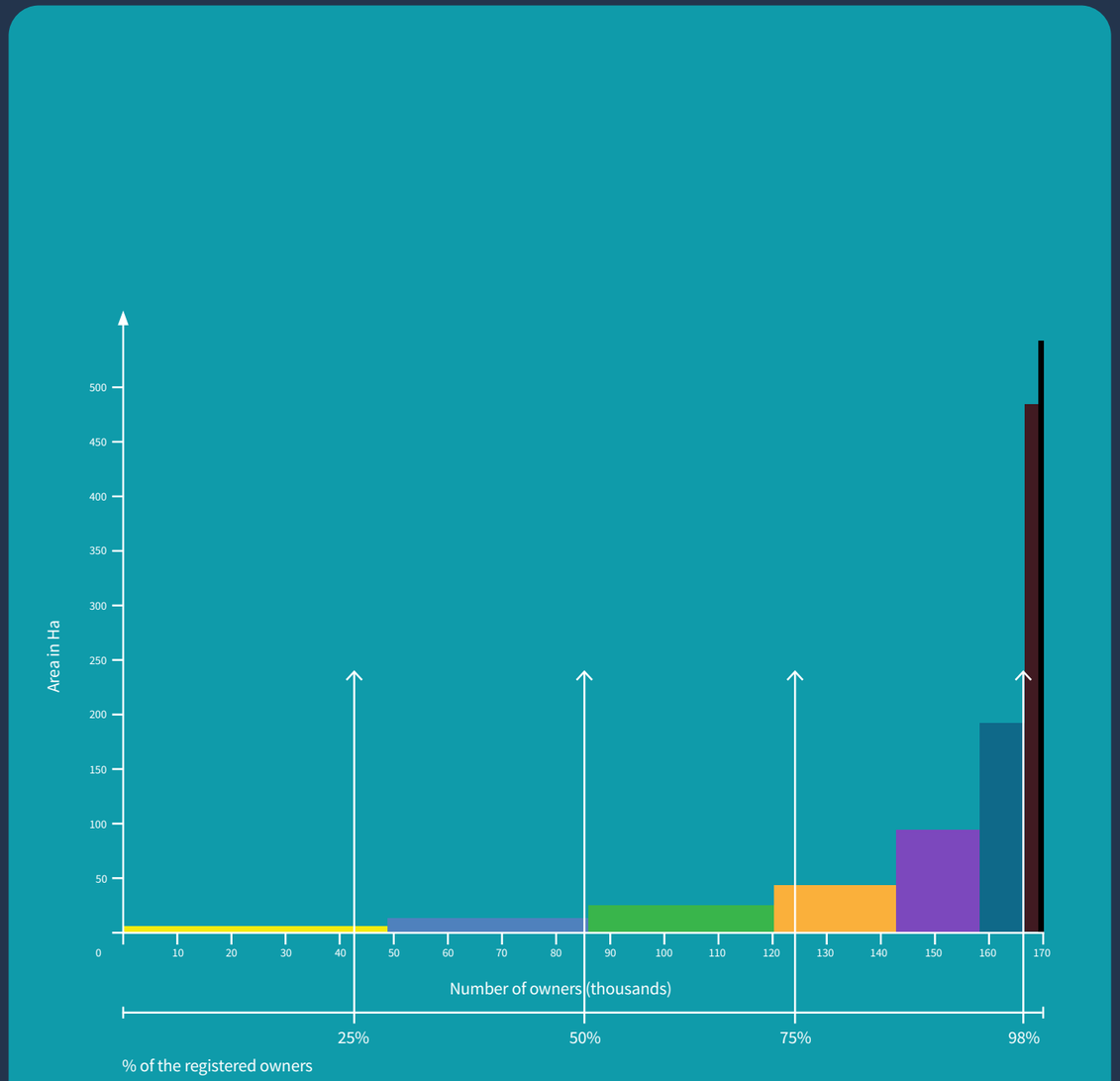


Figure 1: Forest Owner Spreadout, Norway 2020

Conditions for forestry is variable across Europe, this affects the activities and income-generation:

Soil and site differences

There are enormous differences regarding conditions for growing forests and having forestry as part of your income-generating activities in different parts of Europe. From the fertile, quick growing, rich and diverse broadleaves forests of the south to the slow growing, monocultural spruce, pine, and birch forests of the north. Thus, what counts as a small property in the northern socio-economic understanding, might constitute a relatively large and economic viable holding if located further south.

Managerial variabilities

Further there are significant differences in how small-scale and large-scale owners manage their holdings. In particular, it is more difficult for a small-scale than for a large-scale owner to carry out systematic and active management over time, partly due to size of the forest-area itself, partly due to the fact that the income-possibilities generated annually from their forest is small and only accruing to viability at intervals between decades to centuries of non-active intermission.

No matter what, the general pattern is: Across Europe there are only a small number of large-scale owners – be they state/public owners, institutional, corporate or large individual owners, who can manage and extract large and valuable volumes continuously. And, correspondingly, we find large numbers of micro-to-small-scale, private owners who often get no more than a meagre yearly outtake of firewood for the household and/or a once-in-a-generation commercial logging. **Most of the 16+ million forest owners are small scale, bordering to micro scale!**

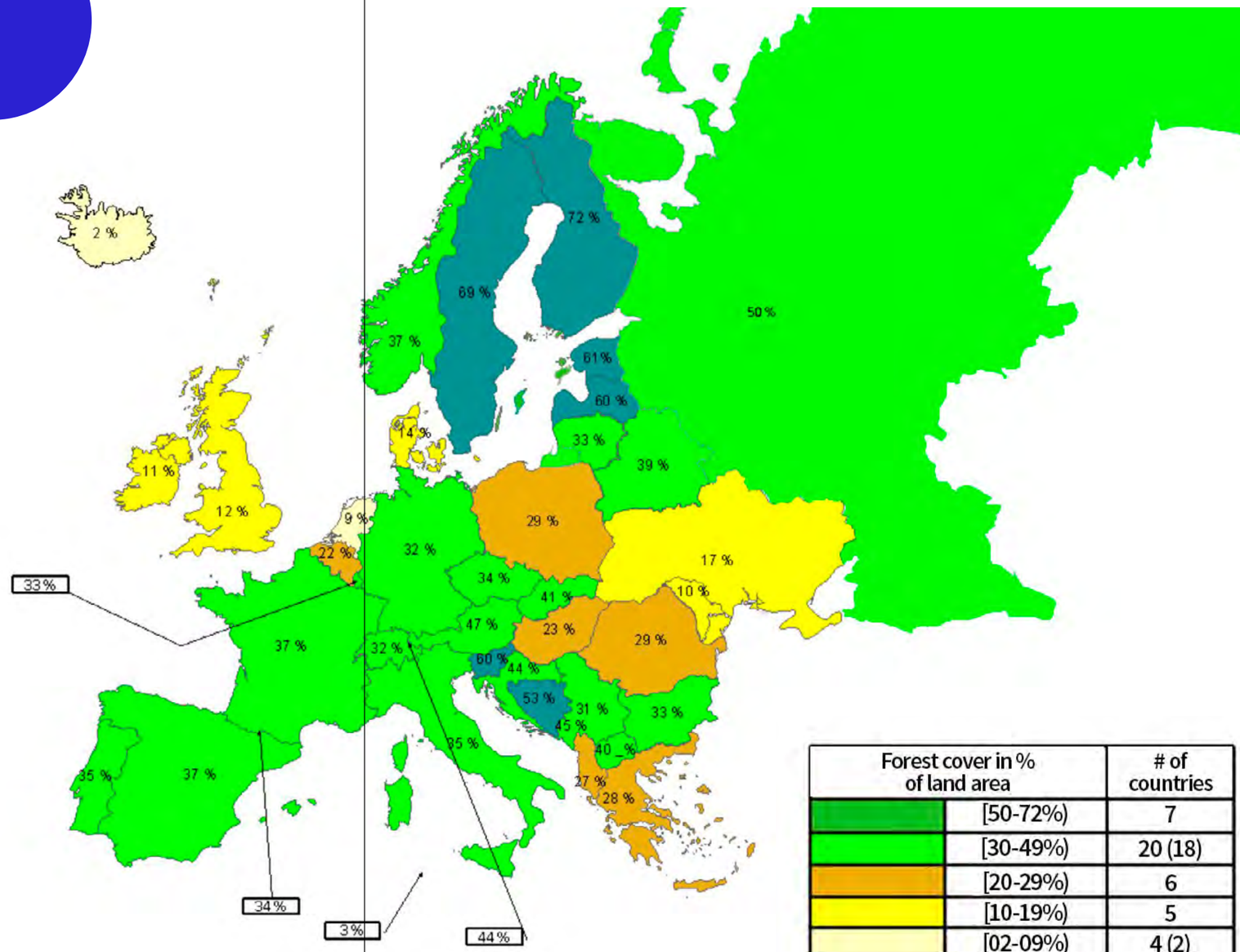
Photo credit: Munții Carpați

3 FOREST ECONOMY

Over recent decades, alongside the strong afforestation-trend going on in Europe, a strong and vibrant forest industry has developed, directing large volumes of timber towards wide range of products and activities, creating jobs, wealth and income on a scale Europe has never experienced from forestry before. Thus, forestry and forest economics also changed, from mostly being an integrated part of a subsistence-type in an agrarian based economy, to a global, large scale economic power-house that for many European countries is of national importance.

The growth in the industry has brought with it a strong increase in forest cover. A century ago many European countries were almost de-nuded. The forest resource had been heavily exploited for centuries, with next to no focus on rebuilding the resource. To secure wood for strategic purposes, many countries started an active afforestation policy – that have been ongoing all up to now. The result we show in this link: **Never before in recorded history has the forest cover been larger in Europe.**

Figure 2: Forest cover, shown as percentages of the land area. Europe 2011



Forest cover in % of land area		# of countries
	[50-72%)	7
	[30-49%)	20 (18)
	[20-29%)	6
	[10-19%)	5
	[02-09%)	4 (2)
Europe Avg.	35%	42 (38)

CIA's World Factbook 2011
# of countries in () = excluded the tiny states

Regarding the economic values of the forest-related activities, there is still a large degree of uncertainty to what are the real values. In general, revenue – and thus the descriptions of value - are explicitly stated only for the main commercial products (pulp and timber) and a select few more (like firewood). **An interesting example is thus how the values created from pulp and timber primarily can be viewed as a national and large-scale industrial income rather than a general element, distributing wealth on a rural and/or overall scale to the inhabitants and the manifold small-scale owners:**

Traditionally, forests used to be a subsidiary activity to the landowners' main economic activities, be they in agriculture or other kinds of industries. Yes, the European forests provided materials and input for the tools produced, timber for construction and space for animal grazing. But there was little of the kind of large-scale logging operations we find emerging since the mid 1800s. This was mostly a result of ownership: Forests used to be the property of the kings and emperors, dukes and barons, and were often out of bounds to common people – even strictly forbidden to enter. The forests were hosting game kept for hunting and for extracting **timber to build warships.** Actually, ownership was in general a keepsake for the ruling classes. The naval connection – and in particular the building of warships – placed a huge emphasis on controlling access to the forest resource, securing ample time for the trees to grow big and strong enough to be suitable for the building of draconian vessels of war.

The conversion from the pre-historic forests of the European landscape, was strongly pushed by the need for new agricultural land, the need for wood to burn charcoal and for various uses in the extensive mining industries that grew up all over Europe. In Norway, in the 17th century, vast areas in the interior was clear-cut and denuded – the area actually turning into northern deserts -- just to provide the wood needed to produce charcoal to extract copper from the mines around Røros.

Figure 3: consequenses of removing forest cover in extreme locations

Another major forest consumer was the expansion of northern-European coastal cities from 1300 – 1600. Holland, England and what is Germany saw this happening. Cities like Amsterdam, Hamburg and London all needed to fortify the land to bear the load of building above. The coastland was soggy marshland that would make any construction sink in over time. So, long trees were piled into the ground to strengthen the ground to take the loads. This took enormous amounts of wood. Best suited was the straight-growing, tall conifers (spruces in particular). **Thus, a major trade in wood arose.**

For Europe as a whole, the forest economy transformation has been a long-lasting development taking more than 200 years to come around. During this period forestry has gone from being purely local resource exploitations to a more sustainable, cyclical economic endeavour, where logged forests are not left to themselves to regenerate or be transformed into croplands. Rather, areas are now systematically replanted/afforested to establish future forests for production (and potential income!). This is often demanded in national laws, ranging from a ban on changing forest land to other uses, to linking state support to reforesting a logged area.

Also, silvicultural knowledge and competence has developed, so the stocked forests of today are both growing faster and producing higher quality wood than did the old ones. It is as for agricultural products in general – over time they have been transformed into higher yielding, stronger and better suited products for the markets at which they are aimed. Especially if regarded from a purely economic viewpoint.

In this process, of course, there has been sacrifices regarding the decline of local species, the promotion of standardized, large scale production systems, and the introduction of high-yield external/exotic species to replace the indigenous.

This has left Europe today with what is considered a large and valuable forest resource. Highly valuable for our economies, supplying timber, woodchips and pulp for a wide range of valuable products, if perhaps at a loss of biodiversity. Further, new research shows that our forest can largely supply the basic raw materials to establish an emerging new economy: the bio-economy – to replace the fossil- based economy of the 20th century.

4 THE INVISIBLE HAND

The word “economy” dates back to the old Greek language. Originating from the words for household (oikos) and for dealing with numbers (nomos). So, economy basically refers to the art of keeping your property or your responsibilities in good shape – be that money- or more general valuewise. Further, for economic considerations to be of relevance, there must also be some kind of a shortage. If an abundance of the resource is available, one does not feel the need to think about how best to make use of them (please remember this condition when we discuss the Circular Economy further out).

This adds up to: **Economy deals with how to make the best (the optimal) use of our scarce resources.**

From its 1700’s emergence, the Market Economy has developed into a universal, scientific discipline, based upon a set of four simple but still important principles:

1. Many (small) stakeholders/actors, both as producers and as consumers, to ensure no one influence on how solutions (= prices) are reached.
2. It is open and free for anyone who wants to participate
3. Everyone has full and equal access to information (transparency)
4. There are no external or unaccounted for effects

Adam Smith. Spearhead of the Market Economy.

Adam Smith (1723-1790) is often referred to as the originator of this understanding (although he was neither the first nor the only one). He postulated that if these four conditions are fulfilled, the market economy will provide the best (optimal) solution possible (Adam’s understanding is often called the “The Invisible Hand”: if all of the right conditions are in place, the optimal solutions will emerge, even if nobody actually were aiming exactly towards them). To date his understanding has often been contested – but never disproven. Just perverted, like what happens when one or several of the conditions are violated and one still insists to call it a free-market economy.

Forest economy relates not only to how we create monetary wealth from the forest – rather to the value of all aspects of forest related activities – and deals with how we ‘keep them all in good shape and balance’. This involves anything that affects how forests “are valued” – up to today and into the future. Thus, Forest Economy – as we will understand it – is inevitably linked to ensuring a Sustainable Forest Management. And even more so: since forests are owned, managed and used by people, the social dimension of forests also must be taken into consideration. This takes us towards a more holistic understanding of (forest) economy based upon the three dimensions: Environment, Market and Society (see more about this in section for Circular Economy).

In practice, this means we need to explore how natural processes that govern the growth and biological developments in the forests are valued – and linked – to how we make use of the forest (plantations, tree-growing, uses for other purposes like agriculture [cattle grazing and source for tools and props], hunting and fishing, picking berries, fruits and mushrooms, uses for recreation, health restoration and for mitigating effects of unfortunate human activities in other places, sectors and aspects of life [e.g., to consume and convert CO2-emmissions coming from our urban lifestyle]):

This also has to do with how benefits and costs are distributed among us all: in society, through the market systems, and back into the ecosystem. Are the effects of the values created being distributed in a sustainable way? **Or do we rather find that some of us get the benefits and others mostly have to take care of the costs?**

Forest economy is how we as humans choose to value the good and bad outcomes, the positive and negative effects, the ups and downs in our experiences that have a relation to the forest.

5 ECONOMY IN THE FOREST

As we have seen, never before in modern history has Europe been covered with so much forest. And we have seen that the number of forest owners is very high (it is estimated that more than 16 million in Europe own, manage and/or get income from forests). Further, data show that forestry is a large source of value-creation in Europe. Thus, it may be a bit surprising to learn that the typical European forest-owner family does not earn much income annually from their forest holdings.

Forestry, or more precisely activities related to production and extraction of timber, wood and wood fibers, rank among among the most globalized market-based activities. Such forest products are traded and exported across borders all over the world.

The most traded are wood fibers (pulp) and timber (round or sawn wood). Traditionally, whole ranges of other products were also important forest products: e.g., mosses, berries, fungi, bark (cork-oak), sap, burned wood (charcoal, tar for ships, turpentine), as well as products related to the hunting and other uses of animals naturally living in the forest (game like birds, boar, deer, moose etc.). Further, forests were a main source of firewood and for wood to make fences and farming tools and props, and the forest areas were actively used for grazing of cattle and other husbandry animals.

In the aftermath of the industrial revolution, especially since the late 1800's, the demands for other than the top two products (pulp and timber) have – to a large degree – fallen away. Today though, we can observe a resurging interest to reinstate and reinvent a multitude of these traditional forest products, and a growth in what is known as experience-based products like trekking, camping (glamping), sports activities and games (role-playing). For some of these, there has been established specialized and often highly profitable markets – like for the underground growing black and white truffles that can reach beyond €1000 per kilo.

High value non wood forest products (left to right: Tuber melanosporum and Tuber magnatum).

The mix of emerging products vary from country to country (even from one part of a country to another), but the tendency is clear: there is an awakened interest in extending the range of products and services which the forest can contribute to our 21st century societies.

6 ESTIMATING THE REAL VALUE OF FORESTS AND OF FORESTRY IS NOT AN EASY TASK

While forestry doubtless is of high importance in the European economy, it is hard to present detailed figures of how important it is, and how much value is generated – especially at local level. There are good reasons for this. Perhaps most important that forestry still is very much dependent upon domestic conditions in the individual countries. Laws and rules for ownership, possible degrees of utilization, trade etc. are not fixed upon common standards, but rather **a result of traditions and experiences that often go way back into unwritten history.** There are no common European or EU policies enforced.

Why then is this relevant?

Ownership not only inflicts restrictions on access, ownership is also the main factor for deciding how wealth and income is generated and distributed. When it comes to forest ownership, European countries can in general be divided in two main groups: countries with largely private ownership, and countries with largely public (national) ownership. Of course, there are many varieties of this. And no country is absolutely only one way or the other.

Historically, forests used to belong to the ruler and the ruling classes (the emperor, the king, the church and the nobility), as did almost all land – except in the “free cities”. Ordinary people were either citizens (inhabitants of cities that had privileges/ monopolies for trade and crafts) or peasants (the ordinary people working the land for the ruling classes). In most of Europe this was the main picture until the mid-/late 1800s.The Russian ‘Kulak’ was not formally released from serfdom until the revolution in 1917 (some say not really until 1989, but that is another story). The northern states (Norway and Sweden in particular) were among the few that for a longer time have supported an independent class of small scale, land owning farmers. But they were more farmers than foresters. The forest was part of the farm – not a separate activity.

As a general picture of the European situation, this did not really change much until the agrarian and the industrial revolutions took hold and moved the focus from wealth and wealth accumulation (Mercantilism) based on the primary industries, towards industrial (secondary) production and more recently to services (tertiary) and what we find today in the post-industrial or hyper-industrial economies. When new regimes of production came to dominate, there was no longer any need to keep the rural, agrarian population on such a tight leash.

A result has been the mosaic of forest ownership we can observe across Europe today. Ranging from the Northern/Western models with a high degree of private ownership to the Eastern models dominated by state ownership.

Also, of high importance is the share of small vs large properties. It is estimated there is +16 million small scale forest owners in Europe, with the term small-scale being quite variable from region to region. There are no fixed measures defining what is a small-scale owner. While the average private forest holding size is closing in on 50 Ha in Norway, the average in some eastern European countries may be down around 2,5 hectares. What then determines if a forest property is small scale? If anything, it might be if and how the property can be large enough to deliver an annual stream of income of significance to the owner, or, alternatively, if the forest can be a source of occasional but larger lumps of income.

7 MAKING MONEY FROM THE FOREST?

Forests can, as we have seen, be a major source of wealth, even if this value might not always be distributed in a way that benefits the local areas and the local communities. Partly the value is in the form of income – from timber sales and/or from working the forest, partly through the more general values forests represent (from land-value to well-being). Still, it is hard to give exact figures that show the actual value of the forest.

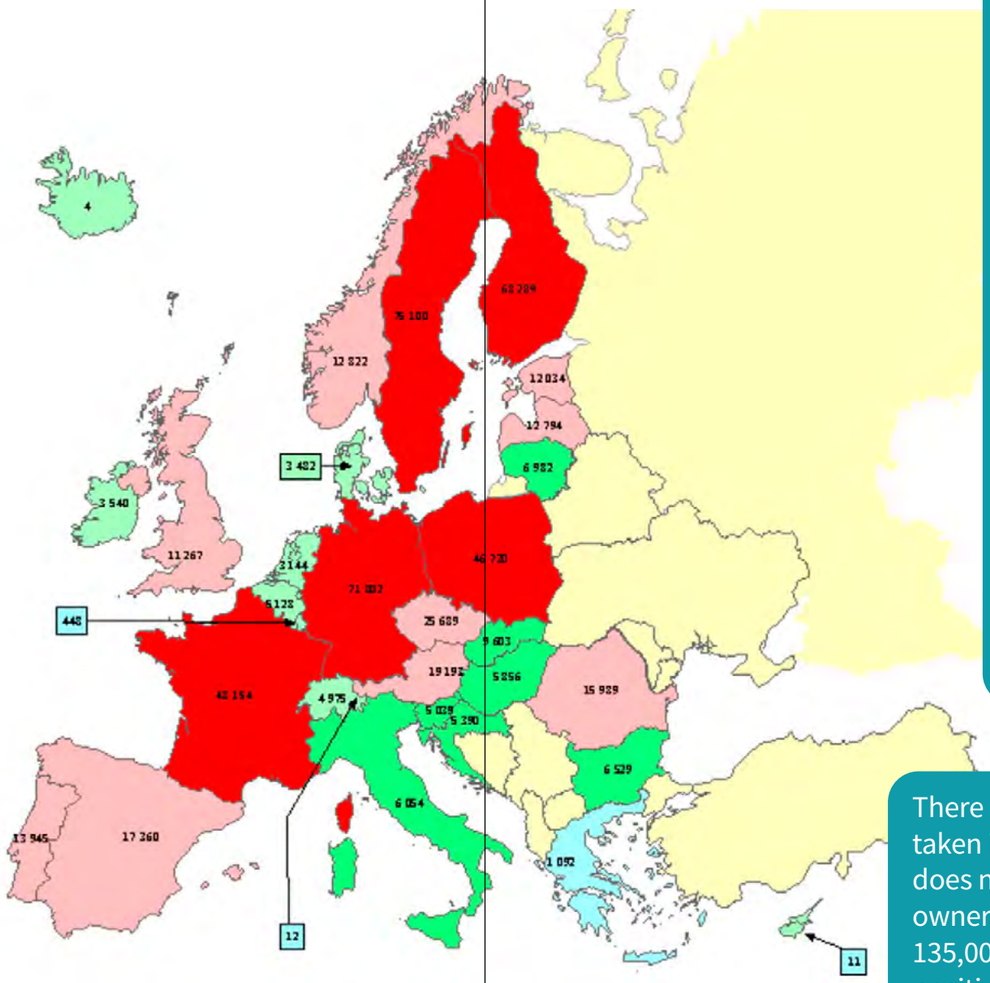
The main reason is that there is no central, European forest market where all kinds of forest products are valued, priced and sold. Instead, there exist various combinations of local, sub-national, national, super-national, European and global markets, where different forest products enter different market segments.

The examples show some of the simpler challenges when calculating the value of the forest. There are much larger difficulties affixed to the task of calculating the full (monetary) value of the forests. No good statistics exist, and we know that various market use different formats for the calculations.

What we do know, is that in Europe, (EU + EEA) over the last decade, somewhere around 500 million cubic meters of wood has been **logged annually** (see figure below). If data for Russia, Belarus and Ukraine are added, this number will increase significantly, exceeding 800 million m3.

The European volume of 500 million m3 can be estimated to have a stumpage value (the marketing value of the trees when/where they are cut) of some 30 billion Euros (using an estimated price of ca. 60 euros per m3).

Earlier, we showed that there were some 16,5 million private forest owners in Europe. If we assumed all forests were private, this would constitute an average value of around 1800 € per owner per year. But we know that private owners own only around half of the forest area and that the typical private owners are small-scale owners, who hold the smaller properties and thus often can log much less frequently than every year. This implies that the typical (whether we use the average or the median sized owner), will each receive a sum of money that is much less than this average. If we further exclude a third of the gross value as reserved for state owned/public forests, and then adjust for the disproportionate share which falls to the large plantations/corporate owners, we are left with a value in the range of 50-ish € for the typical owner on a yearly basis. And then we have not even adjusted for costs for logging and bringing timber to the market which has to be deducted (as this often is done by professional contractors).



Logging - roundwood, fuelwood etc. (2018 or latest available data) 1000m³		# of countries
	[50 000 - 100 000)	5
	[10 000- 50 000)	9
	[5 000- 10 000)	8
	[500 - 5 000)	5
	[0 - 500)	4
	[50 000 - 100 000)	9

Example: Forest income in Norway

In Norway (2018, source www.ssb.no), the gross income from the forests (wood sales) amounted to just below 100 million € (95,9 million €). The same year, there was a registered total of ca. 135-140.000 private forest owners in Norway, and they controlled some 85 % of the productive forest area. A simple calculation gives that the average owner would receive an amount of almost 600 € a year. Significantly higher than our estimated European average, but the average Norwegian forest owner has a property perhaps 5-10 times bigger than the average of Europe. And Norwegian price/cost levels are in general much higher. Adjusted for this, we see that the European estimate we made may not be too far off the mark.

There is another important element that here needs to be taken into account. The average Norwegian forest owner does not log from her forest every year. And large-scale owners log more frequently than small holders. Out of the 135,000 forest owners in Norway, only some 18,500 had positive income from their forest in 2018, implying that the average owner will log for sale only every 7-8 years, and the small owners even less frequently. The table below shows that the income received for the ones who did log very much depends on the property size. If you logged, and you own one of the small properties, on average you would receive around 1/10 of the average amount calculated for all owners. If you owned one of the largest properties, you would receive almost 50 times this average! Further, if you own one of the largest, you can expect this income every year, while if you are one of the smallest, you probably will experience this income once or maximum twice during the time you own the property.

Registered income from forestry, 2018

Property size (in Hectares)	Total Income (Mill €)	Owners, total and per property size group	Average per owner (€)	Averages per property size group compared to total average
2,5 — 10	3,6	38 562	93	0,1
10 — 25	8,8	30 618	289	0,4
25 — 50	13,7	20 622	664	0,8
50 — 100	19,6	14 738	1 328	1,6
100 — 500	20,2	7545	2 679	3,2
200 — 500	16,8	3366	5 004	6,1
500 — 2000	10,2	786	12 990	15,8
2000 — >	3,1	78	39 136	47,5
In total	**95,9**	**116 315**	**824**	**1,0**

So, what does all this this tell us about forest economics?

- That forest economics are complex, differing from country to country, even when looking just at the largest producer groups
- That there further are huge differences between the owners. If you are a large-scale owner, you will be able to – in all aspects – make more money and hence more profit from your property than would a small-scale owner
- That forestry in total generates much value, but also that this value is unevenly distributed, regionally and socio-economically.
- That most forest owners in Europe are small-scale (although the understanding of what is small and large scale differs from country to country)
- So – this implies that although forestry is a large factor in several countries' national economics (generating large values and adding much to the GDP), the values are distributed so that, generally, only a few benefit from them.
- And finally – even if forests in general can be said to be a rural element (most forests are found growing outside of the urban and peri-urban areas), there is little evidence for saying that forestry will be an important factor in a country's rural development efforts/strategies.

Outdoor Recreation and Cultural consumption

Forests have always played a large part in human life. Indeed, some scientists claim that we seem to have evolved to gain not only the benefit of the necessities of life – wood, employment, food, etc. – but also more intangible benefits such as improved mental health, i.e. "forest bathing" and improved physical health (patients exhibiting quicker recovery when able to see or be around trees) (Ulrich 1984).

Plus, of course, trees and woodlands have played an important part in local and personal identities, as site markers for significant events and indeed as significant parts of, and landscapes in themselves.

Cultural services

If we take an Ecosystems Services approach to looking at what services forests deliver for human society, one of the ecosystem services categories is 'cultural services'. Within an ecosystems services approach, these include a wide range of services from spiritual, through educational, to recreational and health benefits. Here we will look into some of these important non-economic services that forests provide to human societies.

These include a number of Social Benefits of Forestry including physical recreation, aesthetic appreciation of beauty, non-commercial harvesting of Non-timber Forest Products (mushrooms, plants, etc.), and other uses outside of the strictly commercial.

Identity services

Across the range of ages, forests can provide important identity resources at both the individual and societal level. These range from what children learn from their experience in the forests (as well as stories they read about them) to the key roles a forest or certain trees can play in building the identity of a place.

Health and well-being

Whether experiencing the restful feelings created by being quiet in a forest, or the physical health benefits of physical activity in one, the very act of our presence in a forest delivers important health and well-being benefits for people. Of course, being in a forest usually involves physical activity and in particular public health and other officials are beginning to see the value in 'prescribing' forest walking as a post-operative recovery strategy (Evans and Franklin 2007). Here it is the aesthetic values of forests which are seen as supporting better and more consistent participation in such activities.

Well-being is a difficult term to define. Simply, it can be defined as the experience of health, happiness, and prosperity. Here we see that beyond physical vitality, well-being includes other intangible components such as social ones, personal accomplishments and personal fulfilment. Forests are spaces in which human beings can achieve these. Of course, they are not the only spaces in which this can be done, but the millennia long human heritage spent living in forests eases and enhances the way we naturally respond to the conditions in and of forests and that activities and tasks within forests can deliver these well-being benefits to us.

Amenity Consumption and 'Being' in the Forest

Forests can be beautiful. Or not. But increasingly, all nature is becoming an amenity these days. We like to be out in the woods. Being in a forest can provoke feelings of awe, of wonder, of admiration. Increasingly, being out in the forest to enjoy the other benefits – health and well-being, etc. – is seen as being an act of consumption. We consume these amenities because we go where they are, spending time, effort and money, and do not go somewhere else.

And this brings us to the pivot of what we might call the 'Social Economy' of Forests and Woodlands. Because of so many reasons why it is good for human bodies, minds and souls to be actually 'out' in the forest, there are strong motivations for us to spend time, attention and money to get there. All of the above points, and others as well, drive the consumption of forests and trees not by commercial professionals but by ordinary people who want to enjoy those benefits. This is the basis of the Social Economy of Trees and Forests. **Click here for animation**

Such an economy provides jobs in fields such as tour leadership: provision of tourism services, including facilities for play or to stay; professional social activities such as group bonding or corporate retreats, and of course, education which uses the forest as a classroom.

The social value of forest also extends beyond its economic or financial value. Local forests are often icons of local identity. Whether as places to play and recreate, or as places with historical and cultural value, people like to live near forests. A UK study in 2004 demonstrated that whilst it was difficult to put a monetary value on living close to a forest, respondents certainly asserted that there would be a loss if a forest within 500 m of their house was cut down and removed (Slee et al 2004). It is hard to say why they were so concerned, but it seems likely that the loss of the particular woodland would lead to a loss of the amenity values it provides. People like having forests nearby and value their presence beyond any productive value that the forest creates. Further, that affection for forests can generate political action when such forests are threatened.

As we talk about the biodiversity value of forests, we also have to acknowledge two key aspects: one is the value of the ecosystems services they generate (see Chapter ….); and the other is the opportunities forests offer for humans to experience and encounter other species, be they plant or animal. Given that, for the majority of our existence, we humans have lived much closer to the natural world than we do now, the second forms part of the affection that woodlands generate and could be said to be a cultural value of forests.

A last point to make is that forests have value to us regardless of whether they are valuable as production forests. In fact, monoculture plantation forests may have less social value than what we might call 'scrub forests' – that is, forests which are not mature, forest which do not feature magnificent examples of mature trees, or forests which are in the middle of natural regeneration. Regardless of the 'scrubby-ness' of forest, people still value them for play, recreation and even walking their dogs. We must be careful but still look beyond the values of professional silviculturists who emphasize managed productive forestry as the epitome of high value forests. To people, all forests have the potential to be loved, to be used extensively, and to be highly valued by local communities.

8 RECREATION

To begin with the topic of recreation, we must realize that this category contains within it a wide range of activities. Generally, when we think of recreation in forests we think of walking, hiking, mountain biking, camping and other physical pursuits. These also include organized activities such as Geocaching, Scouting and other group activities, horse-riding (both amateur and competitive) and group walking. Unorganized activities can include berry-picking, mushrooming, bicycle- and motorbiking, four-wheel driving, and the seeking of amenity experiences (walking in the forest to a viewpoint, for example, where the forest walk has as much value as the endpoint). Other, less active recreation in forests can include meditating, picnicking, resting, swimming where appropriate, gathering in groups around a fire, and other direct experiences of the forest.

In 2013, for the first time in human history over 50% of people in Europe lived in cities. Urban life increasingly reduces peoples' ability to experience forests and other natural environments, leading to a deficit in accessing those natural environmental benefits provided by environments like forests. As a result, the value of forests of human recreation has been growing considerably over the last decades. This can lead to conflicts between the use of forests as production environments and as ones for recreation. Intelligent, careful design and management of both types of forest uses, however, can reduce such conflicts. Knowledge of this is currently growing significantly.

9 IDENTITY

Across the range of ages, forests can provide important identity resources at both the individual and societal level. Just think of children playing in a forest. Being natural and in many cases, relatively unmanaged, forests offer valuable spaces for children to play in, stimulating both bodies and imaginations and becoming a core part of their personal identities through imagination, the learning of key skills, and the experience of unique situations. As we can observe from European lore, forests have always – for good and for bad - been a focus of human stories, not the least with children making up their own stories in/from the woodlands.

As we grow up, we may engage with forests through both recreation and employment. In both cases, people build identities out of the things they do. Age is no barrier to experiencing the benefits of being in forests – an example can be found in Scotland where groups of elder persons recovering from medical procedures are prescribed ‘forest walking’ in their recovery and they report it very enjoyable and successful (Evans & Franklin 2007).

Further, engaging in activities in a forest stimulates the creation of stories and those stories can form part of our personal identities, whether as children or adults. Things that go on in forests, therefore, can become a set of stories that shape how we see the forests, and how we see the societies we build around them. Whether positive or negative, forest stories help define places and the people whos lives are touched by them. Each time we go into the forest, we have the potential of creating a new story which influences the identities of the people and places associated with those forest spaces.

10 HEALTH AND WELL-BEING

Whether experiencing the restful feelings created by being quiet in a forest, or the physical health benefits of physical activity in one, the very act of our presence in a forest delivers important health and well-being benefits for people. To begin with the physical benefits, we must start with the increasing levels of inactivity and the poor health consequences that increasingly dominate the ever more technologized, fast-paced urban lifestyles. Such a sedentary lifestyle has been associated with the increase of poor health, and typical outcomes such as diabetes, illness of the heart and lungs, and obesity. Physical activity has been proved to be a direct counter to these conditions. As the advertising logo of a prominent sports shoe manufacturer proclaims, “Just do it!”. And forest environments are a great place to ‘do it’, whether “it” is simply walking, running, cycling, or other, more strenuous physical activities. Not only do they provide a green, calming environment for doing it, but they provide rich, oxygen-packed air to breath, soft forest floors to run on, and a wide variety of views, vistas and environments to experience whilst engaging in physical activities.

Well-being is a difficult term to define. Simply, it can be defined as the experience of health, happiness, and prosperity. This is somewhat too simple, however, and more detailed definitions can be summarized by the following: "Wellness refers to diverse and interconnected dimensions of physical, mental, and social well-being that extend beyond the traditional definition of health. It includes choices and activities aimed at achieving physical vitality, mental alacrity, social satisfaction, a sense of accomplishment, and personal fulfillment” (Naci & Ioannidis 2015). Here we see that beyond physical vitality, other intangible components of well-being include social ones, personal accomplishments and personal fulfillment. Forests are spaces in which human beings can achieve these. Of course, they are not the only spaces in which this can be done, but the millennia long human heritage spent living in forests eases and enhances the way we naturally respond to the conditions in and of forests and that activities and tasks within forests can deliver these well-being benefits to us.

11 AMENITY CONSUMPTION AND ‘BEING’ IN THE FOREST

Forests can be beautiful. Or not. But increasingly, all nature is becoming an amenity these days. We like to be out in the woods. Being in a forest can provoke feelings of awe, of wonder, of admiration. Increasingly, being out in the forest to enjoy the other benefits – health and well-being, etc. – is seen as being an act of consumption. We consume these amenities because we go where they are, spending time, effort and money, and do not go somewhere else. And, in contemporary times, consumption is a rapidly growing part of the economy as people pay for the opportunity to experience these things.

This phenomenon has been captured by Pine and Gilmore in what they call ‘The Experience Economy’ (1999). In a world of globalized consumption, where so much is the same, regardless of where it is located, there has grown a demand for things and experiences which are unique. Whilst ‘consumption’ is not new, nor is the consumption of forest spaces by being in them, it has grown as an activity which generates greater economic rewards. Further, whereas we once used to want to experience what everyone else does, now the desire to have unique experiences is growing considerably. Wherever large producers compete, price becomes the key aspect which separates one product or experience from another. In such a setting, those products and services which are unique and unobtainable elsewhere gain a higher value. This has always been the case in fashion clothing – people are willing to pay more for a tailored outfit from a couturier, for example, than from a mass market shop. And people are willing to pay more for a meal from a Michelin starred restaurant than from a fast food chain. In the Experience Economy, people are willing to pay for direct experiences that they cannot have or find elsewhere. A good example is coffee: the raw beans are worth very little per gram. Roasted and ground they are worth more. Made into a cup of coffee they are worth even more. And the recent phenomenon of Starbucks, for example, is able to charge even more because what they sell is not coffee, but the Starbucks experience. If you go to Starbucks website, you will see that it is the story and experience that they emphasize – not the black liquid.

Similarly, rural places which once suffered from isolation and a lack of interest, may now become higher-valued destinations if they can be seen to offer experiences which cannot be had elsewhere. And while it is often the landscape or rural culture which lies at the heart of this draw, it is actually the experience which people can have in these landscapes or cultures which really draws their attention. And as a result, people are willing to pay more for such experiences. This can be observed in the tourism sectors of outdoor recreation and adventure tourism, which are usually considered to be the fastest growing sectors of the tourism economy.

Coming back to forests, certain forests offer those who actually spend time in them unique and special experiences. Whether simple walking in a forest (or 'forest bathing' as it is sometimes called - Ulrich 1984) or more active pursuits such as mountain biking, ziplining, or camping and trekking, we can see forests as a stage upon which people enact their pursuits, creating unique, individual and temporal experiences that they will never forget. Indeed, Pine & Gilmore's famous motto applies here – "The best things in life are not things." They are experiences. These experiences are individual – we all have different experiences – and they are ephemeral, like theatre or live music – they are created in the moment and cannot be recreated exactly again. They therefore become memories or stories. And this is what those who pay for something in the experience economy place the value upon. And forest experiences encompass a wide range of activities from adventure tourism, to experiencing cultural heritage and history in a forest, to simply 'being' in a forest.

This leads us to consider what we might term the 'social economy of forests': Forests and trees do not merely generate an economy when we cut them down and use the timber or fiber for manufacturing or burning. They also generate vast economic activities related to this Experience Economy. And indeed, people use forests for social purposes other than outdoor recreation. Forests are associated with contributing to increased health and wellbeing. Forests are places in which communities come together to accomplish shared objectives. And forests are places in which education can happen – from outdoor kindergartens, through learning about science and ecology, to their use to help rehabilitate individuals who are at risk of falling from society. All these types of activities happen in forests, and there are often financial transactions associated with them. This is something we see, for example, in Scotland, where 'Community Woodlands' generate economy activity and jobs through the creation of forest classrooms and the delivery of woodland experiences to clients of the justice system (Evans, 2001).

So, there are Social Benefits of Forestry, and these benefits can deliver significant economic impacts on local areas. Even at a wider economy scale, arguments can be made that the economic activity generated by these social activities are greater than those generated by traditional forestry. This is very hard to pinpoint in exact figures, but it certainly can be seen in the number of jobs created. As argued in the section on Forest Economy, mainstream forestry requires efficiencies which result in investment in machine labour over human labour. In the social economy of forests, it is people who deliver the experiences. In Scotland, for example, a 2009 report by the Forestry Commission Scotland asserts that Scotland's forests produced 10,300 FTEs (Full Time Equivalent jobs) in direct employment from timber sales and 17,900 FTE jobs from tourism and recreation attributable to woodland, where woodland was the primary reason for the visit (FCS 2009). Further, the activities associated with woodland tourism are, in general growing. For example, a study of a Community Woodland in the Loch Ness region of Scotland claims that there were no Bed and Breakfast offerings within 10 kms of the woodland in 2000, but that in 2009 there were now 42 BnBs and a business that solely functions as a booking agent for BnBs (FCS 2009). Whilst all might not be directly attributable to the existence of the Community Woodland, some will be, and the others can be indirectly attributed to its creation.

Further, within the EU there has been considerable moderation of the agricultural subsidies to support, first agro-tourism, and later, agro-forestry. It is not inconceivable that these two could be combined to offer new non-wood production sources of income to small scale farms and woodlots. Thus, the EU has recognized the value of forests in rural places as a key source of both economic and more generally, human social activities in their widest sense.

The social value of forest also extends beyond its economic or financial value. Local forests are often icons of local identity. Whether as places to play and recreate, or as places with historical and cultural value, people like to live near forests. A UK study in 2004 demonstrated that whilst it was difficult to put a monetary value on living close to a forest, respondents certainly asserted that there would be a loss if a forest within 500 m of their house was cut down and removed (Slee et al 2004). It is hard to say why they were so concerned, but it seems likely that the loss of the particular woodland would lead to a loss of the amenity values it provides. People like having forests nearby and value their presence beyond any productive value that the forest creates. Further, that affection for forests can generate political action when such forests are threatened.

As we talk about the biodiversity value of forests, we also have to acknowledge two key aspects: one is the value of the ecosystems services they generate (see Chapter ….); and the other is the opportunities forests offer for humans to experience and encounter other species, be they plant or animal. Given that, for the majority of our existence, we humans have lived much closer to the natural world than we do now, the second forms part of the affection that woodlands generate and could be said to be a cultural value of forests.

A last point to make is that forests have value to us regardless of whether they are valuable as production forests. In fact, monoculture plantation forests may have less social value than what we might call ‘scrub forests’ – that is, forests which are not mature, forest which do not feature magnificent examples of mature trees, or forests which are in the middle of natural regeneration. Regardless of the ‘scrubby-ness’ of forest, people still value them for play, recreation and even walking their dogs. We must be careful but still look beyond the values of professional silviculturists who emphasize managed productive forestry as the epitome of high value forests. To people, all forests have the potential to be loved, to be used extensively, and to be highly valued by local communities.

Forests and the circular economy.

A major characteristic of forests and forestry – not differing much from other types of agricultural and primary level production -- is the observable circularity. A forest is planted, it grows and matures, then can be cut down to give room for a new generation of forest to emerge, occupying the same area and being of same qualities as the former forest. Thus, forestry as a rule is a cyclical, continuing activity over large stretches of time. The forest may not grow very fast, a rotation may take 100-150 years, but what will come forward in the next rotation is in principle as it was in the first.

This, in principle, **holds just as true** whether the forest is logged (production forest) or left to itself (pristine or natural forest). The main difference is that in a logged forest, larger areas are ‘behaving’ in the same way at the same time (think plantation forest), while in an untouched forest, the trees generally will go out of and come in to the ecosystem at individual frequencies – if there are no outside disturbances (like a large windfall or, indeed, a fire).

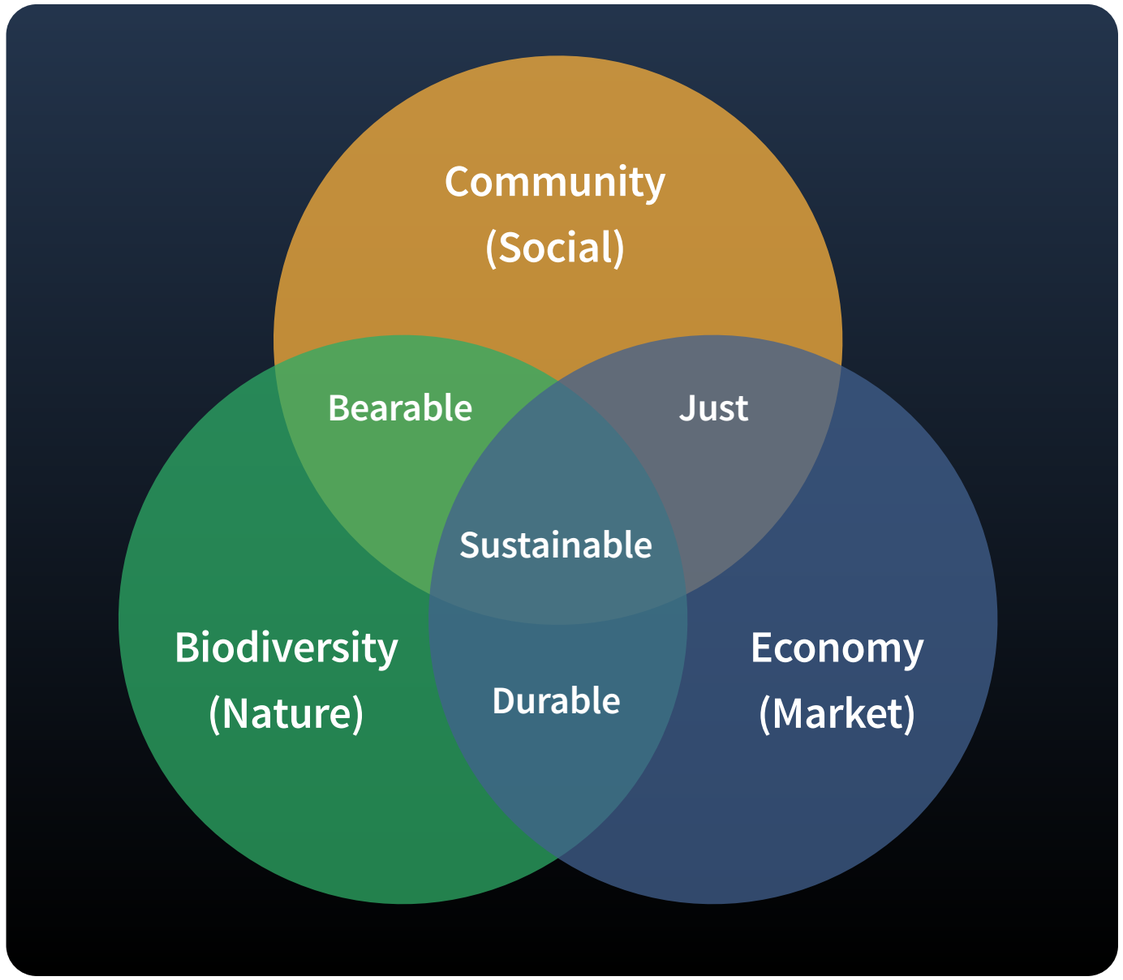
The cyclical element is (as with other types of primary production) doubtless present. But is this cyclical element -- the fact that a forest has the innate ability to keep regenerating herself without deteriorating, ensuring that a forest – or any form of agricultural or primary production, is also what we today would label as an element of a circular economy?

To understand this, we need to look briefly into what is and what constitutes a circular economy.

12 CIRCULAR ECONOMY – A SIMPLE DEFINITION

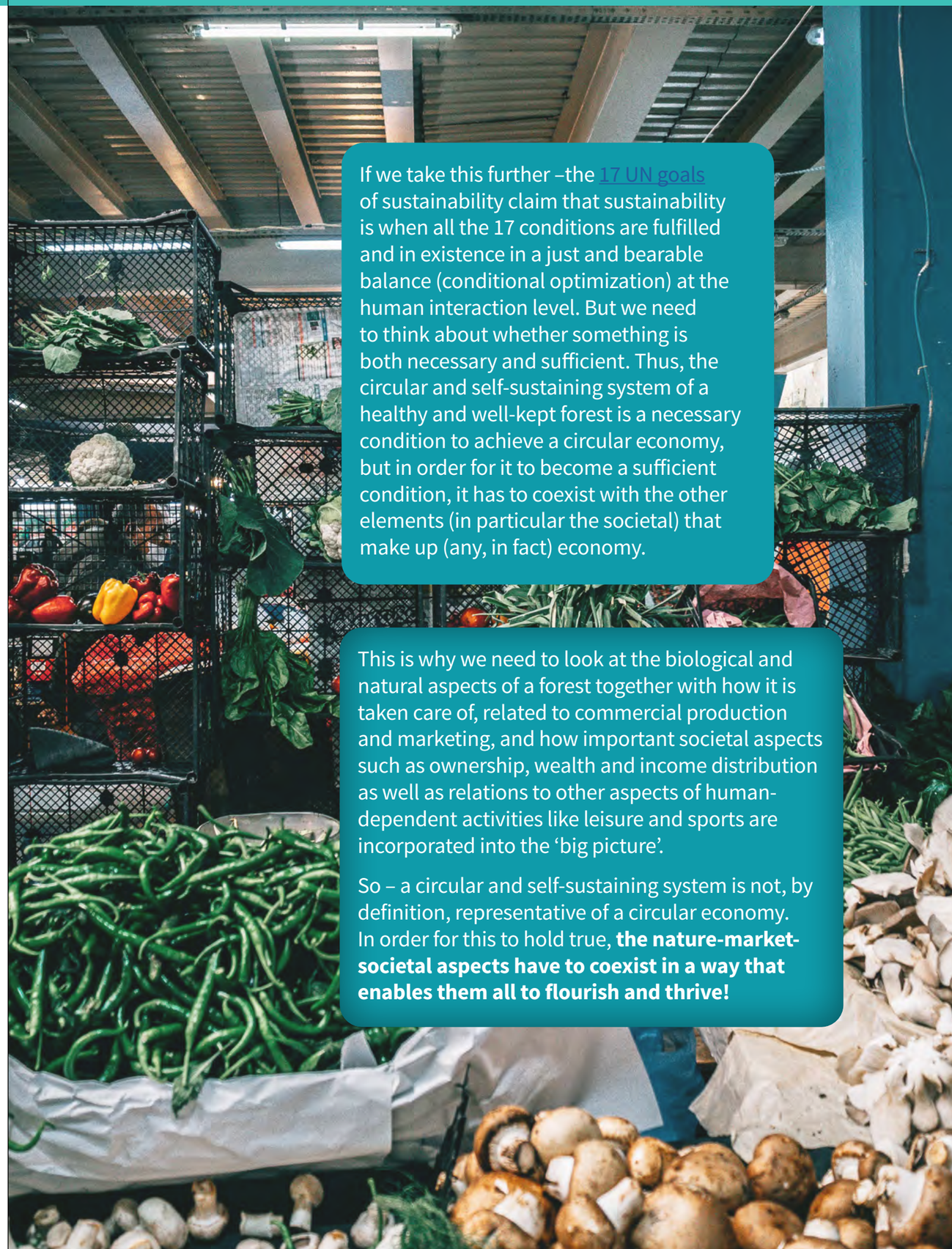
Several definitions of the circular economy are in use today. Common for most of them is a focus on the ideal of reducing towards zero the need to extract from, or to introduce new elements into the economy. This is about keeping it functioning by itself in a non-degenerating state without consuming its basis for production. “A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems”. Largely, a well-kept forest will hold up well to such criteria.

What we need to take into consideration is that ‘an economy’ is something more than a biological process alone. It is a comprehensive system, dependent upon human activities, affected by how the economy is able to respond to societal relations. “A circular economy” is still a system where the interplay between biological/natural elements and economic factors are valuated through a lens of human interpretations. This is very well depicted through the classic sustainability model; the partly overlapping circles of biodiversity (nature), economy (market) and community (social). Sustainability is the state when all three aspects are weighed upon each other, not allowing one to dominate the others.



Industrial Circular Economy

This can be illustrated through comparing an ‘industrial circular economy’ to the concept of circular economy. They both focus on reducing, reusing and recycling. But where the industrial variety mainly focus on optimizing the integration between Market and Nature, the broader circular economy concept seeks to optimize all the three dimensions. This can be exemplified by looking at a situation where scientists and experts study and come up with optimal solutions, focusing upon the technical, biological and economical processes. Still, the optimal solutions need to be implemented. This lies to society to take charge of, often done through our various typologies of representative democracies or through our acceptance through the spending of money. Generally, this results in implemented solutions differing from what were the scientific optimal solutions, because the solutions also need to be seen as acceptable for the people making up the society. While a market-nature solution will depend upon what is durable (ensures no or minimum degradation of environment) the Community dimension will assure solutions are experienced as bearable (the ratio between what you get and what you lose) and just (it feels right, in relation to socio-economic and other social- value aspects).



If we take this further –the 17 UN goals of sustainability claim that sustainability is when all the 17 conditions are fulfilled and in existence in a just and bearable balance (conditional optimization) at the human interaction level. But we need to think about whether something is both necessary and sufficient. Thus, the circular and self-sustaining system of a healthy and well-kept forest is a necessary condition to achieve a circular economy, but in order for it to become a sufficient condition, it has to coexist with the other elements (in particular the societal) that make up (any, in fact) economy.

This is why we need to look at the biological and natural aspects of a forest together with how it is taken care of, related to commercial production and marketing, and how important societal aspects such as ownership, wealth and income distribution as well as relations to other aspects of human-dependent activities like leisure and sports are incorporated into the ‘big picture’.

So – a circular and self-sustaining system is not, by definition, representative of a circular economy. In order for this to hold true, **the nature-market-societal aspects have to coexist in a way that enables them all to flourish and thrive!**

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03.

Community

1 FOREST AND HUMAN LIFE

The environment includes all the natural and human-made elements and phenomena that act in a very close interdependence and ensure life on Earth. The natural elements have a well-defined role in the functioning of ecosystems, influencing ecological balance and, by extension, human life and human societies. Forest is one of the components of nature that forms an ecosystem itself that supports the life of an impressive number of plant and animal species.

Historical perspective

Living in close connection with the environment and all that it offers, the human being had a direct and special relationship with the forest throughout its evolution: from the first moments of anthropogenesis to the present day. Human life has been sustained and influenced by the existence of the forest as a space and the products provided by the forest (forestry and non-forestry alike), but it has also influenced, sometimes decisively, the existence of the forest ecosystem. Human-forest history reflects not only the evolution of knowledge and technology, but also the awareness of humans concerning nature and the role that humans play within the planet.

An artist's impression of an ancient human in his habitat

Source: *Chuang Zhao/PA*

Thus, the turning points in human evolution – such as the emergence of agriculture and animal husbandry (aprox. 8000 B.P - *Before Present*), the industrial revolution (late eighteenth - early nineteenth century), the technological and knowledge revolution (second half of the twentieth century) – decisively influenced the human-forest relationship: from a simple beneficiary of forest products with a very limited horizon of knowledge, in the period before the emergence of agriculture, to the ecologist concerned about the fate of the forest and each component of the forest ecosystem today.

46000 B.P.

Aprox. 12000 B.P.

Aprox. 6000 B.P.

Aprox. 10000 B.P.

Aprox. 3000 B.P.

Starting with 2800 B.P.

IIIrd – XIIIth century

Aprox. 2000 B.P. (Ist century)

950-1250

Starting with Xth century

XIVth century

1250-1850

XVth-XVIth century

XVIIth century

First half of XIXth century

XVIIIth century

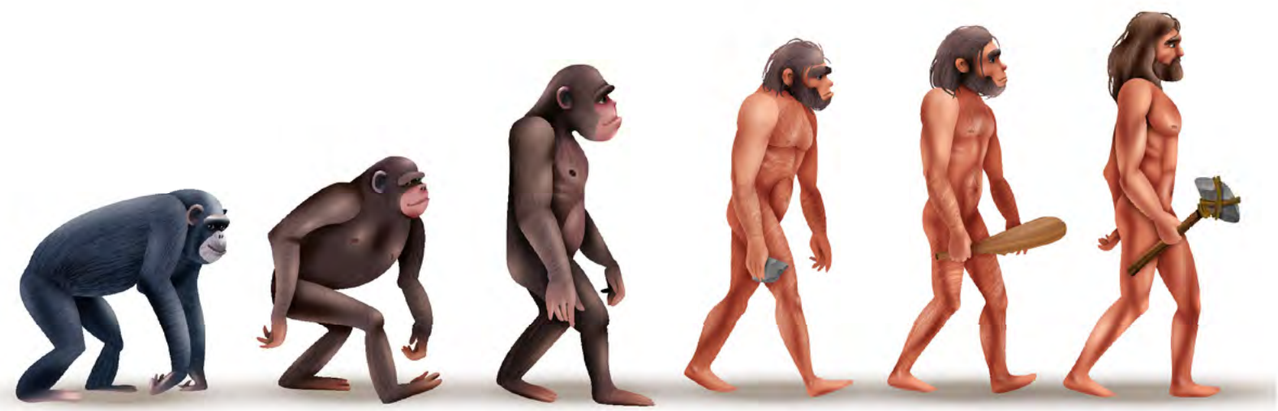
Second half of XIXth century

First half of XXth century

XXI century

Second half of XXth century

Click on the timeline beside to read more information.



At the beginning of humanity, in the period of evolution from the first anthropoids to homo sapiens sapiens (as it is today), human life took place in a total dependence on nature, on what it offered. Before human being became sedentary and practiced agriculture and animal husbandry, his only "occupations" were survival (food and safety) and perpetuation of species. It is the period in which daily activities were represented by gathering and hunting, so that human life – essentially satisfying food needs – took place according to the "supply" of nature, without any control over it.

Thus, human being began to capitalize on what the forest offered him, making life easier. The forest provided man with food and shelter: meat from hunting, berries, mushrooms and various plants, edible roots and seeds, wood for tools/weapons/shelters and as material for fire. Nevertheless, archaeological evidence shows that humans were using fire not only for heating or protecting from animals, but very often as a tool for improving mobility and opportunities for foraging and big-game hunting.

The transition of human beings from gatherer-hunter to farmer happened gradually, so the direct consequence was changing the natural landscape in the Neolithic (New Stone Age): human settlements, land cultivation and grazing livestock. The agriculture practiced by Neolithic civilizations was a primitive one based on obtaining agricultural land by slash and burn clearings. The land was, therefore, cleaned, sown, harvested and, after one or two seasons, abandoned. Then, another area was cleared and cultivated and so on. This phenomenon had multiple consequences:

✓ transition from a nomadic to a sedentary life

✓ deforestation to transform forest into arable land

✓ first form of nature control; however, this did not mean any idea of land planning and/or a long-term strategy regarding harvesting agricultural/forestry products

✓ decreasing the land area necessary for feeding one person

✓ population growth (from 6-8 million in the sixth millennium BC to 250 million in the last part of the first millennium BC)

Archaeological evidences show the image of sedentary, stable communities, which carried out intense economic activities and intensively used forests and its resources. A typical settlement in Central Europe consisted of 6 households with about 30 people. For daily living, specialists estimated that it was necessary not less than 6 km^2 (20ha/person), including: settlement (constructions, gardens), arable land, natural meadows or pastures (most likely from deforestationor forest outskirts), forest (wood for fire and construction, fruits, hunt...). The effects of deforestation were reflected as follows:

✓ changing the natural landscape

✓ soil erosion

✓ reduction of forest-specific fauna

✓ increasing the frequency of fires in forests

✓ increasing the number of invasive species (weeds)

✓ the selective use of plants by humans and domestic animals led to a change in the distribution of species in forests

If at first the large areas covered by forests were cleared up with the help of stone axes, the discovery of bronze metallurgy and then the generalization of iron tools eased the human burden, but did not radically change the process or the pace of deforestation.

The development of the classical civilizations, Greek and Roman, determined demographic growth, urbanization, trade development within the Mediterranean basin, general uses of tools, weapons and ornaments processed from metals, etc. All this were directly reflected on the forest, either for arable land and pastures or to use wood for:

✓ constructions (houses, roads and bridges, furniture, ships, military buildings etc.)

✓ fuel for household and public bathrooms or melting metals (both wood as such and charcoal)

Artisans mounting shingles (Northern Romania; 1979)

Source: Ioniță G. Andron, Colecția Muzeului Județean Satu Mare

In fact, in the first centuries of the first millennium large areas form the Mediterranean basin are deforested. This phenomenon, started since the Stone Age, is perfected by the Roman empire. An interesting case is the oak forests on the island of Cyprus. Alexander the Great established here the naval base for the construction of ships from long, straight oak timber, causing the disappearance of these forests.

House under construction (southern Romania; approx.1910-1920)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Clișee sticlă. Cotă: CS-0438

It is important to notice that for the first-time people are aware of the impact of their actions on nature. Greek and Roman civilization not only validatesarchaeological data through written information, but offers a literary perspective on the human-forest relationship. Most of the classical writers, from Homer to Strabo and Plinius, noted not only the vast territories covered by forests, but also the changes in the landscape under human actions: "[mountains] at the present time they have been brought by the toil of man into cultivation, though in former times they were thickly covered with a wild and untrodden forest of large trees [...]".

The breadth of this Hercynian Forest..., is to a quick traveller, a journey of nine days. For it cannot be otherwise computed, nor are they acquainted with the measures of roads. It begins at the frontiers of the Helvetii, Nemetes, and Rauraci, and extends in a right line along the river Danube to the territories of the Daci and the Anartes; it bends thence to the left in a different direction from the river, and owing to its extent touches the confines of many nations; nor is there any person belonging to this part of Germany who says that he either has gone to the extremity of that forest, though he had advanced a journey of sixty days, or has heard in what place it begins. It is certain that many kinds of wild beast are produced in it which have not been seen in other parts.

Julius Caesar

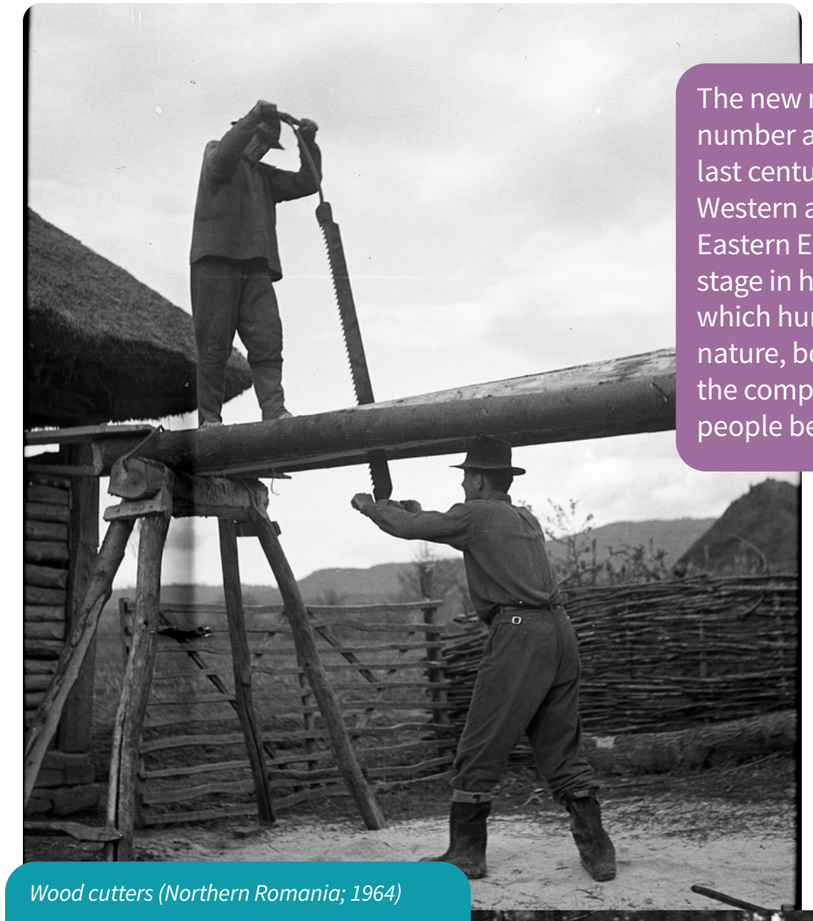
The Gallic Wars

Book VI, Chapter XXV

The decline and then the collapse of the Western Roman Empire under the pressures ofmigration flows led to population decrease, abandoning cities for villages. As a result of the restriction of human activities the forest claimed its lost territories, so the forested areas increased again. It is a turbulent period, in which migrant peoples are sweeping Europe in successive waves, and their mixture with local peoples formed today's European peoples. Called "dark age" by historians, it was a period in which the economy was reduced to agricultural-craft activities concentrated around fortresses, comfort was rudimentary and the scientific knowledge of the ancient world is forgotten. The forest became once again a shelter and an important source of food, people's lives unfolding in the rhythm of nature and in close dependence on its whims.

Vercingetorix Throws Down His Arms at the Feet of Julius Caesar

Lionel Noel Royer (1899)



Wood cutters (Northern Romania; 1964)

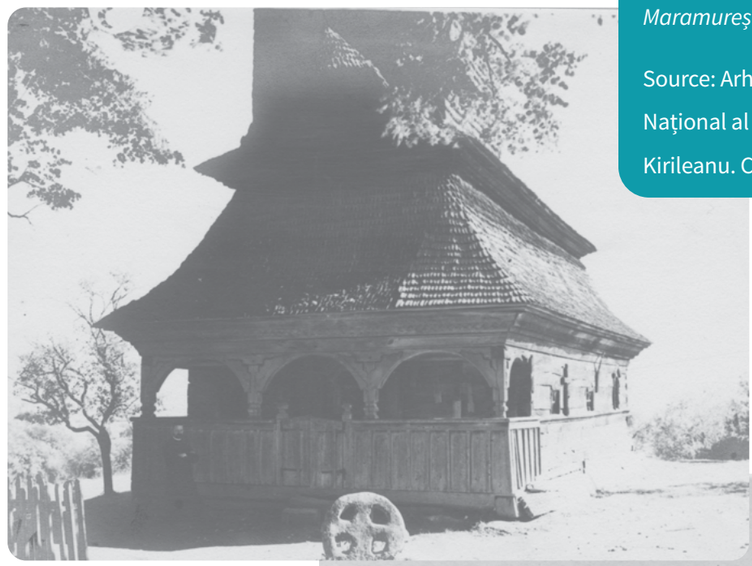
Source: Ioniță G. Andron, Colecția Muzeului Județean Satu Mare

The new medieval states and decreasing the number and intensity of invasions since the last centuries of the first millennium (first in Western and then gradually in Central and Eastern Europe) is the moment of a new stage in human relations with the forest, in which humans detachedthemselves from nature, being "outside" and "above". From the component element of nature condition, people become its "master" and "creator".

Wood cutters (Romania, Suceava county - 1962)

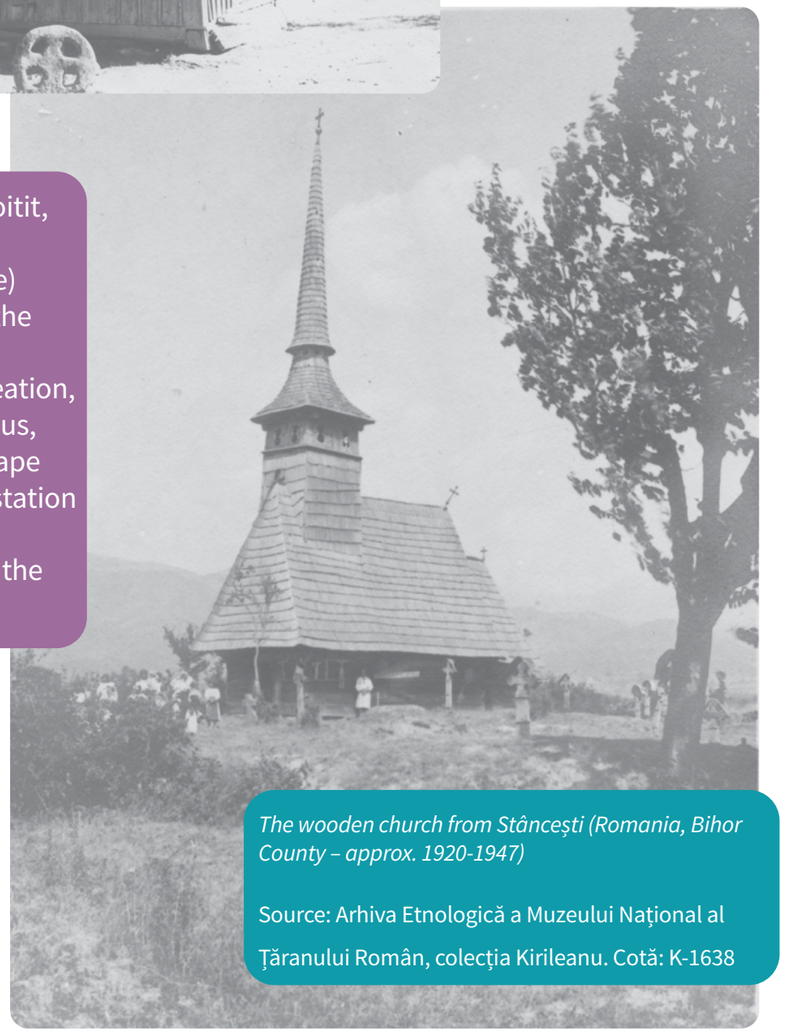
Source: Arhiva Etnologică a Muzeului Naţional al Ţăranului Român, colecţia Fototeca MAP. Cotă: FMAP-7577

The role they assume is not only to exploitit, but they seek to understand and shape nature/landscape (the forest, in this case) according to their needs. By combining the empirical knowledge obtained over the centuries with the Christian model of creation, humans assume the role of "creator". Thus, direct consequence is, again, the landscape transformation through massive deforestation and the construction of more and more numerous and larger settlements, while the population increased.



The wooden church from Buzești (Romania, Maramureș County – approx. 1920-1947)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Kirileanu. Cotă: K-1641



The wooden church from Stâncești (Romania, Bihor County – approx. 1920-1947)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Kirileanu. Cotă: K-1638

One of the important moments of the human-forest relationship in the Middle Age was the technological progress that radically improved the energy production for an increased needed production. Iron plough with a coulter to cut the soil vertically, a ploughshare to slice it horizontally and a mouldboard to turn over the resultant furrow slice, rigid collar and nailed horseshoes led to increased speed and power in preparing the land, which led to the introduction into the agricultural circuit of fertile soils, but wet and heavy, from forested areas.

Spring agricultural land preparation during Middle Age - miniature illustration from the most famous medieval manuscript called "Les Très Riches Heures du duc de Berry"

Source: Wikipedia Commons

Europe's population growth and using settlers for extending the controlled medieval state area have also changed the way people relate to the land for agriculture and the forest as a space that can be turned into arable land. The settlers were offered, along with other economic and sometimes political privileges, the opportunity to become owners of new agricultural land, which led to an intensification of deforestation. During the Middle Ages the distribution of land was extremely precise: grazing areas were deficient because arable land was more important. Thus, domestic animals - sheep, goats, pigs - were left in the forest outskirts where they fed during summer. In order to prevent overgrazing, the land owners established clear rules and harsh punishments for those who broke them. As a Norwegian proverb says, the forest was the mantle of the poor, so the survival of the growing family ultimately depended on its exploitation.

Men beating down acorns to feed their pigs - Detail of a miniature of a calendar page for November from The Queen Mary Psalter

Source: The British Library

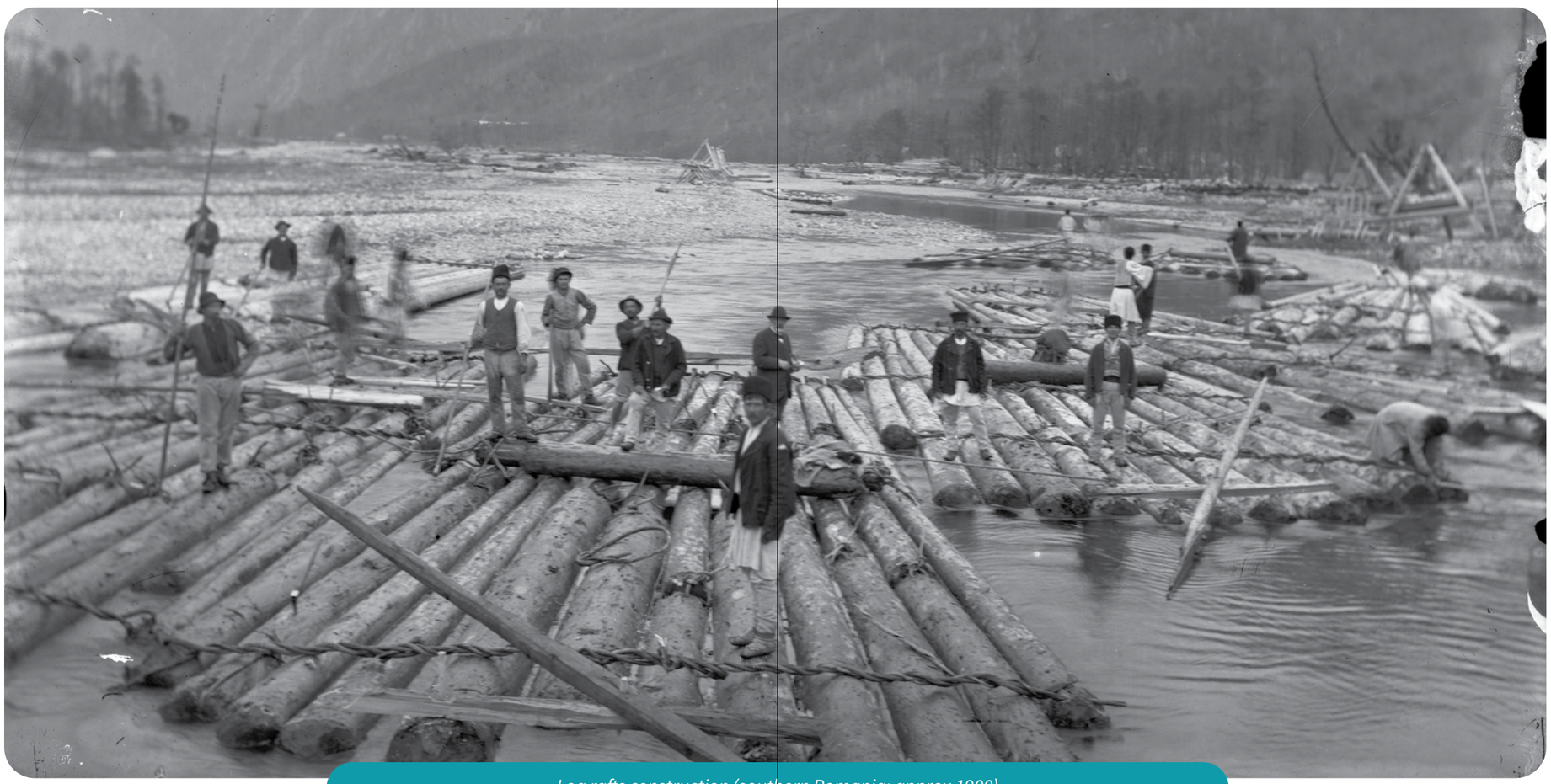
The decreasing of forested areas (which directly affected hunting), doubled by the aim for strict territorial control, led the nobility to increase legal control over forest areas, which were transformed in many cases into personal domains. Also, despite the rapid pace of deforestation, the nobility (or free peasant communities that managed forest areas) established strict rules on access to forest resources, whether it was about forest products or the transformation of the forest into arable land. These regulations prove that the exploitation of the forest was seen, in the context of the knowledge and way of life of those times, as a source of long-term benefits. Beside these, the negative demographic developments - caused by wars, famines caused by extreme weather phenomena, epidemics (Plague / Black Death in the XIVth century) temporarily caused forested areas to grow again.

Hunting (dogs killing a wild boar) - A XVIth century calendar scene from Netherlands included in medieval manuscript called The Book of Hours, use of Rome

Source: The British Library

If the innovations and technological improvements of the Middle Ages were based on the principle of learning by doing in which people observed what works best, but without really understanding why things happened, starting with the Renaissance and then with pre-modern scientific discoveries humans tried to know and understand the laws of nature. Gradually, the belief that technological progress could overcome the limitations imposed by nature prevailed both to economy and the way peoples perceived the world. The great geographical discoveries and the colonial expansion of Europe significantly contributed to this as well: as new territories were discovered and exploited offering easy access to what appeared to be an unlimited stock of natural resources, direct effects on the environment (forests, especially) became more diffuse and therefore more difficult to realize. Estimates based on historical sources as well as pollen analysis showed that between the VIII-XVIII centuries the area covered by forests in Europe had decreased from about 65-70% to only 35-40%, with a higher intensity of deforestation before 1500.

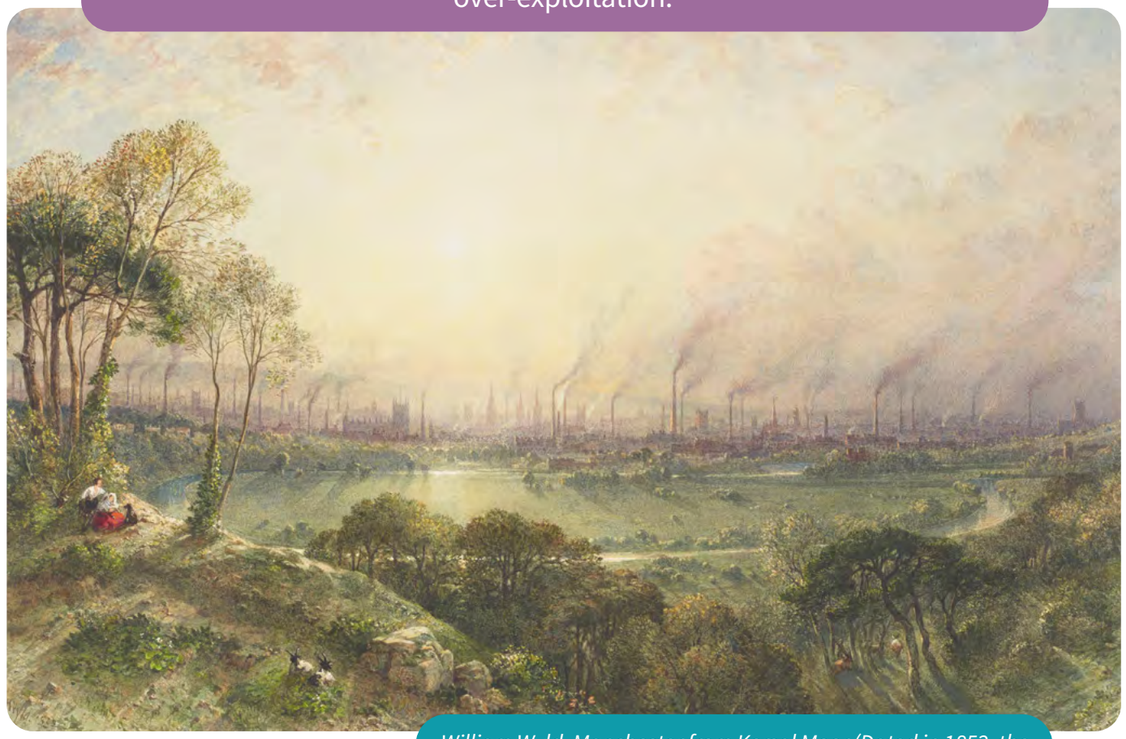
The industrial revolution, which began at the end of the XVIIIth century with the invention of the steam engine, radically changed the economic and organizational model of human society. Notions such as utility, productivity, profit, capital accumulation have governed human activities, and land (forests also) have been categorized as natural capital whose utility was given by the added value they could provide. This meant not only that they entered into a new form of exploitation, but they had to be exploited in a way that would give them the greatest possible utility and productivity (as must be done with any productive good).



Log rafts construction (southern Romania; approx.1900)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Clișee sticlă. Cotă: CS-0972

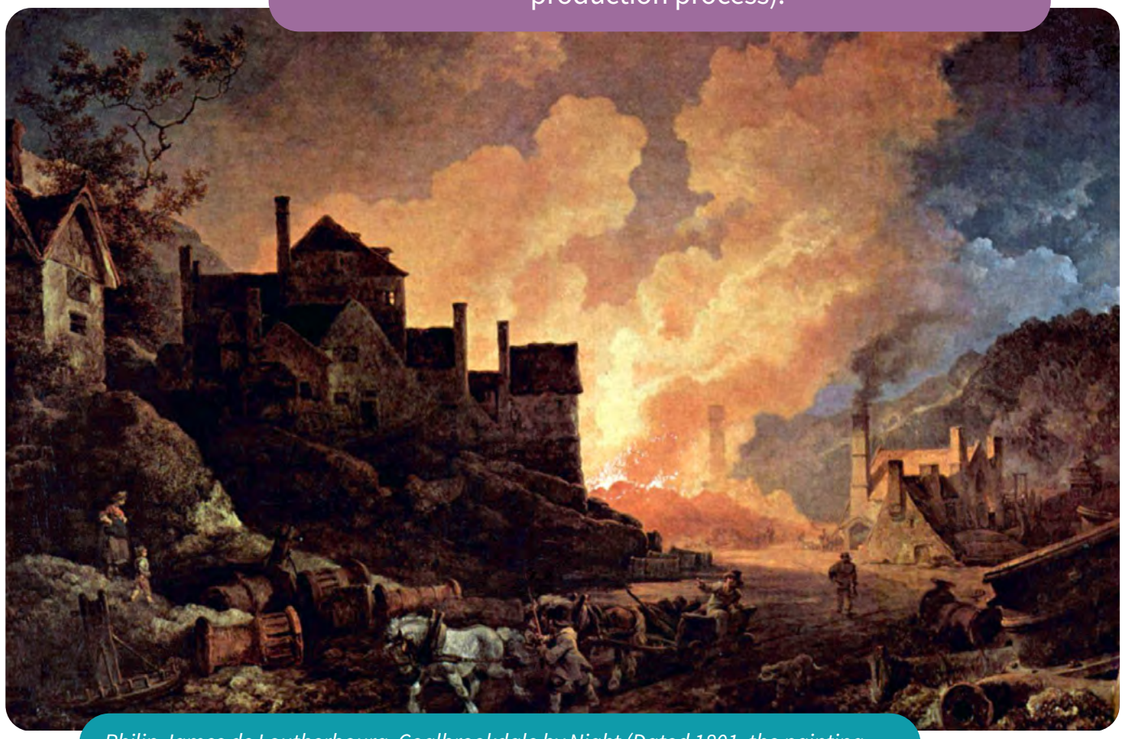
Another important moment related to the industrial revolution is the gradual transition from charcoal to coke obtained from mineral coal. The process first began in the British Isles (where the industrial revolution took place) and then gradually spread to the rest of Europe. It must be said that the transition to the use coal in metallurgical processes was largely due to economic calculations: production costs (energy price) and profit. With a growing demand for metallurgical products, the British industry was facing the high cost of charcoal, due to the low production that could be ensured by the ever-smaller forest areas. In fact, other European countries (Austria, Sweden, Russia) that continued to use charcoal as fuel until the second half of the XIXth century, imposed restrictions on exports of metallurgical products in order to protect their own national forests from over-exploitation.



William Wyld, Manchester from Kersal Moor (Dated in 1852, the painting shows the significant contrast between nature and urban, industrialised, landscape)

Source: Royal Collection Trust

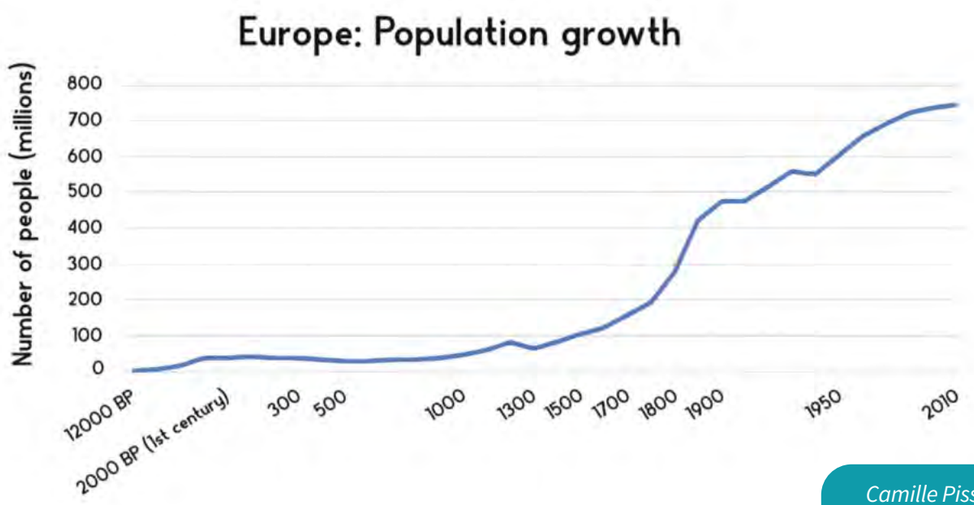
The XVIIIth and XIXth centuries also saw the spread of literacy and the newspapers. If in previous centuries the paper was obtained from a pulp consisting of rags, hemp and straw, since 1850 a new mechanical method of making wood pulp spread: boiling chipped and ground wood into special chemicals. The fact that the main innovators in the field were chemists and engineers from countries with vast forest areas (Germany, Sweden) is not surprising. However, the new technology had a direct impact on the environment: forests, but also water (necessary in the production process).



Philip James de Loutherbourg, Coalbrookdale by Night (Dated 1801, the painting depicts the Madeley Wood Furnaces, which belonged to the Coalbrookdale Company. It shows the impact of the industrial revolution activities on nature and human life)

Source: Wikipedia Commons

Scientific, technological and economic changes have contributed to increasing life expectancy and the number of populations. Urbanization, the increased need for food, the simplification of the exploitation of natural resources through increasingly efficient technologies have definitively changed the terrestrial landscape: from mostly wild to mostly anthropogenic. Nevertheless or because of it, the urbanists realised the need of a healthy urban environment which has to be planned and built not only to maximise its utility, but also to become a place of life, of physical and physical recreation. Thus, parks were developed to provide an improved image of the city (crowded, dirty, polluted) and to rebound in some way the lost connection with nature: places for relaxation. Later, the city planners designed playgrounds for children and special fields for sports, including for adults (since, gradually, the workday reduced from 12 to 10 and then to 8 hours, the need for active and healthy activities was obvious; so appeared the early mass sports).



London Hyde Park: one of the oldest and most famous public parks in the world

Hyde Park London from an 1833 map

Source: Wikipedia

▹ See more.

Camille Pissarro, Hyde Park (1890; it shows the footpath along the southern bank of The Serpentine)

Source: Wikipedia

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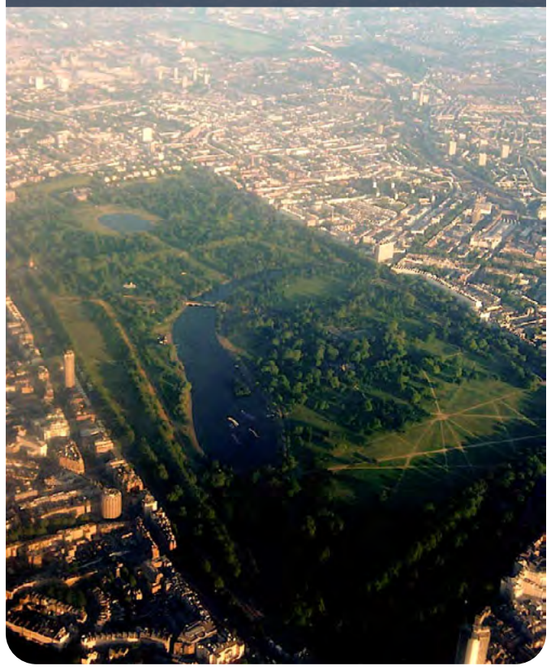
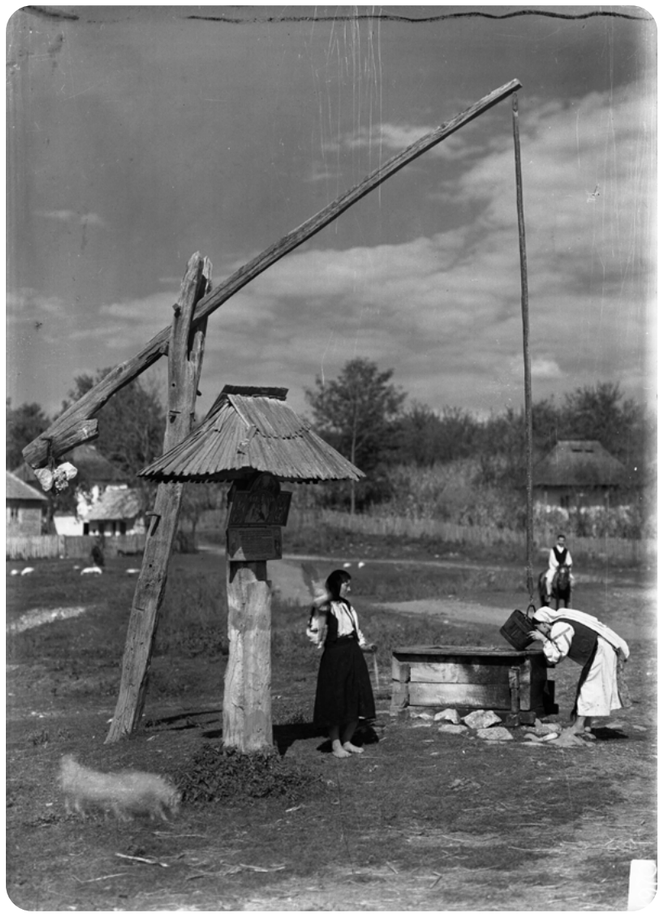


Aerial view of Hyde Park

Source: Flickr

However, in regions where wood was a cheap and easy to get resource, meaning the forests still extended on large surfaces, houses and even public buildings (churches) were built by wood. This was the case of central, eastern and northern Europe. What is most astonishing is the fact that some of them have been standing for more than hundreds of years.



Women at a fountain with shadoof (approx. 1920-1940)

Source: Arhiva Etnologică a Muzeului Naţional al Ţăranului Român, colecţia Oroveanu. Cotă: O-0261

Wooden house and deck (Romania, Bistrița Năsăud County – approx. 1955)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Fototeca MAP. Cotă: FMAP-2945

The wooden church from Rozavlea (Romania, Maramureș County – approx. 1920-1950)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Oroveanu. Cotă: O0861

Wooden cross and mill (approx. 1920-1950)

Source: Arhiva Etnologică a Muzeului Național al Tăranului Român, colecția Oroveanu. Cotă: O0271

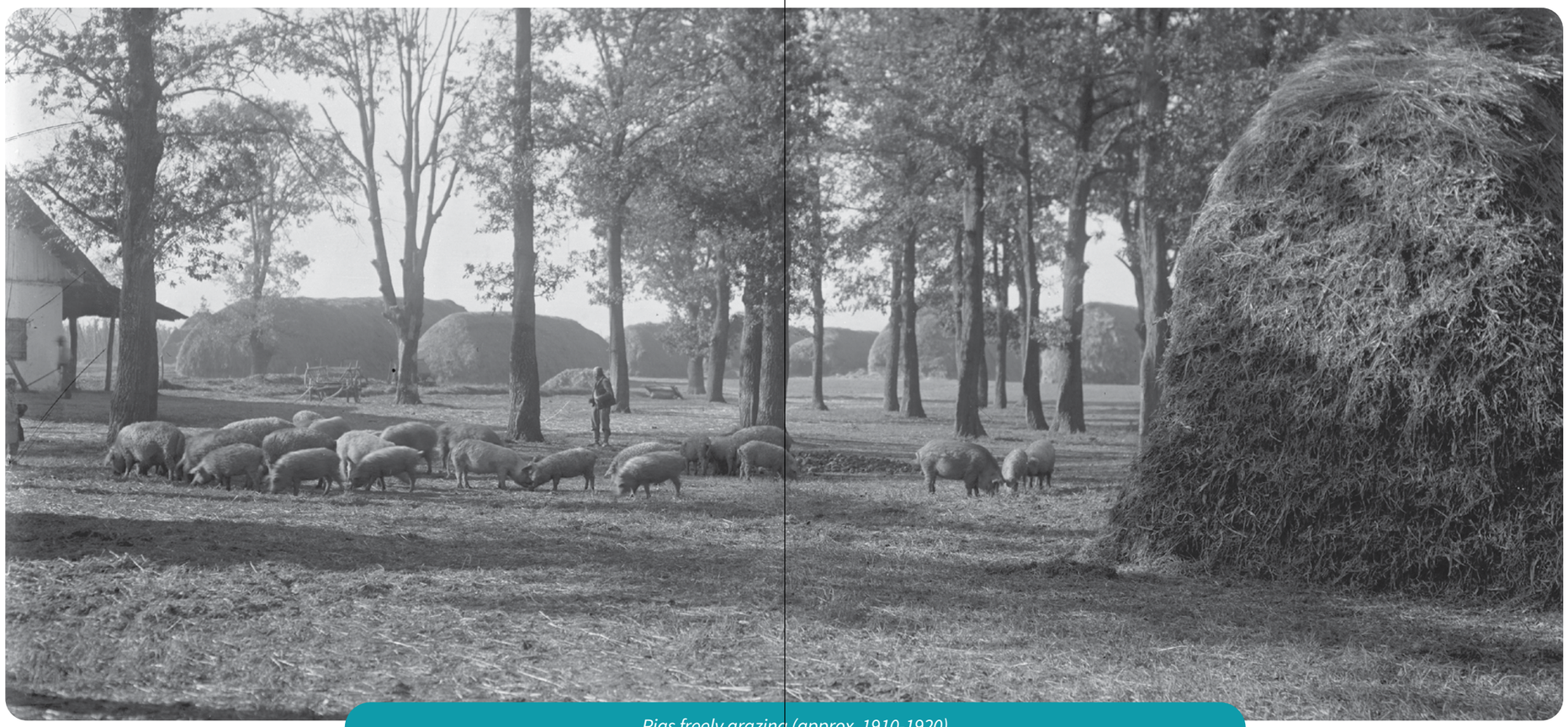
Until the middle of the XXth century, humans viewed humanity and the forest as separate spheres, without connections; the forest was the stage on which the human performed and, obviously, could shaped it according to its own will and interest. Hence the desire to improve nature, to make it more efficient by eliminating decomposition and death and, therefore, to organize and standardize it. Thus, uniform and productive plantings were made, without any other vegetation, which even it led to the growth of forested areas in Europe did not create specific ecosystems. At the same time, however, conserving biodiversity opinion has strengthened and expanded, so that secular forests were transformed into national parks or protected areas. They became "monuments" without economic value, organized like a museum where human "predators" access was restricted and supervised. Today, humanity is aware that the regenerative strength of nature is limited (with direct effects on human's well-being), that anthropogenic activities are the main cause of climate changes and natural capital (including forests) must be equated with human capital. Thus, a new integrative perspective on environment emphasises the relation between consume and deforestation: "embodied deforestation". This concept links deforestation to consumption, meaning that any product or service consumed in one part of the world has a concrete ecological impact within the geographical place where it was produced. So, people from all over the world should be aware that even if in the region/country where they live forest (environment, in general) are protected, by their consumption habits generate overexploitation of forests (or land, or other natural resources) in other regions/country from of the planet.

Non-commercial forest products

The importance of forest for humans is not limited to wood products. The forest ecosystem also includes plants and animals that provide people various products for living or even medical use, so they do not have commercial purposes. Non-commercial forest products are those products that can be obtained from forest, regardless of their origin (vegetable or animal) and which can be used exclusively for personal consumption. The main non-commercial forest products are, depending on their origin and use, the following:

- small dimensions dry wood - branches (usually for fire)
- medicinal and aromatic plants:
  - ✓ their number is very large and their distribution on the continent is not Uniform;
  - ✓ the most common are: chamomile, hawthorn, St. John's wort, valerian, horsetail, wormwood etc.
  - ✓ they can be used as such or only certain parts of them: root, bulbs, leaves, bark, seeds, flowers
- mushrooms
- fruits: berries (raspberries, blueberries, blackberries, etc.), nuts, hazelnuts, chestnuts (also called "bread of the poor"), acorns (for animal feed)
- honey
- meat from hunting: if in the past hunting was an integral part of human meals, as agricultural products became easily accessible and ownership of land, including forests, was regulated, hunting was gradually restricted; so, today it is practiced in a controlled manner, with very strict rules

The way in which these products may be harvested from forests is established today by laws and regulations. Even before the modern era and the first land regulations/laws the forest was seen as a collective asset that community members could use within certain limits. If commercial hunting and logging were strictly forbidden (in the case of nobiliarydomains) or subject to very strict rules (in the case of free communities), gathering of medicinal plants, fruits, firewood and even grazing animals were allowed for all community members.



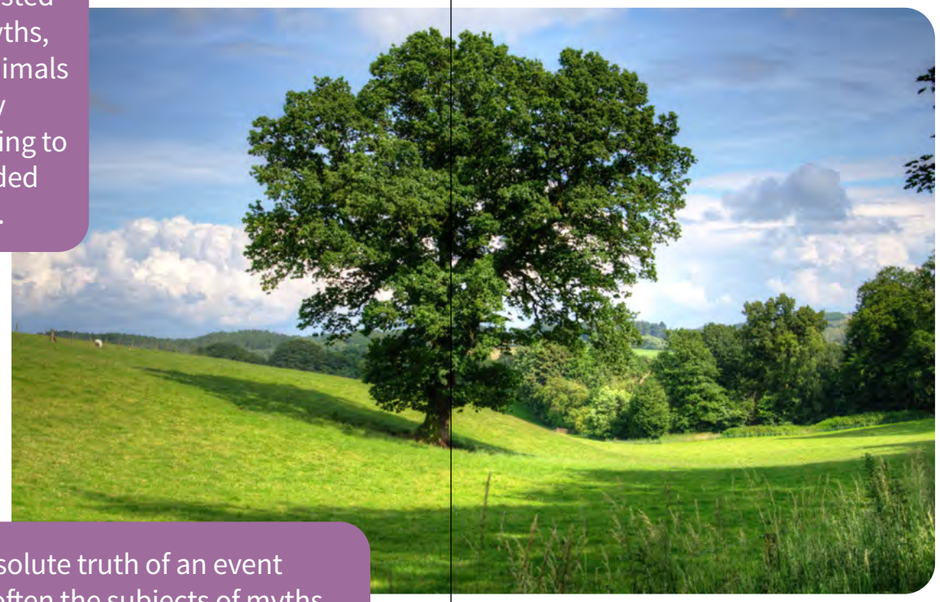
Pigs freely grazing (approx. 1910-1920)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Clișee sticlă. Cotă: CS-0252

The benefits that these products offer is closely related to human well-being and health: from the consumption of natural (unprocessed) food obtained in a sustainable way to the maintenance of health or the treatment of pre-symptomatic conditions and sometimes even diseases. Humanity's accumulated knowledge about medicinal and aromatic plants has been passed from generation to generation, being validated both by trial-and-error process repeated over times as well as through scientific researches conducted in the past two centuries.

Culture and Mythology

The relationship between people and nature also has a socio-cultural aspect, and human creations are decisively influenced by the environment in which they were created. The way of life and thinking plus the meaning that humans give to life and the world surrounding them are influenced by the environment in which they live. Due to its size, characteristics and importance for human life, the forest is one of the main elements of nature that humans have included in their cultural concerns. The forest is alive, grows, adapts, it can be open, bright and inviting or, on the contrary, closed, dark and threatening, but it is also stable, being fixed to the ground on which it grows. Since pre-historical times people have invested the forest (trees) with magical functions, created myths, legends and stories about and with forests/trees, animals and/or fantastic beings living in the forest. Also, they named settlements and geographical places according to the type of forests or the tree names which surrounded them and played an important role in their daily life.



For pre-modern people myth has the value of an absolute truth of an event that took place at the beginning of the world. Most often the subjects of myths are cosmogony (creation of the Universe) and anthropogony (appearance/ creation of human beings), appearance of plants and animals, establishment of settlements/states, extraordinary deeds of fantastic or historical characters. For pre-modern humans the myth is both real and sacred, it is a model to follow, so it is repeatable through periodic rites. By imitating the deeds of the god/hero or just talking about them, people recreate the sacred conditions of time and space in order to give meaning and value to their existence.

The forest is the vegetal image of humanity: trees of various species, ages and shapes, clear or dark areas, complete silence or a symphony of sounds, the triumph of life and the tragedy of death, all these are the equivalent of human society in any aspect of it. People were impressed by the large forest areas, the size of the trees, the diffused light on the ground due to the shrubs, the abundance of predators, so the forests were seen as a special, unknown space, inhabited by beings with fantastic powers which can influence, for better or worse, human life.

Myths and legends transmitted through popular tradition show the forest as a space of transition, a path to other worlds. Thus, the forest was a sanctuary and/or the living space of the divinity, but also a place of refuge in case of danger.

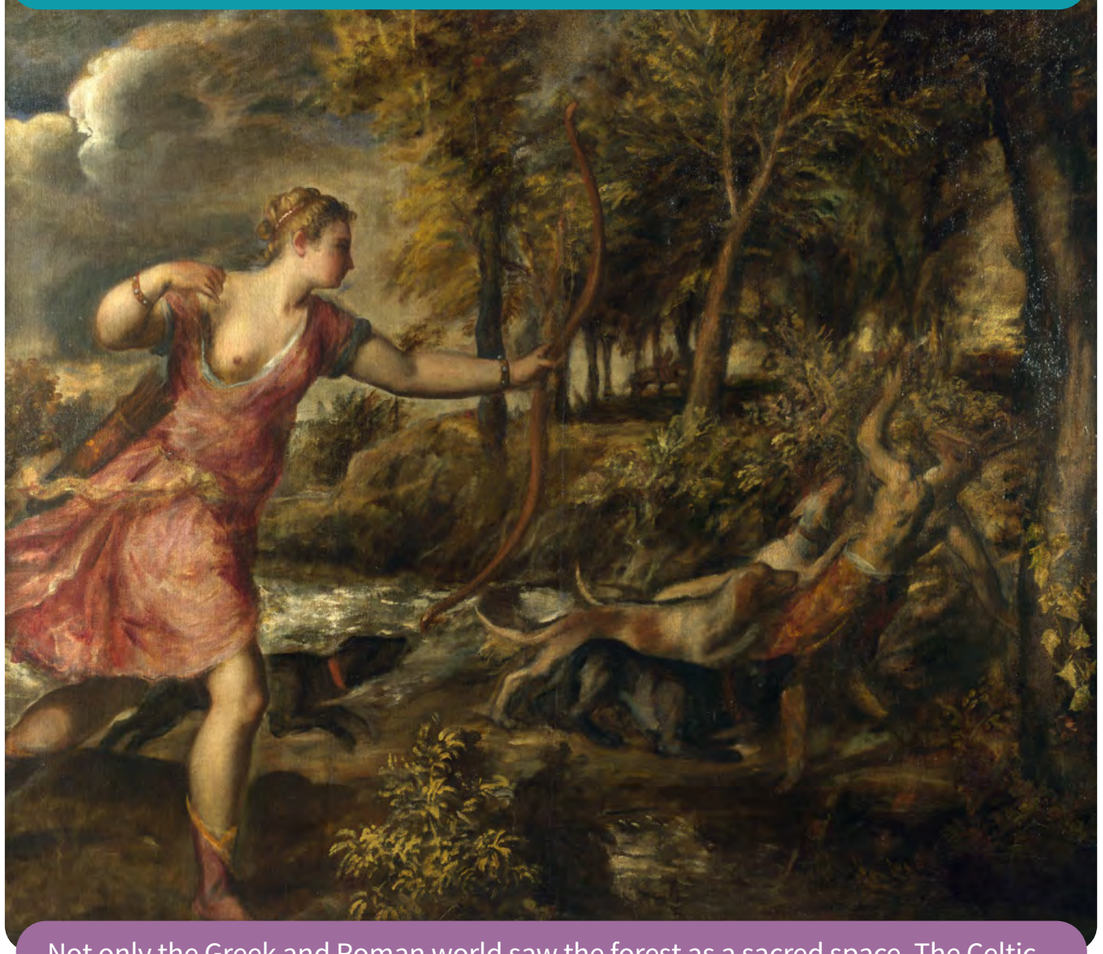
Click here for dicitionary

All versions of this myth describe the place as a valley with platanus, myrtle trees and silver fir trees, with slender cypresses and beautifully smelling flowers, so all the ingredients of power, greatness and beauty. Because he violated the sacred space Acteon is transformed into a deer and later hunted even by his friends. The conclusion is simple: the sacred space in the forest cannot be violated without the risk of a severe punishment. In fact, any economic activity in the forest was preceded in ancient societies by specific rituals which aimed to conciliate the gods/spirits.

In ancient mythology forests were dedicated to certain gods, being both the place where they received sacrifices and prayers, and the place where gods rest, thus forbidden to humans. Perhaps the best-known example is Artemis (Diana for Romans) in Greek mythology: the goddess of nature and hunting, eternally untamed, she cared for wild animals, enlivened the growth of trees, herbs and flowers, blessed marriage and birth. Her favourite place was in the woods, both for hunting and as a place to rest. The entry of a human into the sacred space, forbidden, was drastically punished, as it is reflected in the story of Acteon, the young hunter who, separated from his friends with whom he had gone hunting, accidentally arrived in a valley dedicated to Artemis.

"The Death of Actaeon" - work of Italian Renaissance painter Titian, painted in oil on canvas around mid XVIth century. It is on exhibition in the National Gallery in London.

Source: Wikipedia



Not only the Greek and Roman world saw the forest as a sacred space. The Celtic peoples, whose area of existence extended throughout Central and Western Europe, worshiped a deity, called ***Nemetona,*** and the sacred space - ***nemeton*** - was delimited inside the forest. There are numerous and evenly distributed stories of hermits and popular saints secluded in the depths of the forest who dedicated their lives to nature and fusion with divinity. The forest is also home to fantastic characters: fairies (can be good or bad), ogres, trolls, dwarfs, Muma Pădurii (in Romanian mythology or Baba Yaga in the mythology of Slavic peoples, is a witch of extreme evil, who lives in the depths of the thickest and darkest forests; she is the mother of the dragon) etc.

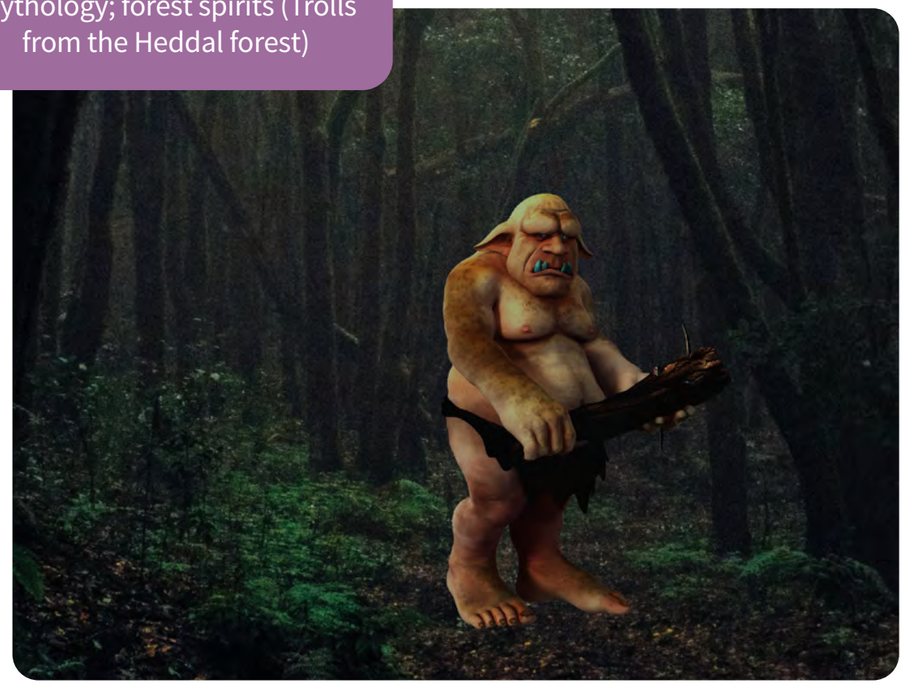
FOREST FANTASTIC CREATURES

Basajáun → specific mythological character from the Basque Country. His name means "Master of the Forest". Basajáun has human appearance, but his big, strong, hair-covered body and big beard give him a frightening appearance. The character, despite his appearance, is a positive one, his role is to protect the forest (and nature, in general)

Homem do chapéu de ferro (Iron hat man) → specific character to Portuguese mythology. He is a colossal-sized being, with a torn smile and a big iron hat on his head. He always appears under the trees, being accompanied by a black pig (a kind of native pig to the south of Portugal) or a big deer. When he is enraged, his whole body sets off flames and manages to stop the storm rays with his hands!

Forest Mother → specific character to Eastern European mythology, very common in Romanian folk mythology. She appears under different names - Muma Pădurii, Vidma Pădurii, Pădureanaetc - and in different poses: either an old woman, very ugly, or a nun with dishevelled hair, or she is a half-human, half-wooden being, or, less often, a very beautiful woman who can change her appearance. She lives in the darkest areas of the forest. Being the mistress of the forest, she takes care of the trees that she raises as her own children and she decides which and when they can be cut down or struck by lightning. She also punishes foresters or forest gatherers who break nature's rules, scares or kills the travellers who venture into the thickets of the forest, steals children from the cradle (especially the beautiful and quiet ones) and replace them with other ugly and crying children. In some areas, the character has positive qualities, being sometimes portrayed as a defender of good and defenceless ones: children, travellers lost in the woods.

Troll, Hulder, Rise → specific characters to the Scandinavian mythology; forest spirits (Trolls from the Heddal forest)



Homem das sete dentaturas (Seven Dentures Man) → specific character to Portuguese mithology. It always appears around noon, being more likely to be seen on very hot days! Deep down, this evil being may have been created to frighten children, so that they wouldn't walk on the streets in the hottest hours. Since the south of the country is an arid, dry, area where the forest has since ages given way to grain fields, it would be dangerous for children to play outside under a scorching sun and very high temperatures. So this mythological character was created due to the absence of forest.)

By its structure, the tree was the connection between the underground world (through the roots), the terrestrial world (through the trunk and low branches) and the celestial world (through the top canopy), representing both the axis of the world, to which humans referred in the desire to confer order and meaning of life, as well as the symbol of life and rebirth.

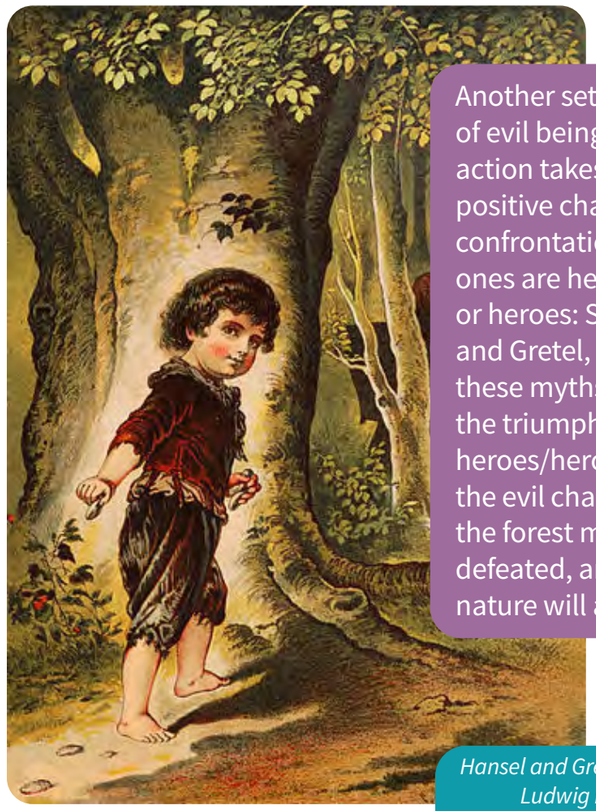
In ancient mythologies the image of the ancestor tree often appears, and one of its best-known representations is the biblical myth of the Jesse`s tree that inspired many artists over time. In the modern times, when the people lost the interest for sacredness, this symbol was transformed into genealogical tree. Also, because there is an extremely intimate connection between humans and the tree (it represents a human mirror in the plant environment), the tree is used as a symbol in psychological tests in which people reflect what is more intimate, more hidden and/or what they desire

Symbol of life and family, the tree is also representing power and greatness. For this reason, trees (especially oak, lime, olive, platanus, elm) are central element in settlements as a place of judgment or meeting of the rulers. It also symbolizes youth, knowledge and wisdom or other traits that pre-modern people knew that belonged to deities and only rarely can they be obtained by certain chosen people: demigods or heroes.

Miniature of the Tree of Jesse from The Queen Mary Psalter

Source: The British Library

Myths, transformed in the modern era into simple stories/tales, speak of trees with enchanted leaves (or fruits) that grow in "distant" lands (meaning in another world), guarded by all kinds of fantastic beings. The hero must overcome his human condition and defeat them (either by strength and physical abilities he/she possesses or by his/her special cleverness or with the help of other fantastic "good" beings) in order to obtain what is reserved only for gods. This model includes stories such as: The mighty offspring and the golden apples (a fairy tale spread from the Caucasus area to the Balkan Peninsula, including Romania), Youth without old age and life without death (Romanian fairy tale).



Hansel and Gretel by Adrian Ludwig Richter

Source: Wikipedia Commons

Another set of tales has as its subject the attempts of evil beings to harm positive characters. The action takes place in dense, dark forests, where the positive characters are sent or attracted. During the confrontation with the negative characters to good ones are helped by animals, semi-fantastic beings or heroes: Snow White, Sleeping Beauty, Hansel and Gretel, Little Red Riding Hood and so on. All these myths, legends and tales have in common the triumph of good. No matter what dangers the heroes/heroines face, how many or how powerful the evil characters are or how hostile and frightening the forest may seem at times, good cannot be defeated, and the life that generates the cycle of nature will always triumph.

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An interesting aspect represents the legends about the outlaws. They hold a special place in the popular literature, being presented as positive characters that acted on behalf of the oppressed: they punished the rich, whom they robbed when crossing through the forest, and then give their fortunes to the poor and exploited. In reality, they were people who, for various reasons - usually because they had broken the law - took shelter in the dense forests. Whether the legends have some basis in fact or not, for the poor the existence of these bands that attacked and robbed rich travellers in the forest was a form of satisfaction against the social inequalities and injustices.

The freedom, danger and mystery that characterised the lives of these people gained admiration of contemporaries such as, in time, through repetition, legends with many variations were created. Among the many legendary characters from Europe, the well-known is Robin Hood from the English Sherwood Forest, whose legend, probably, has the most numerous variants. Other similar characters are: Matthias Klostermayr (Bavarian Hiasl) in the German area, Diego Corrientes Mateos in the Iberian Peninsula, Zé do Telhado (nickname for José Teixeira da Silva Juraj) in Portugal, Jánošík in the Slovak-Polish area or Iancu Jianu in Romania.

The social character of the outlaws' actions, especially in areas that were under multinational empires' domination (centraleastern part of Europe), determined some groups of anti-Nazi or anti-communist fighters, which tried to oppose armed resistance against those totalitarian regimes, to take the name of these legendary characters: this is the case of a Romanian anti-communist partisans group from the arpathian Mountains - ***"Muscel's Outlaws" ("Haiducii Muscelului")*** - and one of Slovak antiNazi fighters who took the name of Juraj Jánošík.

Even if the modern era eliminated the sacred from everyday life, and myths and legends have lost their importance, they remain present in human consciousness through tales: authors such as ***Brothers Grimm, Charles Perrault, Petre Ispirescu, Hans Christian Andersen*** took the stories from popular folklore and passed them on through literature. So did cinematography, which took themes from mythology (including forestry) and translated them into movies.

Another important cultural aspect of the forest is the wood as material for cultural creation. It was used not only for create buildings, tools and house stuff, but these products were in the same time subject of cultural creation. Almost all the wood products were decorated with symbols from the surrounding nature (plants, birds, animals), geometric or religious symbols. Remarkable is the skill of the artisan who managed to give to the wood not only utility, but also aesthetic and cultural value.

Peasant carving a wooden gate
(Romania, Brașov County – approx. 1955)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Fototeca MAP. Cotă: FMAP-2980

The portal of The wooden church from Valea de Jos
(Romania, Bihor County – approx. 1920-1951)

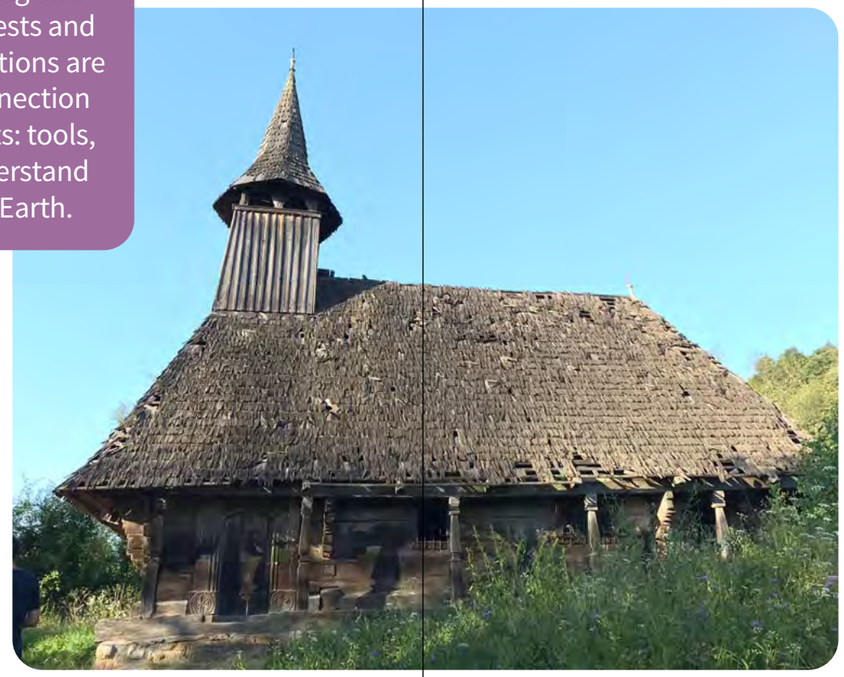
Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Kirileanu. Cotă: K-1549

The modern age has not changed the cultural relations between humans and the forest, it only adapted to the new way of thinking and knowing the world. The mythical-religious functionswere replaced by aesthetic emotion or recreational-sports functions. Today people do not see the forest as a sacred place anymore; they see it more rationally, understanding the importance it has for maintaining the ecological balance and, especially, understanding that human activities have dramatic consequences for the environment (industry, agriculture, excessive consumption, waste, etc.). But, like the pre-modern humans, they show the same sympathy for forest and enjoy the same benefits. Nowadays, most of the people have understood the importance of protecting and preserving the natural and cultural patrimony to which forests and forest products belong. Therefore, historical wood constructions are restored and given back to communities. Showing the connection human-nature, these historical buildings (or smaller objects: tools, installations etc.) play an important role for people to understand that humans are only a part in a bigger ecosystem called Earth.

WOOD CHURCH RESTORATION PROJECT

The conservation, restoration and enhancement of the cultural heritage is an essential aspect for understanding the evolution of humanity and the values on which it has been based throughout its history, and the wooden constructions need more attention and interventions due to the perishability of wood. One of the greatest initiatives that has been promoting in the past years in Romania is ”TheMonuments’ Ambulance”, a project that has been developed by the Monumentum Association in collaboration with a series of organizations active in the field of heritage.

Photo credit: Munții Carpați



One of the latest projects was implemented in Transylvania: The wooden church from Hida, Sălaj county. Built in 1717, the church, which have served the Orthodox community of the Hida village, has a simple structure on a rectangular plan oriented from West to Est: the entrance room, called pronaos, the main inner space, called naos, and the altar). The community has been a small one, so the church has only 11 m long, 5m wide and 2m high. It is made of oak placed on a stone foundation and is covered with shingles. In the last decades, the shingles have been deteriorated, the roof being drilled and allowing water infiltration, endangering the whole structure, including the murals.

ARHAIC Association, through the “The Monument`s Ambulance” project, organised a salvage work that was done during April-June 2021. The old roof was completely restored with new shingles (40 cm long and between 8 and 12 cm wide) made of softwood and mounted in 3 layers. The team was done by 13 persons: specialists, artisans and volunteers.

Humans, regardless of the level of technological development they have reached, need a story, need emotion, need nature as a source of harmony for the soul and mind. That is why urbanization included in its city plans parks, public gardens and even forest parks in the vicinity of urban agglomerations, all of which having the role of recreating the connection between humansand nature. Given all this, the conclusion is clear: the assurance of a good quality of life on Earth, both now and for future generations, depends on each person, and a correct attitude towards the forest is the essential condition.

SEE IMAGES

Fun facts / Did you know?

THE LARGEST TREE IN EUROPE

Italy: Sweet chestnut tree (Castanea sativa), called ”Castagno della Nave” is located in Mascali (municipality of Catania) and it has 22.43m of girth.

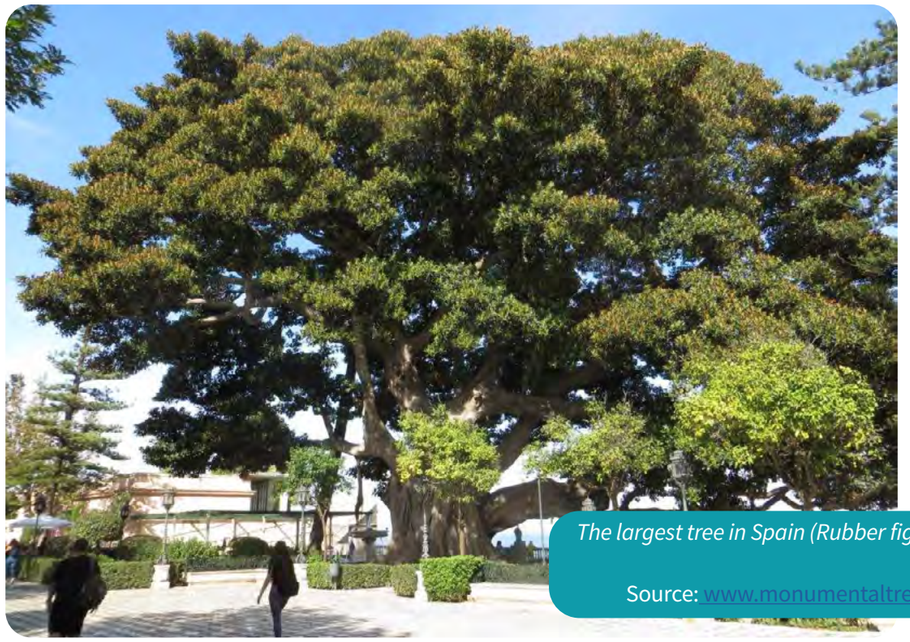
On the project partner countries, the largest trees are:

Norway: ”Brureika Oak”, Pedunculate oak (Quercus robur) in Ullensvang (county of Hordaland): 10.86m girth.

Portugal: Pohutukawa tree (Metrosideros excelsus) in Funchal: 15m girth

Romania: Pedunculate oak (Quercus robur) in Cajvana (county of Suceava): 11m girth.

Spain: Rubber fig (Ficus elastica) in Cadiz (Andalusia): 18m girth.



The largest tree in Spain (Rubber fig – 18m girth)

Source: www.monumentaltrees.com

THE TALLEST TREE IN EUROPE

Portugal: ”Karri Knight” (Eucalyptus diversicolor) in Valle de Canas (municipality of Coimbra): 73m.

On the other project partner countries, the tallest trees are:

Norway: Grand fir (Abies grandis) in Kaupanger (county of Sogn og Fjordane): 51.1m.

Romania: European silver fir (Abies alba) in Șinca Veche (county of Brașov): 51.7m.

Spain: Tasmanian blue gum (Eucalyptus globulus) in Viveiro (Galicia): 68m.

THE OLDEST TREE IN EUROPE

Determining the exact age of a tree is not an easy task, being even more difficult as the age grows, and for millennial age trees an approximation (± 100-200 years) is quite ordinary. Therefore, the title of the oldest European tree is disputed by some specimens located in Greece, Italy, Portugal, Turkey which have around 4000 years old: Olive tree (Olea europaea) and Yew (Taxus baccata).

On the project partner countries, the oldest trees are:

Norway: Pedunculate oak (Quercus robur) in Kjose (county of Vestfold): 1171 ± 50 years old.

Portugal: "Oliveira do Mouchão" an Olive tree (Olea europaea) in Mouriscas (municipality of Abrantes): 3021 ± 200 years old.

Romania: Pedunculate oak (Quercus robur) in Cajvana (county of Suceava): 821 ± 100 years old.

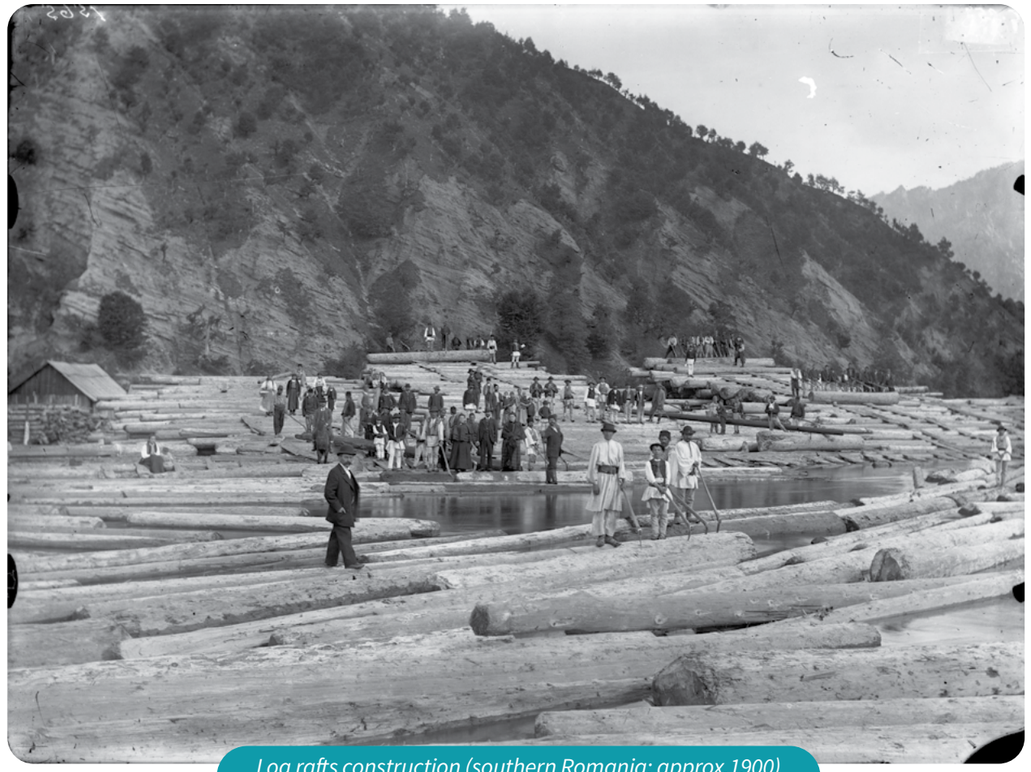
Spain: Olive tree (Olea europaea) in Ulldecona (Cataluña): 1721 years old.

See more and find stories about monumental trees at

monumentaltrees.com

Did you know that...

… in the old times, the transport of large wood material (logs, timber) was done by the rivers flowing from mountains to plains? The rivers were the fastest, cheapest and easiest way to transport logs (grouped in rafts) to processing places or ports. The rafts were driven by people who were specialized in their safe handling on fast and sometimes dangerous mountain waters.



Log rafts construction (southern Romania; approx.1900)

Source: Arhiva Etnologică a Muzeului Național al Țăranului Român, colecția Clișee sticlă. Cotă: CS-0957

Did you know that...

… the close relation with the forest made humans to name some geographical places according to the type of forests or tree names?Here are some toponyms (names of geographical places or localities) related to forests:

Bucovina (region in Northern Romania) - the name means Beech Country

Transilvania (region in North-western Romania) - the name comes from Latin (Terra Ultrasilvana) - and means The Country/Area with many forests

Eiksund, Egersund, Eikås, Eika, etc. (Norway) - the names derive from the word "oak", saying that oak used to grow there wild in old times (it hasbecome a rare species over the last 1000 years)

Granvin (area in Western Norway) - telling it used to be a large plain where spruce trees grew (this part of the country had no natural occurrence of spruce, except from in this place and one-two others)

Maceda (locality in the Region of Galicia, North-western Spain) - the name derives from the name of an apple breed: "malam mattianam"

Lugo (city in the region of Galicia, North-western Spain) - the name derives from "lucum" which meant sacred forest (it's possible that the name is related to the name of the Celtic deity Lugus)

Freixo de Espada à Cinta (city in North-eastern Portugal) - the name literally means "Ash with a sword at the waist"; the tree still exists and has already more than 500 years old

Évora (city and district in Southern Portugal) - in Celtic toponymy Ebðra means "yew"

Carvalhal da Mulher (city in Centre of Portugal) - the name means "oak tree of woman")

Did you know that...

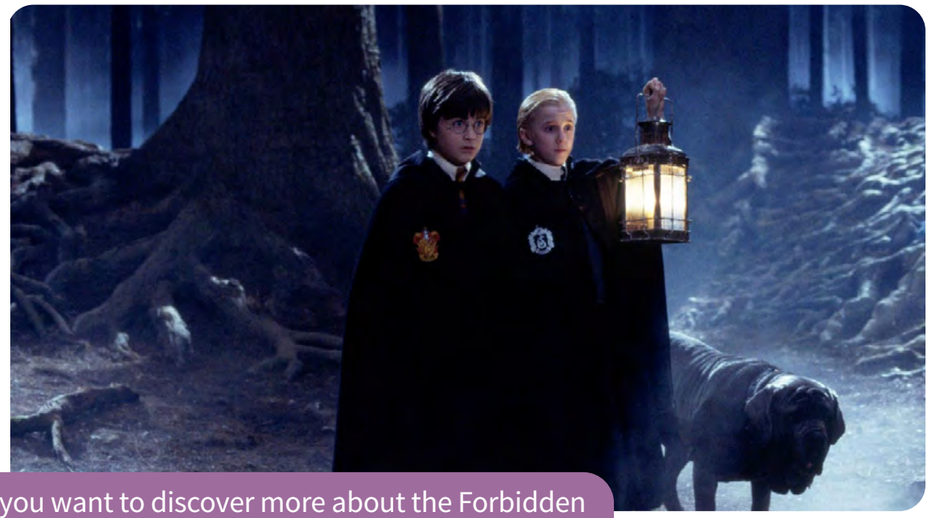
…the OAK represents strength and endurance? That is why different communities chose it as their symbol. The oak is the national tree of England. One funny story from the English Civil War tells that future King Charles II of England (1660-1685) had to hid in an oak tree in order to avoid being caught by the Parliamentarians after he was defeated on Battle of Worcester in 1651. The story was so popular back then that 29th of May became in 1660 The Royal Oak Day (or Oak Apple Day) which celebrated the restoration of the English monarchy.In the other part of Europe, in nowadays Romania, the leaf of oak is the symbol of National Team of Rugby.

FEDERAȚIA ROMÂNĂ DE RUGBY

Anyway, almost all European states have a national tree, proving that the forest has played an important role in the communities' history. Do you know what is the national tree in your country?

Did you know that...

...Harry Potter`s world involves not only magic activities and creatures, but also magic places, such as Forbidden Forest, also known as Dark Forest? Located near The Hogwarts School of Witchcraft and Wizardry, this is a very dense forest (oaks, beeches, pines etc), so the branches and leaves block the light and creates a dark and creepy atmosphere. On the ground there are plenty of tree roots, stumps and thorns that are barely visible in the forest blackness which make walking almost impossible. There are few paths to get through, but even these are very difficult to walk. More, the forest is home to a wide and strange assortment of creatures, some of them friendly, but others dark and dangerous: unicorns, centaurs, trolls, giant spiders, tree dwelling beasts, thestrals, hippogriffs, werewolves, Blood-Sucking Bugbear etc. This is why entering to forest is strictly off limits to students. Anyway, taking into account the darkness of the forest and the stories that it creates not many students would really want to go there. The adventures of the heroes of the novel (Harry Potter, Hermione Granger and Ron Weasley) lead them from time to time within the Dark Forest, but they are brave enough and have friends (good magical creatures) who help them in case of danger.



Do you want to discover more about the Forbidden Forest? Read the books or watch the movies!

Reflexive questions

After browsing through the chapter take your time to try to answer the following questions:

1. Despite many advances in scientific knowledge, many people still do not understand climate change and its implications. What are the reasons for this misunderstanding?

2. If you had to choose between non-wood forest products obtained from crops and those harvested from the forest what would you prefer? Why?

3. At a time when working patterns and community routines are increasingly demanding, especially in urban areas, what role can forest play in the mental and physical health of people?

4. Given all the historical and ancestral links between man and the forest, how can this current link between young people and the forest be characterised? If this connection has been lost in time, what could have been the origin of this loss of connection? And how can it be reconnected again?

5. Given that humankind’s access to knowledge and technology has reached a level that couldn`t been imagined until recently, and climate change is a reality in different parts of the globe, how would you characterise the relationship between humans and forest nowadays? How do you think that relationship should be?

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2 IMPACT OF HUMAN ACTIVITIES IN THE FOREST

Photo Credit: Conceição Colaço

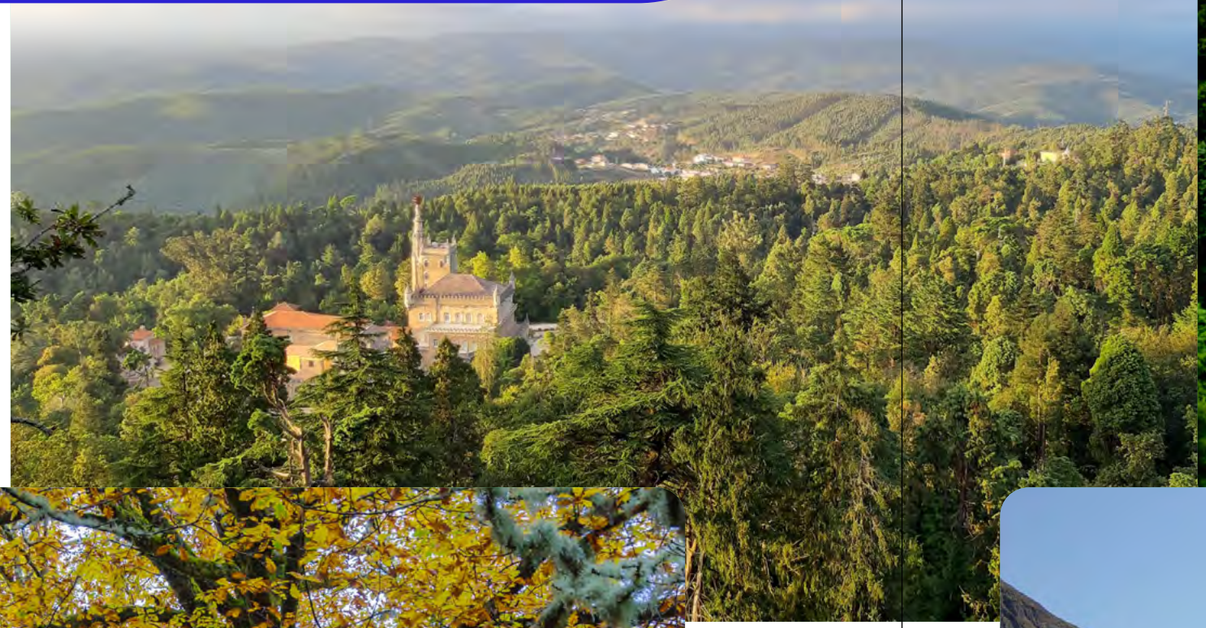
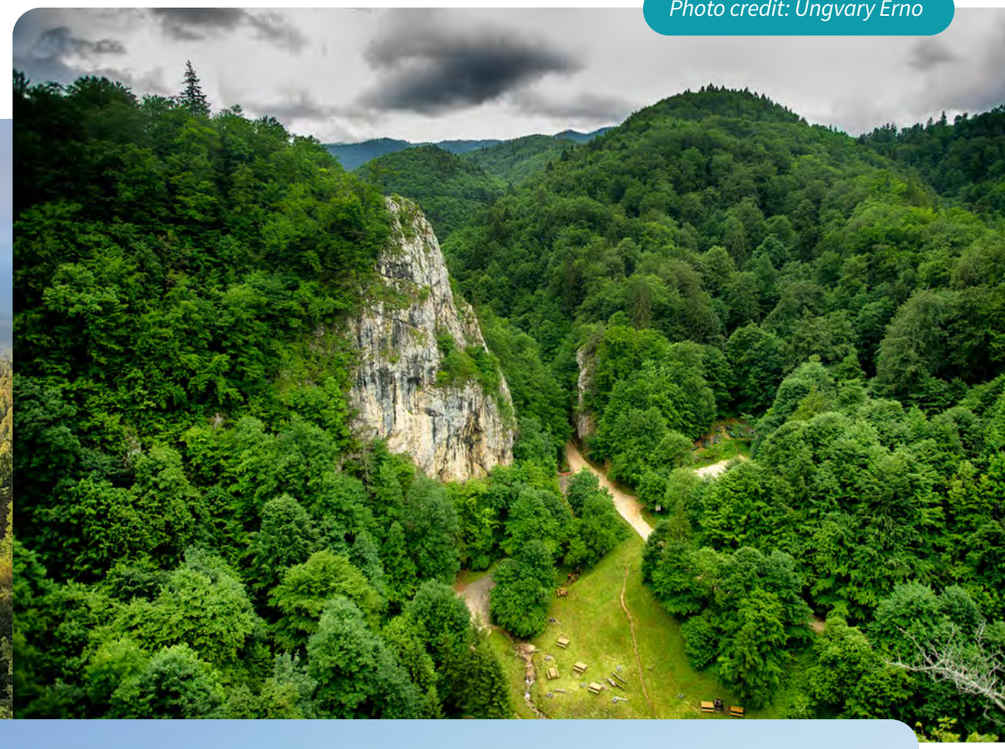


Photo credit: Ungvary Erno



WHAT IS YOUR DEFINITION OF A FOREST?

Individually, we all have an image that automatically pops up in our mind when we hear or read the word Forest, thus defining it for ourselves. Coming up with a definition of what constitutes a forest, though, is no easy task. Can we really speak of Forest as a word in the singular, or should it be plural since there are so many definitions?

▷ See more.

A *Forest* is determined by abiotic (e.g. latitude, sun radiation and temperature, wind, rainfall patterns, soil) and biotic factors (e.g. stand structure, composition and number of species). Regardless of each individual idea of a forest, the definition also depends on the interest(s) that a person or group might find on it. In Shakespeare's famous play, Juliet asks Romeo: "What's in a name? A rose by any other name would smell just as sweet.", meaning that the nature of something doesn't change when we give it a certain name or designation according to our own views or interest(s).

Thus, a person living in Portugal or Spain might identify forests distinctively from someone from Romania or Norway. An economist, an entrepreneur or a business shareholder might define and value the forest very differently from a biologist, a forest owner, a forest engineer or a nature tourist.

A study carried out by Lund (2020) found that over 1.700 different definitions for forests are in use all over the world, showing that different definitions are needed for different purposes and at different scales.

This shows that it does matter what kind of language and words we use to designate something. When we talk about human activities and the impact they have on forests, in order to know what those impacts really are, we also need to know what kind of forest they are occurring on, as well as knowing what we mean by “impact”.

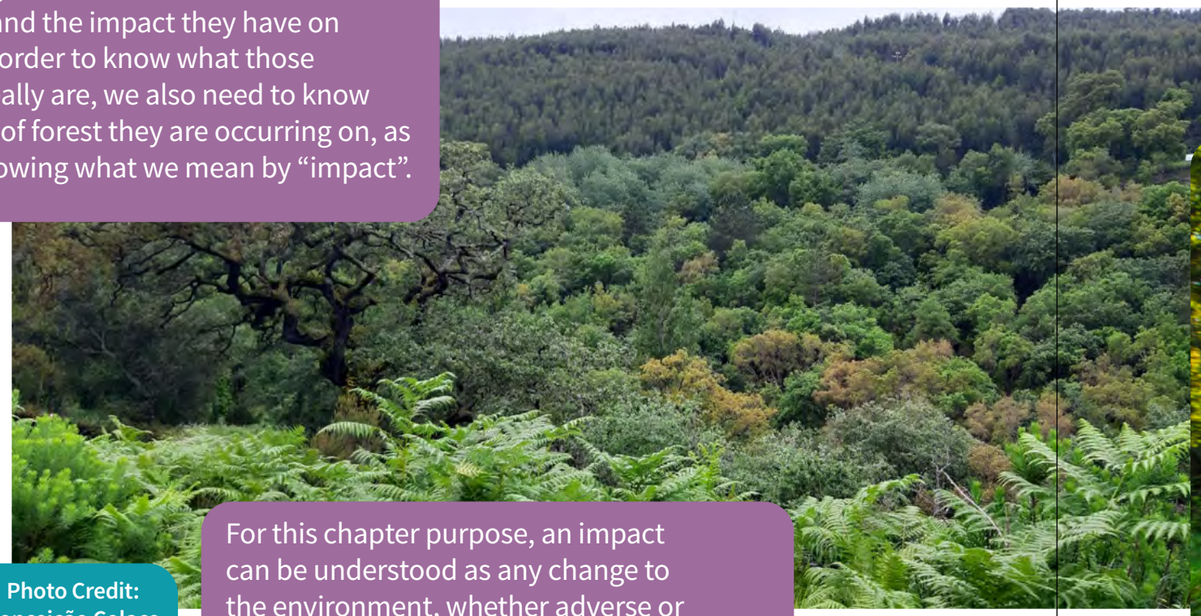


Photo Credit:
Conceição Colaço

For this chapter purpose, an impact can be understood as any change to the environment, whether adverse or beneficial, resulting from how we, as individuals, or as society use its services and resources. This is the effect that people's actions have on the environment. In some cases, we humans create problems for ourselves or other biological communities or organisms - negative impact - and sometimes we improve the conditions for life to thrive and to enhance the services and resources an ecosystem is able to provide – positive impact. For instance, when we cut many trees from a forest on a large extent of land, destroying the habitat of many species, the effect or impact is negative. Conversely, a group planting native trees can have positive impact like contributing to the mitigation of global environmental issues, such as climate change.

So, it is important to understand that the perception of any given impact on forest ecosystems as well as the effects on human society depends on what the notion, view or interest is in regard to the forest. What might be understood as a problem by one person or group, can be perceived as a benefit by another.

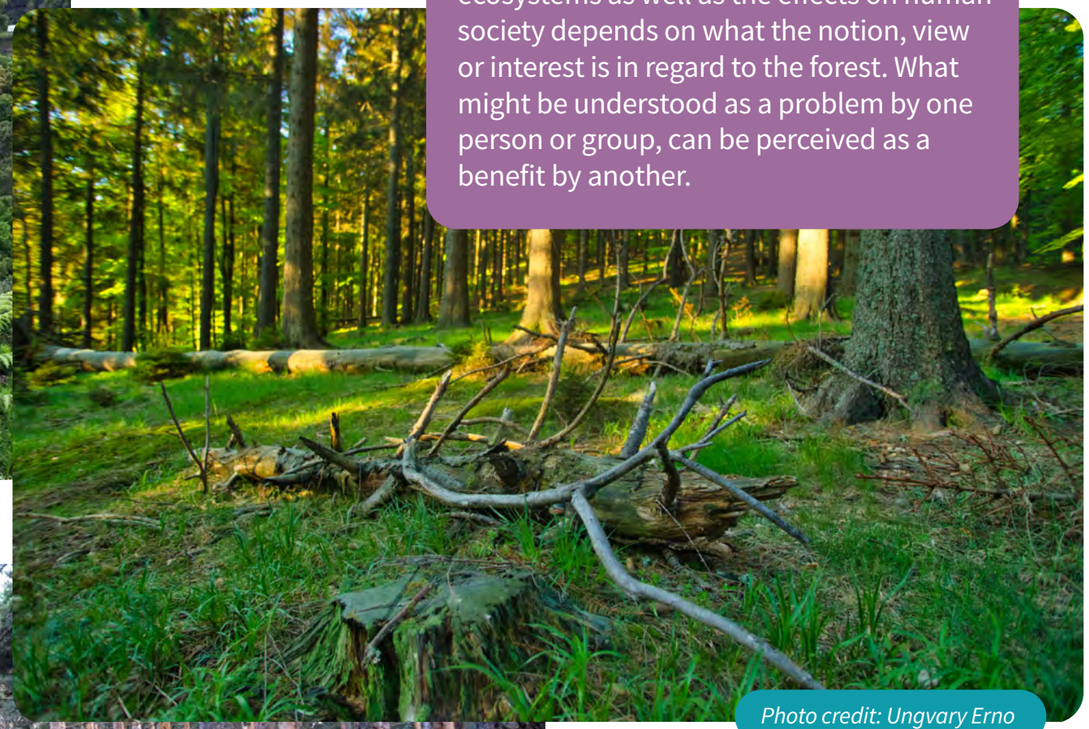


Photo credit: Ungvary Erno

In the chapter of this e-Book pertaining to biodiversity we considered Forest to be an ecosystem made up of diverse dynamic strata, which can range from the soil we step on, to the treetops, typically with great biological diversity, trees, shrubs, with water features (or not).

However, the Food and Agriculture Organization of the United Nations (FAO) defines a forest as:

“Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.”

This definition establishes what a Forest is by the minimum area of land occupied by trees, the percentage covered by the canopies of the trees and the height they can reach.

Areas with young trees that have not yet, but are expected to reach the foreseen dimensions and sizes, are also included as forests. Contained in this definition are Forests used for purposes of production of resources (such as wood), protection, multiple-use (many goods and services can be obtained) or conservation (including forest in national parks, nature reserves and other protected areas).

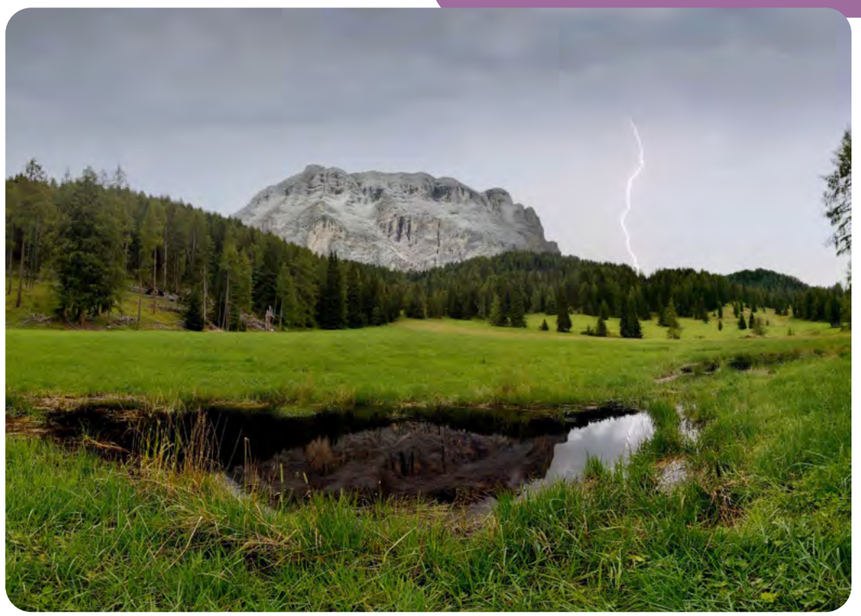
For the Forest Stewardship Council (FSC), a forest is, in its simplest form:

"A tract of land dominated by trees".

In its simplicity, this shows an even broader meaning, encompassing natural forests and forest plantations where no more criteria are established. Forests are simply determined by the presence of trees.

Both these definitions do not establish on what a Forest is based, for instance, in terms of the composition of species or ecological functions.

Additionally, the definition of Forest can change throughout time. Changing views and language accompany historical changes in forest management concepts.



Riparian gallery of the Mondego river

Portugal

Photo Credit: Emanuel Oliveira

The language used, alone can determine the level of impacts humans have on the forest and its resources. For example, a consequence of the minimum tree cover and area thresholds in forest definitions is that small, isolated forest patches, riparian forest galleries, live fences, and agroforests might be unrecorded and get, therefore, disregarded. This "ignoring" of their existence leaves these important ecological features vulnerable to over-exploitation and/or destruction. Alternatively, in a new plantation forest project, for example, these patches can be safeguarded, instead of being planted over with the new trees. This practice can have positive effects, since small patches of native trees can hold high ecological and conservation value and can play an important role in preserving local biodiversity and even local cultural aspects (preservation of identity).

Riparian gallery of Alto Minho

Portugal

Photo Credit: Emanuel Oliveira

As we have seen there are many different definitions of forest. But having one that is broadly used is also a good thing, since it helps us to commonly understand what we are talking about, and it gives us a starting point for counting trees and measuring the size of forests. This is important to see how healthy and wealthy a forest is. And only knowing this can we assess the impacts that we humans have on it.

European Agroforestry Federation

Vote every year for the European Tree of the year. Find out more here.

What is your definition of forest?

CONTEXTUAL OVERVIEW

Understanding the multiple factors that lead to human impacts on forests

In this chapter we will learn that although humans have a large impact on what forests look like, they are not the only thing influencing the differences among Europe's and the world's forests.

Impacts of human activities on forests have multiple origins. Most of the time there isn't just one single factor determining a given impact. For instance, let's see what leads to the increasingly catastrophic forest fires in Europe.

Vegetation growth – primary production

On land, almost all primary production is performed by vascular plants, with a small fraction coming from algae and non-vascular plants such as, e.g. mosses.economic and other social- value aspects).

Primary production on land is a function of many factors, but principally local hydrology and temperature. While plants cover much of the Earth's surface, they are strongly curtailed wherever temperatures are too extreme, the availability of water and of soil nutrients richest. For instance, Spain, Portugal, Italy, Greece, Cyprus, Bulgaria and Romania are the EU countries that will be particularly affected by desertification (soil degradation) and therefore, more likely to lose natural resources in the coming years (to know more, go to EU page devoted to desertification in Europe).

Figure 1 - Primary Productivity 2000-2021 (Neumann et al. 2016)

Primary Production relates to the growth of biomass. The higher the primary production, the more biomass one given territory is able to "produce" – and consequently accumulate. Observing the above map of Europe, where the warm colors (yellow, orange, red and violet) signal the places where the primary production (and biomass) is higher, as opposed to the cold colors (blues) that refer to lower levels of primary production, it is possible to identify the differences between regions and countries.

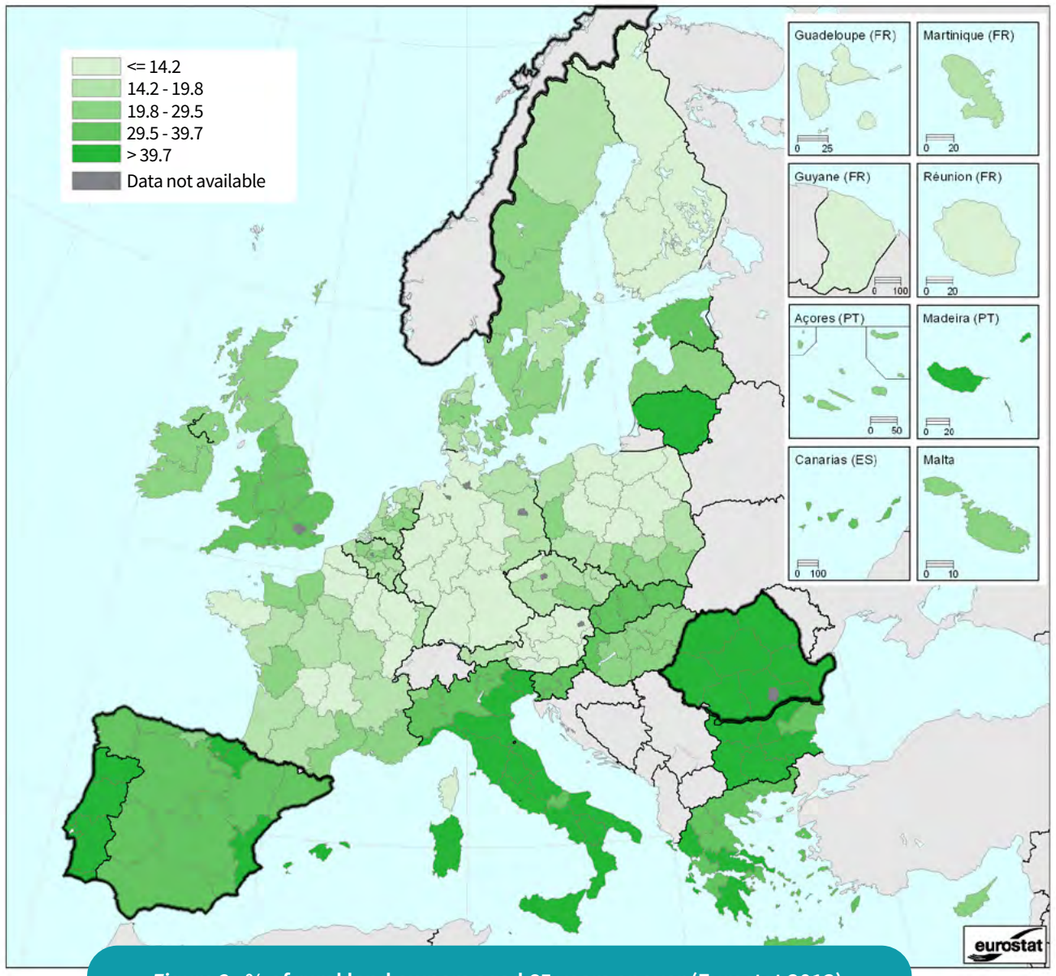


Figure 2 - % of rural land owners aged 65 years or over (Eurostat 2013)
© EuroGeographics © UN–FAO © Turkstat Cartography: Eurostat – IMAGE

Population age and land abandonment

The two previous maps and the statistics they convey are intimately related. The first map shows that in the context of the European continent there is a high percentage of elderly forest owners.

This fact is even more striking in the Mediterranean Europe (Portugal, Spain, Italy, Greece), but also in Romania and Norway where land ownership by people above 65 years is between 30% and 40 %.

These figures link to the second map, translating into the risk of land abandonment. An ageing population as more difficulties to “take care of the Land”. Land abandonment, and the resulting decrease in managed forest land is a matter of great concern in regions within Europe. Land abandonment leads to an increase of shrub lands, continuity of vegetation which create the conditions for the spread of a wildfire.

This is a negative impact, however, in some cases this land abandonment creates new conditions that can promote biodiversity and nature conservation, positive impact. It is worth noting, though, that the term abandonment itself can be perceived as somewhat vague, though it is a problem with a multidimensional character focused on the territorial perspective encompassing depopulation, the decrease of economic competitiveness (potential gains that can be obtained that are not being materialized) and the consequent environmental sustainability.

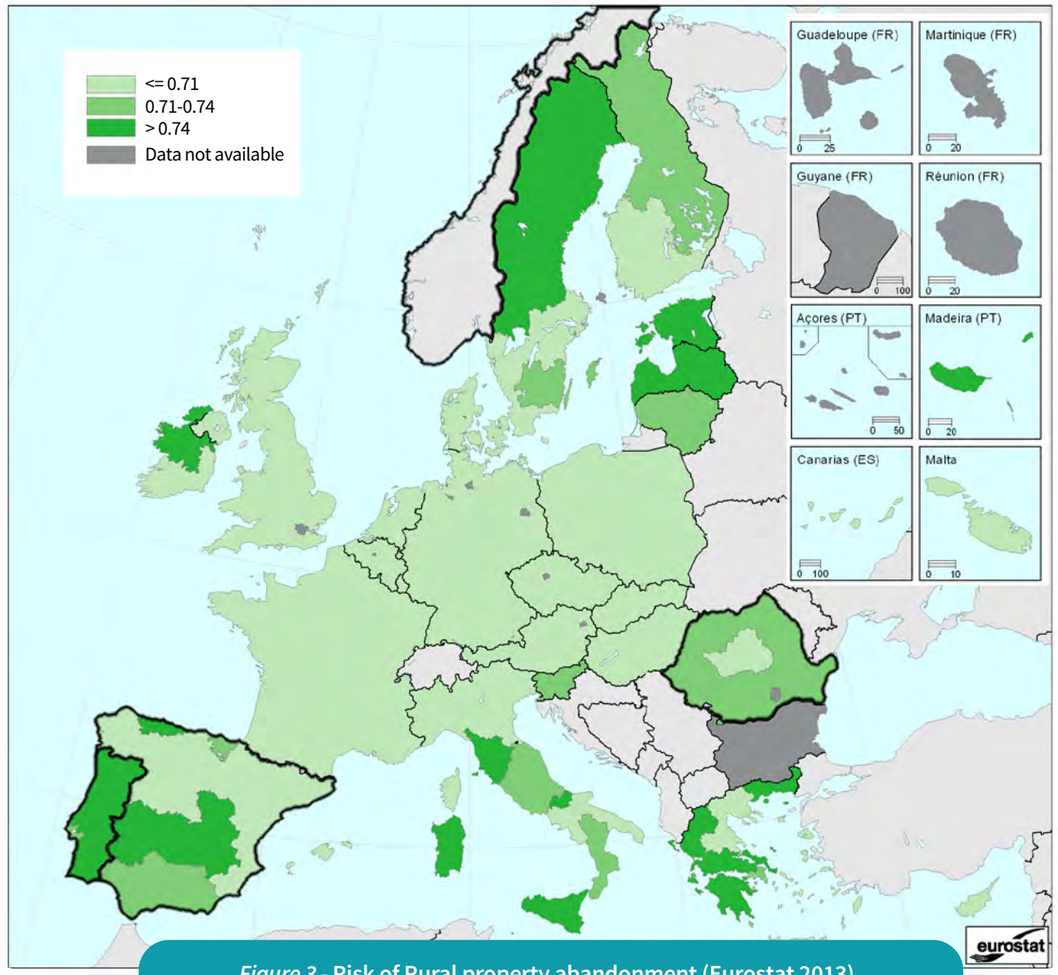


Figure 3 - Risk of Rural property abandonment (Eurostat 2013)
© EuroGeographics © UN–FAO © Turkstat Cartography: Eurostat – IMAGE

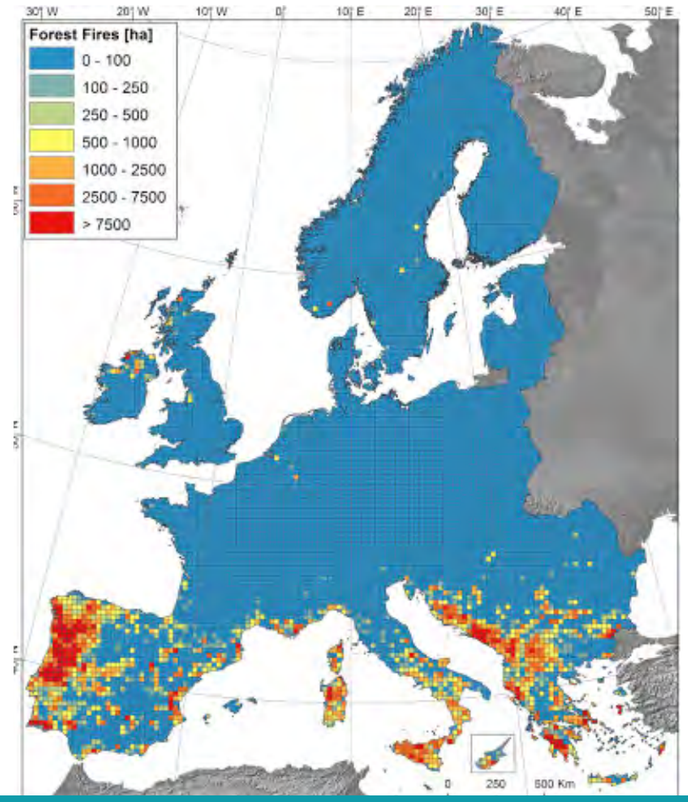


Figure 4 - **Forest fires 2002-2012 (P. Borrelli, et al Assessment of the cover changes and the soil loss potential in European forestland, 2016)**

Forest fires – result of plants, continuity and meteorology

This image shows the map of forest fires area on the European continent. This is one of the major impacts on forests. It can be construed as the corollary of all the maps that preceded it. An ageing rural population, with its diminished intervention capacity, leads to rural land abandonment, which in turn makes it that available biomass is accumulated on the land.

Together with lack of humidity, accumulated drought, high temperatures and wind, these are the physical drivers for the occurrence of great forest losses due to fire. The south of Europe is naturally prone to fires. Nevertheless, North and Central Portugal, as well as Galicia are the territories most affected by this menace. Equally, and at its own scale, in the context of the Romanian territory, this problem is considerable as well. Norway don't have the same forest fires impact as in the countries of southern Europe; however, climate changes can change this reality.

Fighting catastrophic forest fires: a new vision

Photo Credit: Pedro Palheiro

The impact of fire

When you think of forest fires, do you immediately take them for a bad thing?

Fire, although, when intense and uncontrolled, responsible for the destruction of vast areas of forests, can also contribute to the overall health of forests and even improve the survival and reproduction chances of some species.

Photo Credit: Conceição Colaço

In nature, forest fires have always been common, being ignited by natural occurrences such as lightning or volcanism. A few thousands of years ago humans became the main fire starters. Today, FAO estimates 90 percent of forest fires to be caused directly or indirectly by human activities, such as deliberate fires set for clearing land for agriculture and pastoralism, or accidental fires set by thrown away cigarette butts or unsupervised barbecues. Fire can thus get out of control, burning vegetation, but also endanger animals, people as well as entire villages and towns. To know more go to the website of the European Forest Fire Information System to become aware of the different fire causes in Europe and follow real time wildfires occurring in Europe

In more recent times, with increasing populations and a growing aversion to fire due to the negative perception of its impacts, humans have made enormous efforts to suppress fires.

Paradoxically, these efforts have, in many cases, harmed the forest. It is now well established that contrary to previously thought, regular, small-scale, low temperature and ground fires can be beneficial to the forest. These fires can control pests, create space for the strongest, most resilient trees to grow. However, the most important aspect of these fires in the Mediterranean region, is their ability to diminish biomass accumulation (dry plants, leaves, branches, shrubs and fallen trees) which provide the fuel for the bigger, very intense catastrophic fires.

Humans can thus also impact the forest positively through the use of fire. Increasingly, designated professional forest managers use prescribed fire: low intensity fires applied with the correct meteorology to manage forest and prevent forest fires.

Which are the causes of fire in your country?

Do you have traditional use of fire in your country?

How do they do it and what are their objetives?

Impacts on Biodiversity:

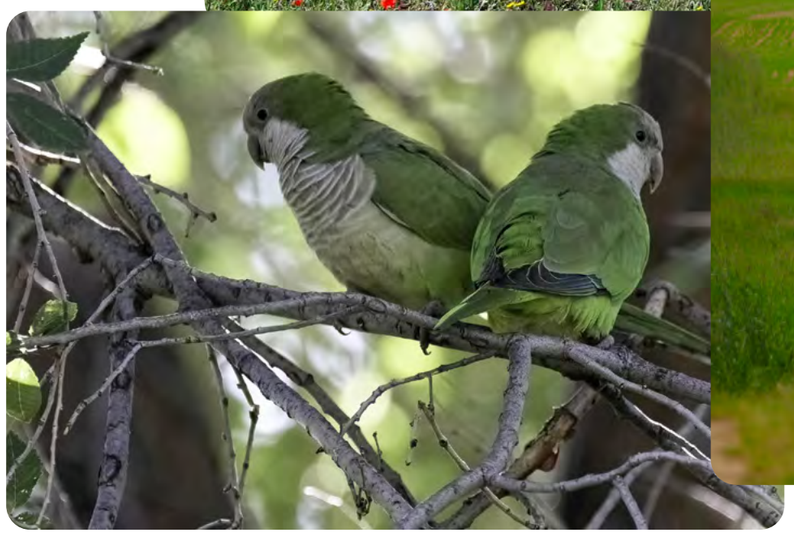
Forests are complex places, and much more than just a set of trees of a certain height occupying a given surface of land. Forests hold a structure of communication networks, interactions and dependencies, with the thousands of its “inhabitants”. Forests are ecosystems.

Throughout the ages forest organisms had to evolve in such a way so that they could be adapted and resilient in order to survive in an environment that experiences many natural perils.

Forests are shaped by natural factors, such as climate, soil and water availability as well as natural hazards. The combination of these forces has always been at the origin of forest size and composition changes. Natural impacts have also been shaping forests for millions of years.

In addition, humans activities permanently convert forest into land to be used for other purposes, such as, for example, building houses and roads, agriculture or grazing lands as well as forest plantations dominated by very few commercially profitable tree species. Other forests suffer clear-cuts to extract the timber and no afforestation efforts are consequently made.

Photo Credit: Conceição Colaço



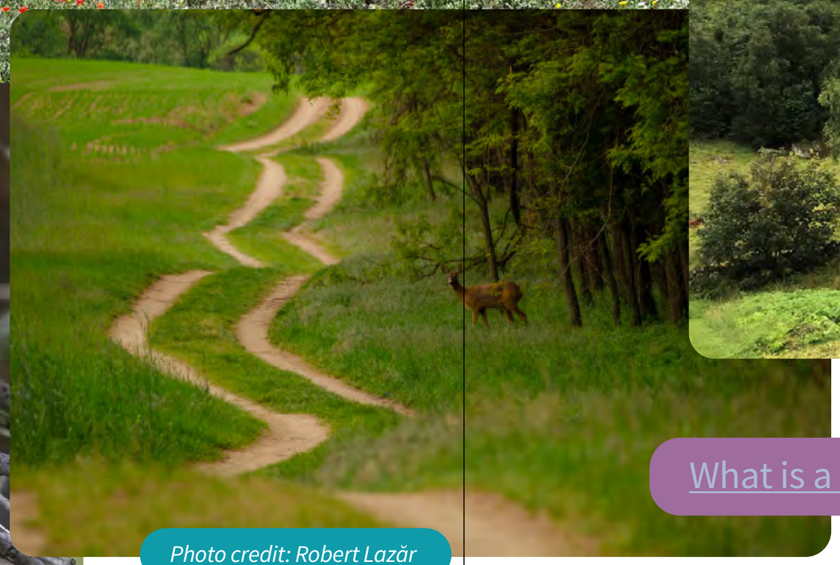


Photo credit: Robert Lazăr

What is a biodiversity hotspot?

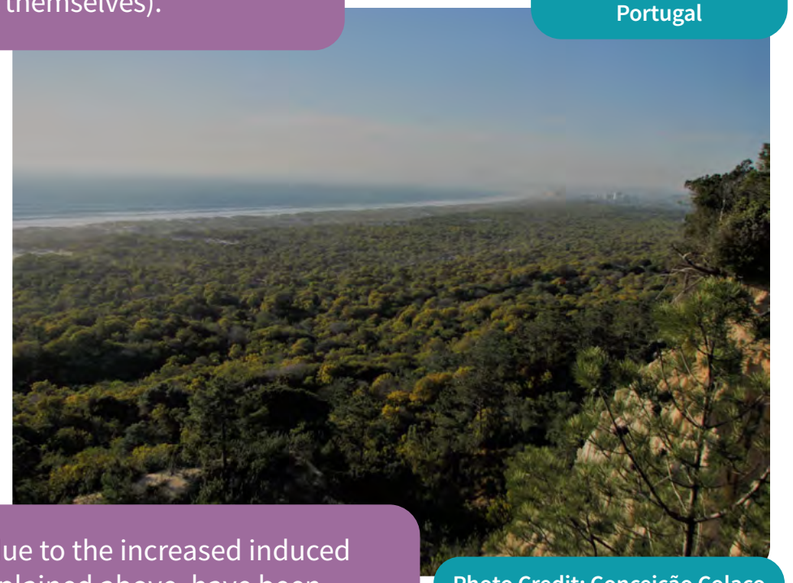
It is frightening: FAO estimates that an area equivalent to five football fields of forest disappears every minute worldwide.

Such drastic transformations are called disturbances. Some disturbances can promote biodiversity (see mediterranea basin biodiversity hotspot), but the majority leads to permanent effects, such as the removal or decrease in the area of a forest. When a forest is lost, reduced or fragmented, many of the other life forms that lived and depended upon the forest are likely to dwindle or disappear. Some species can adapt to a new environment, but many others cannot. In addition, we humans also lose many of the ecosystem goods and services that forests provide us with, which represent many intangible and unquantifiable benefits to the environment and our society.

Source: stock photo

Biological invasions

Any of these cases increase the risk of biological invasions, which relate to the introduction of exotic species (animals, plants and even pathogens) that will cause serious damage to native biodiversity as well as potentially on crop forests (even if they are made up of exotic species themselves).



Acacia forest at Costa da Caparica

Portugal

Photo Credit: Conceição Colaço

Human activities, due to the increased induced disturbances, as explained above, have been causing the introduction of these species on an ever-growing scale, bringing them intentionally or by accident from other parts of the world. Coming from somewhere else other than the place where they are currently causing the problems, these introduced species are called Invasive Alien Species (IAS). If they can survive in their new environment, these exotic species can often thrive quicker than in their originating habitat, because their natural predators and competitors are not there to control them. They normally have competitive advantages, such as using up the resources before the native species get the chance and they are also able to rapidly propagate, crowding out the native organisms.

Some species may also migrate “naturally” as their previous habitat becomes no longer able to support them.

The problem of invasive species is getting worse as more and more people and products move around the world. Climate change amplifies the problem because species are migrating to new areas in order to stay in the climate to which they are most suited.

In the case of forests, the introduction of these foreign organisms to the ecosystem directly reduces their health and productivity.

The continuous patches of plants of the genus Acacia (from Australia) in southern European countries, such as Portugal and Spain are a clear example of this phenomena.

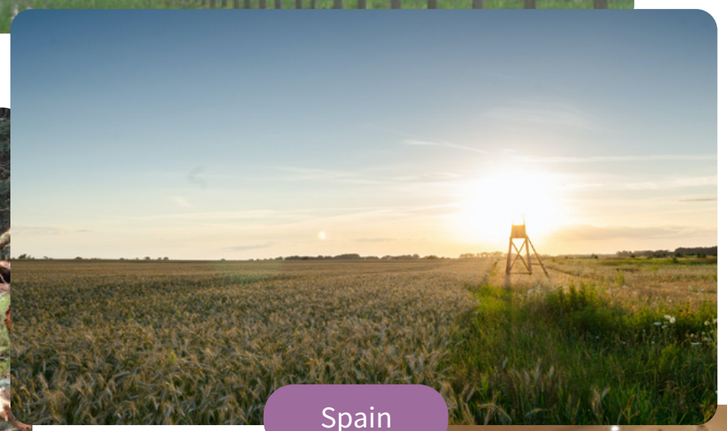
Do you know how much the problems with Invasive Alien Species cost in Europe alone?

Click the names for more info

Portugal Spain Romania Norway

In your country which are the invasive species that have more impact in your forest? What is their origin? Can you draw a roadmap of that species from their country to yours?

Romania



Norway

Portugal

Click the pictures for more info

Photo Credit: Conceição Colaço

Spain

Mata dos medos at Costa da Caparica

Portugal

Photo Credit: Conceição Colaço

The presence of Forest Certification throughout the world promoted by Forest Stewardship Council (FSC) and Program for the Endorsement of Forest Certification (PEFC) confirms that the forest is being managed in a way that preserves biological diversity and benefits the lives of local people and workers, while ensuring it sustains economic viability.

Thus, although the benefit of a monoculture forest seems to be mainly economic, it also has social benefits and, in some cases, can also have ecological benefits. A good example is the monospecific maritime pine stands or umbrella pine stands that helps to retain the sand dunes, protecting agriculture fields, rivers and different infrastructures. This is the case of “Pinhal de Leiria” in Portugal or the “sand dune of Pilat” in France.

To know more about European forests follow these websites: forest.jrc and efi.

In your country which are the most common forest species?

Are they plantations or natural forests?

Forest and Climate Change

Forests are like a canary in a coal mine, since they are, on a global scale, very sensitive to climate change. Small increases in the average temperatures can have strong impacts on the characteristics that define the forest. As we have seen, this can make that some species expand beyond their “normal” geographic range and take over new areas. This dynamic can out crowd more sensitive local species. Ultimately the less resilient ones may disappear from ranges that they previously occupied.

Despite uncertainties that still remain about many of the details of climate change, there is a general consensus among the world's most prestigious scientists and scientific organizations that the world is experiencing a rise in global temperatures and that humans have been playing a significant role in creating that warming.

All throughout this e-Book, we have seen that there are many different natural processes that impact forests. Additionally, we now understand that when there are naturally occurring processes that have negative immediate impacts, the forest is generally able to recover.

Extreme natural phenomena are becoming more frequent and besides impacting human communities also put forests under stress and degradation, exposing them to droughts, damage by wind and snow storms, fires, and making them less resilient with lower resistance to pests and diseases.

It is not hard to imagine that in face of these phenomena, entire forests “move” to places where they find more favorable conditions. Many forests are migrating ever closer to the north and south poles or to higher altitudes.

These adaptations of trees to climate change are being studied all over Europe. For instance the project REINFFORCE created a world unique infrastructure network of 38 arboretums, ranging from latitude 37° in Portugal to latitude 58° in Scotland, with the objective to monitor trends in tree mortality and growth under climate change on a long term perspective. All arboreta include the most common European tree species as well as alternatives species and provenances that could be potentially adapted to future climatic conditions, using the same genetic material among the different arboretums.

Photo Credit: Conceição Colaço

In areas that are already under very stressful conditions (because of drought, for example), forests that are made up of species that propagate with difficulty are at risk of disappearing altogether. But also, wet areas suffer impacts. The rise in sea levels due to the melting of the Ice caps and the expansion of the world’s oceans threatens coastal forests.

Remembering that the growth of forest biomass depends on the place they grow on, climate change can have an impact either by fostering or diminishing that growth. In most cases, however, forests become more vulnerable to disturbances. For example: the change in average temperatures impacts the forests organism’s life cycles. Spring events like blossoming or flowering occur earlier than usual, which can increase the risk of damage from events such as spring frost. Additionally, different organisms within the forest may react differently to these changes, and this can lead to the breaking down of essential ecological functions.

Impacts of the Economy on Forests

From the forests we are able to extract various products on which we depend daily, from raw materials such as wood and resin, to the water we drink, the energy we extract through the burning of fossil fuels and wood, but also foods and substances used in cosmetics and in the pharmaceutical industry. And, never to forget, the air that keeps us breathing!

However, not everything the forest produces is tangible (easily measured) and directly visible! As seen in the previous chapters, forests also contribute to the quality of the water we drink by filtering pollutants and pathogens, and are also important in controlling soil erosion, absorbing greenhouse gases and producing oxygen.

For human wellbeing forest are places of excellence for the promotion of the mental health quality as well as for the enhancement of educational and social life in societies.

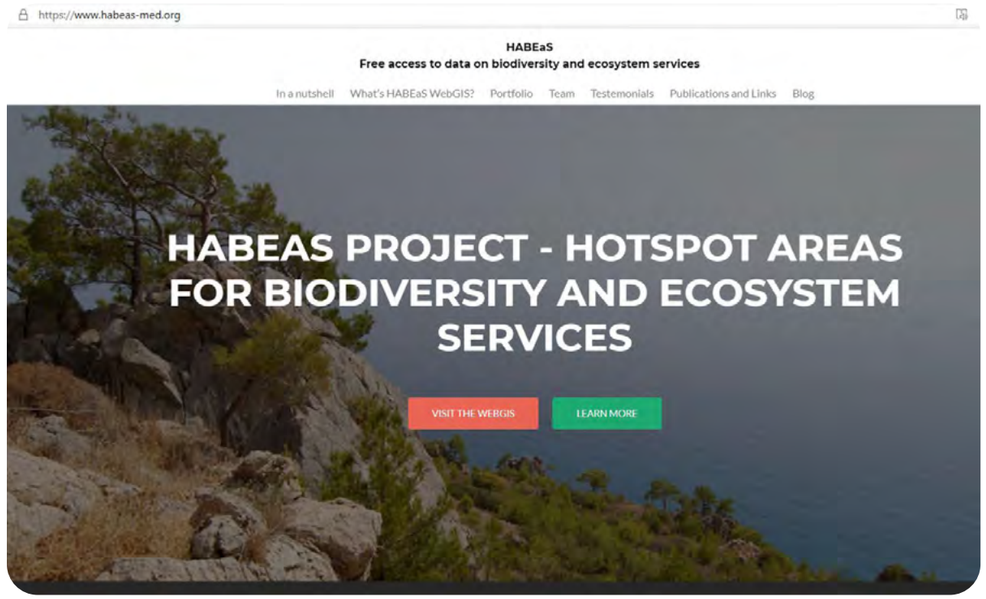
All these functions that are gifted to humans by the natural environment make up what in this e-Book is referred to as the ecosystem services.

Photo Credit: Conceição Colaço

Photo Credit: Conceição Colaço

Photo Credit: Pedro Pacheco Marques

Photo Credit: António Salgueiro



We humans are beings that consume resources. Many of these resources come from the forest and the choices we make every day as consumers can have a strong impact on it.

The United Nations' Sustainable Development Goal nº12 is "responsible consumption and production". As consumers, we must think every day about the impacts of our choices on the planet and about how we can reduce them.

For example: we have all been confronted with images of ecological degradation due to pollution by plastics. Collectively as a society and as consumers we have demanded from companies that they move to employ materials that have a less lasting impact than plastics such as wood, cardboard or paper. But knowing where these resources come from, doesn't this put even more pressure on forests and their resources?

LINK

Worldwide, different places have experienced different levels of impact relating to deforestation and forest loss. In Europe, forest area has even increased over the past 100 years. The economy related to the forestry sector particularly with planted forest is very strong, creating more than 3,9 million jobs in Europe.

In developing countries, the amount of forested areas continues to diminish. As seen, vast forest areas are being lost to obtain raw materials that sustain the way of living in Europe and other developed societies. The following maps show that the global north has seen an increase of Forests at the expenses of the global south.

The exploitation of tropical forests in south leads to loss of habitat to wildlife which can create danger to humans. This will be not only by presence of dangerous animals next to our homes but also because of the different diseases they will pass to human beings (eg. Ebola with the origin in Primates; new virus COVID-19 which is likely to have is origin in wild animals like bats).

Photo Credit: Conceição Colaço

This is a problem that might bring along other societal impacts. Competition for resources generate these kinds of asymmetries. The very nature and diversity of problematics, such as for instance, conflicts that motivate (or are motivated by) racial, xenophobic and ethical issues have at their roots, also environmental problems. In many cases behind these matters lie problems that directly involve the environment and the ways humans go about to obtain its resources. It is well worth thinking about these impacts as well.

In line with more socio-political ways to manage forests, and in view of the abovementioned impacts, there are some attitudes and behaviors we all can have towards consumption in general and the consumption of forest products in particular. For instance, we can seek knowledge to be able to determine the origin of the products we buy. Choosing food, products and materials from responsible and sustainable production is one of the ways to minimize impacts on forests. There are already some schemes in place that make this task easier: We can choose products that have some sort of certification of good forestry practices such as paper or cardboard with the worldwide recognizable seals of FSC and PEFC as well as some more local forest certification labels.

“Sustainable Forest Management is done in our homes through our individual actions as consumers”, meaning that what you chose to buy, from where and when, can have serious impacts on the forest. This is a motto to keep in mind.

THE BENEFITS OF ENVIRONMENTAL EDUCATION

Given all that we have learned throughout the previous chapters we can say that the real trigger for action to cherish, protect and value forests is education! Effective and extensive education is essential to promote active and lasting sustainable forest management policies. Education is also essential to turn young people into proactive citizens, to change behavior and, for example, to raise funding and recruit volunteers for a cause.

We know that school programs address concepts related to the forest, biology, ecology and even ecosystem services, but textbooks cannot teach how each one of us can take an active part in forest conservation and protection! It is not easy to find a book explaining how environmental associations and volunteering can change our territory.

Photo Credit: Conceição Colaço

Also, it is through education that policy makers and the academic community can join forces to train young people towards the environment and nature conservation.

Critical thinking, cause-effect reasoning or learning for active citizenship are still unfamiliar to many European citizens. Basic skills such as digital, social, civic, scientific and learning competences; sense of initiative and entrepreneurship; or cultural awareness and expression are current EU top priorities in the teaching-learning context. ecological thinking and awareness of our planet as a shared place with finite resources. “Ecological” here perceived as the knowledge on the webs or networks of relations at different scales of organization. However, the understanding of the tight relation between environment and society is essential for the long-term sustainability of both the society and the environment.

Photos Credit: Conceição Colaço

Forest education is provided at the University level in several schools all over the world and the Forest engineer or forest sciences professionals have evolved to integrate the dimensions of sustainable forest manage to make sure forests will grow healthy, productive, contributing to mitigate the effects of climate change. In Europe there are several forest education networks that promote school activities in the forest, contributing for a better forest literacy and forest enchantment.

In general, awareness raising activities and educational activities in the field play a fundamental role in educating the public, who, through these initiatives, becomes more aware, participatory and interventional in decision-making about the conservation of their forests.

Initiatives promoted by NGOs, especially when they work locally, make communities aware of the environmental problems that exist not only in their cities or villages, but globally.

LINK

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04.
Fire

IMPACT OF FOREST FIRES IN THE FOREST LIFE AND OTHER ECOSYSTEMS

One of the main issues that should be addressed by mankind nowadays is the fight against deforestation and forest fires. Forest conservation and development is vital for the wellbeing of humans. Forests help preserve ecological balance and biodiversity, they protect river basins and have an impact on climate and weather. Forests provide rural communities with timber, food, fuel, fodder, fibres and organic fertilisers, while at the same time, having the potential to act as a source of energy.

Looking back on history, populations living near forests have always availed of timber residue for fireplaces as well as for charcoal fuel used in heating and cooking. Nowadays, the latter is highly in decline; nevertheless, forest resources are being exhausted at an alarming rate.

▹ See more.

Fire has conditioned the existence and distribution of forests throughout thousands of years, while also acting as an undeniable tool for many agricultural, farming and forest activities.

It is important that society has enough information to understand the problem of forest fires and how to become part of the solution. In order to achieve this, it is necessary that we give careful thought to how we have reached this point and to what measures should be considered, also raising awareness about this problem in future generations. Fires form part of the natural cycle and safeguard the biodiversity of our forests.

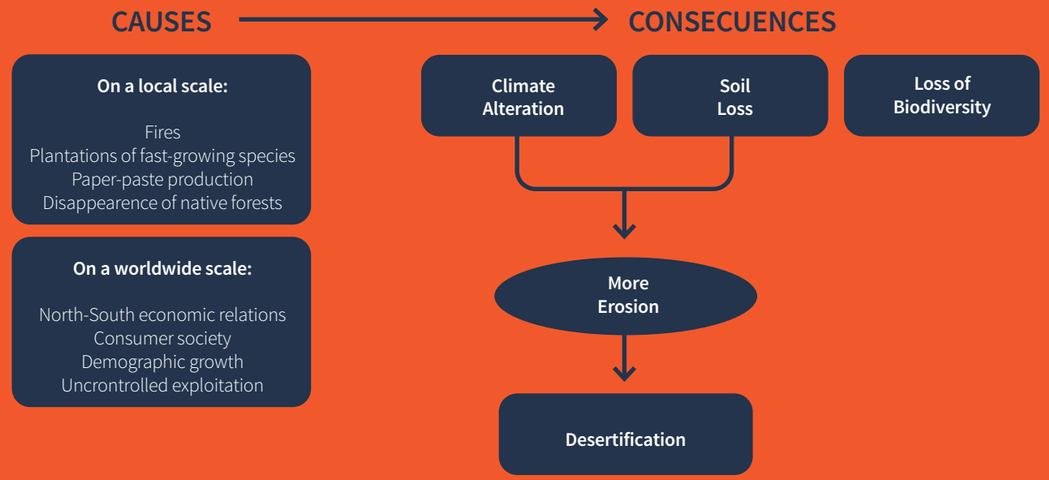
BENEFITS WE OBTAIN FROM FORESTS

Sociocultural
- Source of leisure
- Communicates beauty
- Source of knowledge
- Biodiversity

Environmental
- Regulates climate
- Cleans the air
- Protects from erosion
- Biodiversity

Economic
- Timber and logs
- Fruit
- Resins
- Biodiversity

IMPACT OF DEFORESTATION



What is fire?
The triangle-of-fire concept

Forest fires take place when one or several combustible materials in a forest, jungle or any other area with vegetation are consumed by fire in an uncontrolled manner, causing important harm to wildlife, vegetation and soil, and leading to serious environmental, economic and social losses.

The triangle of fire is a basic and fundamental concept to understand fire, how it takes place and how it expands.

▷ See more.

The spreading of fire

There are three methods of heat-transfer, that is, of spreading of fire:

- Convection
- Radiation
- Conduction

Causes and factors

It is important to make a difference between **cause**, the motive of the ignition, and **factor**, the element or group of elements that will determine the combustion and the spreading, extension and duration of a forest fire.

The main causes of fires can be divided into two groups: **natural** and **anthropogenic**.

Factors that influence the spreading of fires are defined as follows: **environmental** factors and **socioeconomic** factors.

▹ See more.

Relation between fire and forest ecosystems

Fire is considered a fundamental element of nature, in the same way as sun or water, and is always present in forests, having the purpose of preserving the health of certain ecosystems. Fire is one of the determining ecological factors in the composition of many variations taking place in the vegetation and in landscape structures.

The importance of fire in the world makes forest fires one of the most relevant processes in understanding the global cycles of CO2 and of nutrients. The main difference lies in the fact that fires vary depending on the ecosystem.

▹ See more.

The **impact** of forest fires over environmental processes is complex due to variability in the landscape, as well as to the difference in the response of vegetation (Tessler et al., 2017).

▹ See more.

IMPACT ON VEGETATION

The relation between vegetation and forest fires is mainly centred on changes in its structure, composition and ecosystem services.

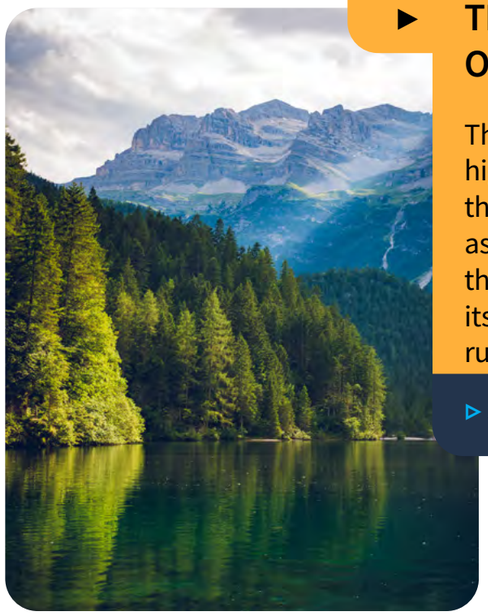
The process that leads to natural recovery after the occurrence of a disruption is known as **ecological succession.**

▹ See more.

IMPACT ON WILDLIFE

Fires can have a large impact on both vertebrate and invertebrate animals, such as death, habitat reduction or loss of territory, shelter and nutrition. Wildlife loss due to forest fires will depend on different factors, including wind velocity, the levels of combustibles, the humidity content in vegetation, the time of the year or the extent of the fire, among other effects affecting soil, water and vegetation.

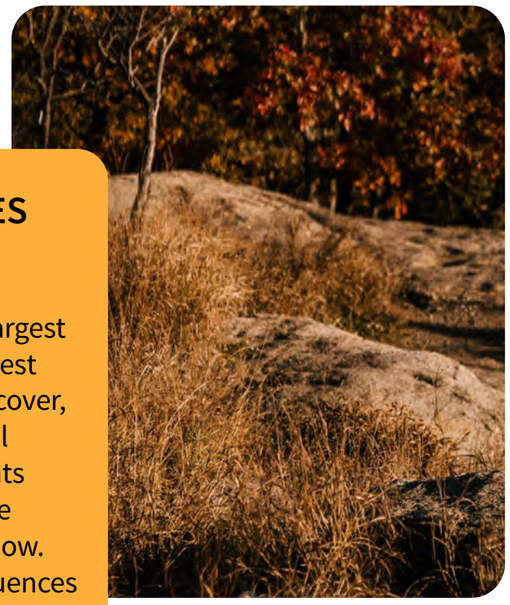
▹ See more.



THE IMPACT OF FOREST FIRES ON WATER

The hydrological cycle of a basin can be highly affected after a forest fire due to the loss of vegetation and organic matter, as well as to changes in soil properties that decrease the soil's infiltration rates, its availability of water and an increased runoff.

▹ See more.



THE IMPACT OF FOREST FIRES IN THE SOIL

The loss of soil due to erosion is the largest environmental damage caused by forest fires. Soil is an asset that is hard to recover, therefore, the degradation of its initial characteristics and the loss of nutrients and fine particles due to erosion make the regeneration process extremely slow. Forest fires have very diverse consequences over soil and their severity increases with the frequency of fires in a single area. If the period in between fires does not allow for the forest to recover naturally, the degradation of the area and its soil will be progressive.

▹ See more.

THE IMPACT ON THE QUALITY OF THE ATMOSPHERE

From the very beginning, forest fires have an immediate effect over the quality of the air. In the moment of the fire, toxic gases are released into the atmosphere, including carbon dioxide, and hazardous particles arising from the incomplete burning of biomass. This results in higher air pollution.

The situation of forest fires in Europe

In 2019 a total area of 161,473 ha of protected land was burnt. This is three times the extension of protected areas that were burnt in 2018 and is one of the worst figures in the last 6 years, only exceeded in 2017. Romania was the most affected country in 2019, and burnt protected areas in France and Spain account for approximately 16% each. On the other hand, Italy recorded more fires than any other EU28 country.

In 2019, fires of over 30 ha affected 24 of the EU28 countries (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom), burning 333,542 ha in total, around 2.5 times the area recorded in 2018.

Country	Area (Ha)	Number of fires
Austria	38,12	1
Belgium	314,54	4
Bulgaria	9006,46	60
Cyprus	419,74	3
Czech Republic	30,26	2
Denmark	90,59	2
France	26640,73	238
Germany	1875,72	10
Greece	3318,41	45
Hungary	525,55	7
Ireland	1658,38	17
Italy	9172,51	141
Lithuania	82,18	2
Poland	113,67	3
Portugal	6413,2	86
Romania	63673,33	164
Slovenia	105,92	2
Spain	25959,92	205
Sweden	83,11	2
Netherlands	20,81	1
UK	10041,97	53
EU28 Total	**159585,12**	**1048**

Source: J.R.C. Technical Report – Forest Fires in Europe, Middle East and North Africa 2019. European Commission.

3 BASIC SAFETY MEASURES TO PREVENT FOREST FIRES

Forest fires present a problem of great complexity that needs to be addressed with solutions pointing in multiple directions. In order to do so, it is important that each of its issues is analysed profoundly in all of its variables.

In the last few years forest fires have destroyed forests and greenery, aggravating the environmental and climatic situation worldwide. Fires cause an increase in temperature, long-lasting periods of drought –having an impact on soil dryness– as well as heat waves. These are only a few of the consequences of fires in the environment. Fires worsen the effect of climate change and, at the same time, climate change increases the probability of fires. Therefore, it is essential to raise awareness in society on the importance of fire prevention, starting from individual action. People with knowledge on forest-fire prevention can save lives, including the life of the planet.

Concerning fire-related accidents, it is essential that the general population become highly aware of the risks and that other alternatives are used as a substitute to fire. On the other hand, it is also extremely important that higher efforts are made to detect and persecute arson attempts.

Forest fires caused the emission of 6,375 million tons of CO2 into the atmosphere in 2019 on a worldwide scale, according to Greenpeace.

It is necessary that immediate fire-prevention measures be taken in every spot of the world. Implementing solutions is a task for both authorities and population, as shown in the following measures:

To not abandon waste that could cause a fire

Abandoning waste or foreign materials (bottles and glass objects, paper or other combustible materials) can cause a violent reaction and lead to a fast-spreading fire. Burning cigarettes or even lighters can be toxic for the environment or potentially cause forest fires.

To not light fires in fire-prone times of the year

A high percentage of forest fires are caused by humans, in many cases due to negligence. The smallest spark or flame can cause a disaster. For this reason, it is not advisable to start bonfires or barbeques nor to burn stubble in fire-prone times of the year.

To invest in forest management

An adequate forest management would prevent from large forest fires. It is essential that direct action is taken over the causes of fires in order to avoid repeating the same mistakes in the future. A larger investment in preventive forestry activities is decisive and it should be administered taking into account climate change, favouring genetic diversity and decreasing the density of tree-covered areas. Reducing forest fires is a matter of forestry and nature management. Prevention, planning and preservation are fundamental in order to reduce the number of forest fires and, therefore, their impact in the environment.

To take precautions in hazardous areas

It is recommendable that homes located in fire-risk areas have self-protection plans and comply with a set of standards that prevents them from fires (avoid planting combustible species, avoid building barbeques close to their perimeters or using them in windy and risky days, dispose of waste in appropriate dumps or landfills, etc.). Self-protection plans could include the installation of water deposits or fire hydrants in the streets, keeping surrounding roads free from vehicles and vegetation, etc.

Diagram: management of vegetation near built-up areas

This is an aerial scheme showing the planning of combustible vegetation near constructed areas and roads, carried out in order to help safeguard the integrity of buildings in the event of a fire.

It is important to situate firebreaks around constructions or built-up and recreational areas in order to minimise the spreading of fires; access roads are a good alternative for this matter. These areas must be cleared from flammable vegetation, keeping trees and bushes pruned permanently. It is important that the existing vegetation is kept at a minimum of two heights lower than that of its natural height.

PLANNING OF COMBUSTIBLE VEGETATION NEAR RESIDENTIAL AREAS

HOUSES AND BUILDINGS

Raise environmental awareness

It is important to put forward initiatives that raise real and effective awareness within the population about the risks and the consequences of forest fires, in order to prevent and decrease the number of fires. Promoting an active attitude towards fires is crucial for the population to perceive the risks, take responsibility and acts to prevent and minimise fires.

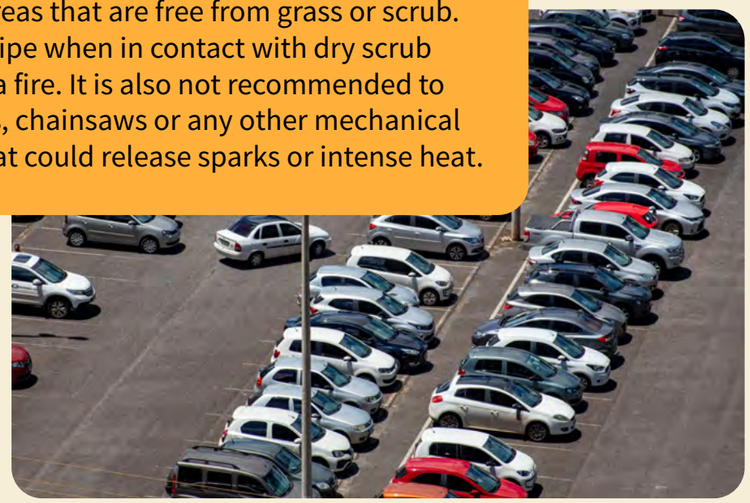
Increasing law enforcement and controls

The existing environmental legislation must be applied at a local, regional and state level regarding fire fighting and prevention, always bearing in mind the climate-change factor. Such plans include the following actions:

- Actions to prevent the causes of fires
- Actions to minimise the extension of affected areas
- Actions with a pedagogical and educational nature
- Actions of surveillance with a preventive and/or a deterrent effect
- Social actions oriented towards the cooperation of citizens and the convergence of different interests
- Forestry-related Infrastructure proposals
- Vegetation treatments

To avoid the use of cars or mechanical devices

Cars or any other combustion vehicles should be parked in areas intended for that purpose or, in any case, in areas that are free from grass or scrub. The exhaust pipe when in contact with dry scrub could lead to a fire. It is also not recommended to use strimmers, chainsaws or any other mechanical appliances that could release sparks or intense heat.



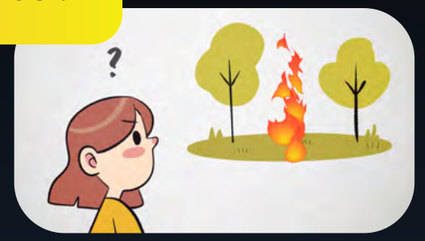
HOW TO ACT IN CASE OF BEING INVOLVED IN A FIRE

Being sufficiently prepared and ensuring an adequate response to forest fires is essential for an effective and efficient management of fires. It is vital to avail of prepared plans and resources before any fire takes place. Responsible authorities must have access to a series of options, know what fires to put out and what mechanisms they should allow in order to control the hazard of fires. They must identify the fires that require immediate action and be clear about coordination and responsibilities.

The **STEPS** you must follow are the following:

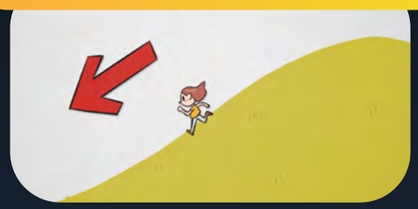
1

Evaluate the situation to decide whether you can help to put it out and call the emergency number.



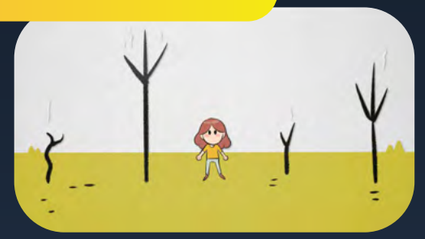
2

Move away from the fire, downhill and against the direction of the wind.



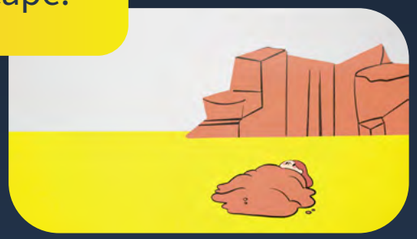
3

Look for an area without combustible materials.



4

Find or dig a ditch if it is not possible to escape.



▹ See more.

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• Authors: Helena Ballart - Pau Costa Foundation Isabel Vázquez - Pau Costa Foundation Sébastien Chauvin - FORESPIR Julia Gladiné - FORESPIR Eduard Plana - Forest Sciences Centre of Catalonia Marc Font - Forest Sciences Centre of Catalonia Marta Serra - Forest Sciences Centre of Catalonia

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ACTIVITIES

With 2 activities sheets focusing on people who work in the forest, the following **Activity Kit** enables any interested student, young person or any other person to learn more about forests and to know some of the professions related to working in the forest.

Naturally, it would be better if everyone could actually go to a forest, be immersed in it and do some of the proposed activities. Since this is not always possible, this activity kit also contains a set of indoor and online activities, which will allow the users to do a virtual “visit” to the forest.

Now, let’s get to know some of the people who work in the forest, what they do, and how they can teach you to better know the forest.

This Activities chapter contains:

Indoor activities

This type of activities helps students to learn in class how to critically think about forests, their resources and the impacts of human origin, working in groups and taking into account two different perspectives of people working in the forests: a forest engineer and a biologist.

Outdoor activities

With this type of activities, students can learn in an outdoor context, through practical exercises in the forest. These outdoor activities can bring students closer to forests and increase their experience regarding some professions related to the forest.

Online activities

The online activities allow students to develop their research skills and promote their curiosity and knowledge about forests worldwide.

ATTENTION, WHEN YOU GO ON A VISIT TO THE FOREST, YOU MUST TAKE INTO ACCOUNT SOME RULES, SUCH AS:

- Take your trash with you or put it a trash bin (if there is one in the forest)
- Don’t make fires in the forest
- Don’t let adults throw cigarettes on the ground
- Protect trees (for example, not damaging the tree bark with a knife or a stone)
- Protect biodiversity - You can take pictures, but not disturb any living beings - they are essential to the forest well-being
- If you see an abnormal situation in the forest, contact the responsible entity by phone or email, according to the emergency level

ACTIVITIES 1 — FOREST ENGINEER

Hello, I’m Simon.

I’m a forest engineer. Everyday I have to make decisions, coordinate, plan, study and support forestry activities linked to production and exploitation of the forest’s products such as timber. I’m also very busy with the protection and conservation of forest and natural resources.

I also do inventories on the type, amount, and location of standing timber and appraise the timber's worth. Sometimes I participate in the determination of how to manage conservation of wildlife habitats, creeks, rivers, water quality and soil in the forest. I also give advice on how to best comply with environmental and territorial regulations. What I like the most about my job is when I have to devise plans for planting and growing new trees, monitor trees for healthy growth, and determine the best time for harvesting.

Since I’m busy with all of this, I’m also responsible for the development and implementation of the management plan for

1 **Activity 1**: Forest for You

General objectives:

Learn to define what is a forest: what are the elements that constitute a forest and what are its functions.

Critically think about how the physical elements influence the functions and resources that can be obtained from a forest.

Specific objectives:

Think about different ways to manage a forest with different purposes.

Establish conclusions on how management shapes what a forest is (or can be).

Establish conclusions on how the physical element present in a forest can (or should) determine its management.

Duration:

45 minutes

Skills:

Teamwork, critical thinking

INDOOR ACTIVITY

Simon tells us that that he is busy with the preservation of forest and natural resources and that he takes care of the forest by managing it. However, he also explains that he has to appraise the forest's timber. So, he has to preserve the forest resources as much as possible while extracting the timber that will be used for a great number of applications. Simon knows very well what a forest is for him.

What is a forest for you?

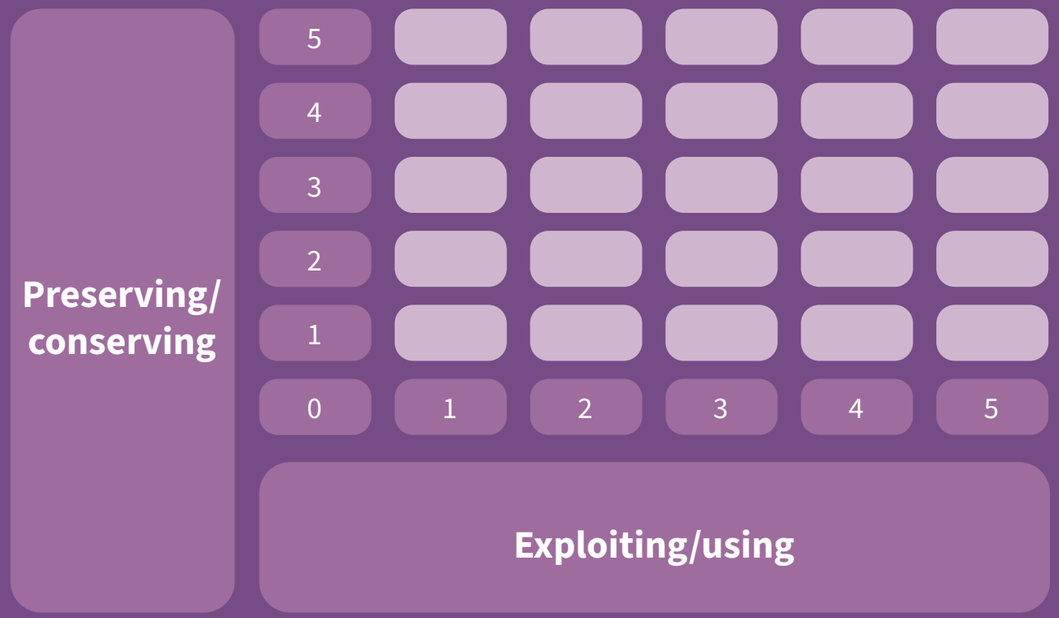
In a small group or alone, please name **10 key words** that represent what a forest is for you:

1. — .....
2. — .....
3. — .....
4. — .....
5. — .....
6. — .....
7. — .....
8. — .....
9. — .....
10 — .....

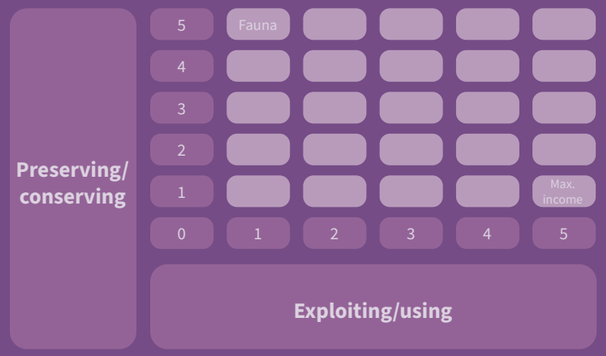
Insert the words into the grid:

If you think that a word is more related to the exploitation of forest resources you can put it at higher score along the "Exploiting/using" axis, and lower along the "Preserving/conserving" axis.

If you think that a word you chose is more related to the preservation and conservation of forests, give it a higher score along the vertical axis and a lower score



Example:



You can now discuss the words and the place you attributed to each one on the grid with your colleagues/ other groups. Here are 3 guidance questions:

1 - Did you find that all the colleagues/groups put similar key words in similar places in the grid?

2 - Can you find patterns in the placement of words?

3 - In short sentences, what are the main conclusions you can draw in relation to Biodiversity, Economy or Social aspects?

Conclusion 1. —

.....

Conclusion 2. —

.....

Conclusion 3. —

.....

2 **Activity 2**: Timber in the Forest

General objectives:

Learn methods to measure trees in order to quantify timber in a forest

Learn to quantify forest resources

Specific objectives:

Learn how to measure the size of an individual tree trunk

Learn how to estimate the number of trees and the quantity of timber in a forest

Duration:

3 hours (outdoor activity) + 1 hour (online activities)

Skills:

Mathematics (circle geometry, solid volumes, averages, measurement units' conversions), Motor skills

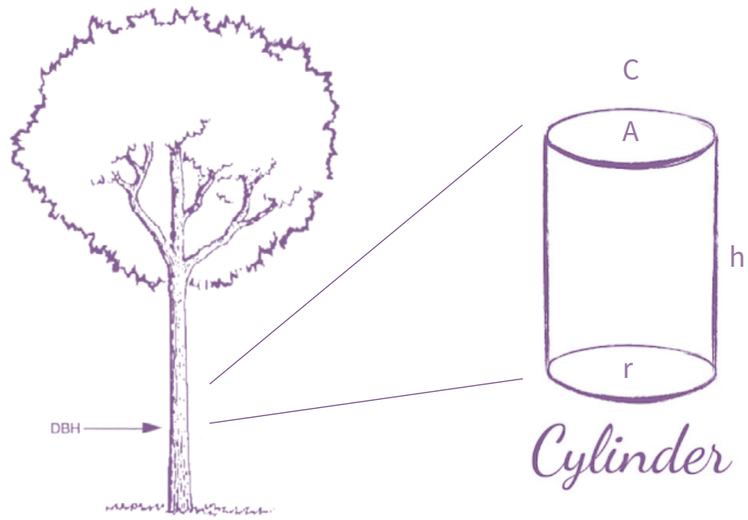
OUTDOOR ACTIVITY

Simon tells us that he does inventories on the type, amount, and location of standing timber. He really needs to know how much wood there is in the forest, that can be used for various applications.

Let's learn how he does this!

First, we need to know how tall the average tree is, and especially how tall the trunk of the tree is.

Material you will need:
- A notebook/laptop/tablet to take notes of your measurements and make calculations
- A measuring tape (25 m)
- A small handsaw
- A rope or string (≈ 100 m)



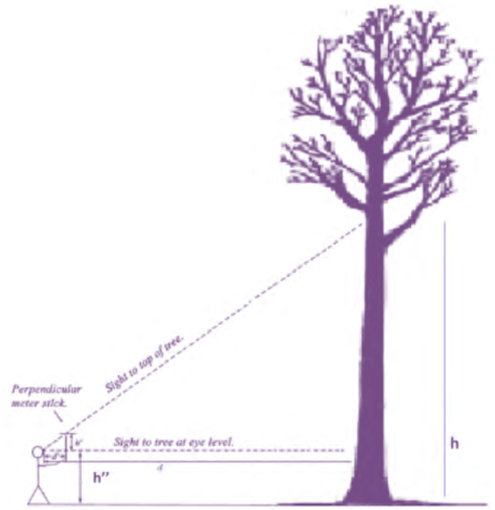
C: circumference
h: height
A: area
r: radius

For the purpose of this activity, assume the tree trunk is a cylinder. But is it though?

Determining the height of the tree, and the height of its trunk

(The same method is used to indirectly estimate the height of anything that you can't measure directly with a ruler or measuring tape)

- Choose the straightest stick you can find and cut it at exactly 1 m of height. Now you have your meter stick. That is the measure we will name ***h'*** **(1 m)**
- Stand from the base of the tree a sufficient distance that will allow you to clearly view the top of the tree trunk, where the treetop starts (the place at top where you would cut the log)
- Hold the meter stick perpendicular with its bottom end at eye level and start walking back and/or forth until the meter stick coincides with the height of the tree trunk. Record the distance from the stick to your eye (basically the length of your arm, which will be measure ***d'***). Remember that your sight passes just above the meter stick and that your stick measures 1 meter.
- Measure the distance between you and the tree using a measuring tape. This will be measure ***d***.
- Measure the height between the floor (it's your base!) and your eyelevel. That's measure ***h''***.



Resorting to your math skills, can you calculate how tall the tree trunk is? Let's see how we can find out measure h !

Use the formula: h= [(h' / d') * d] + h"

Take note:

h' = 1m
d' = ...
d = ...
h'' = ...

Calculate:

h = ...

Calculating how much wood there is, on average, in a tree trunk

a) Assuming that it has a cylinder shape, with the measuring tape, measure the circumference of the tree trunk, at the height of your chest. Starting from the value of the circumference, calculate the area of the tree trunk, imagining that it had been cut. That's area A.

b) Now multiply the value of A by the height of the tree.

.....
.....

There! All done! You now know how much usable wood there is in a tree trunk. In order to do better, go on to "3 Determining how many trees there are in the forest".

c) Repeat these measurements for about 5 trees, and calculate the average. This is our value **Volume_tree**.

.....
.....

Determining how many trees there are in the forest

So many! Don’t worry, you’ re not going to count them all!
We will now use averages to estimate how many trees you have in a given area.
With the measuring tape, measure on the forest floor a square of 20m x 20m. and with four sticks in the ground and the rope/string, limit the area.
Count the number of trees in that square and take note of the number.
Repeat this process at least 3 times in different areas of the forest.

a) Now you must calculate an average. So, on average, how many trees do you have in an area of 20m x 20m?

average number (N) of trees in areas 1,2 and 3: (N1+N2+N3)/3 = NTrees
NTrees/(20 m x 20 m) = NTrees/400 m2 = Average number of trees/400 m2

b) How many trees are there in a hectare? (how many m^2 are there in a ha?)

.....
.....

That is your average number of trees per hectare (ha) NTrees /ha

c) Can we now know how much wood there is in that forest?

.....
.....

Well done! Simon is proud! You now know how to estimate how much wood there is in the forest.

ONLINE ACTIVITIES

Online Activity A

You learned here one method of estimating the height of a tree.
Do a quick search on the internet and see if you can find other methods. Discuss the

Online Activity B

a) In the world:	b) In your country:	c) In your region:
Where:	Where:	Where: .....
How tall:	How tall:	How tall: .....
Species:	Species:	Species: .....
Common name:	Common name:	Common name: .....

ACTIVITIES 2 — BIOLOGIST

Hello, I'm Peter.

As a biologist I study life and living organisms. In my profession we can focus on many things - how an organism has come to exist, how it is generated, how it grows, how it functions, what it does, or where it lives.

A biologist is someone who studies the living organisms also in the context of their relationship to their environment. I'm sure you have heard of biodiversity! That's what I'm most busy with.

Biologists study humans, animals, plants, bacteria, and all other living things you can think of, to gain a better understanding of how the body and nature works, and how external factors may be of influence. Studying these things can be very complex and diverse.

As a biologist working in the forest, I contribute to manage, protect, rehabilitate and enhance habitats so that the forest species of animals and plants can thrive. My duties are therefore varied and can include such projects as building and installing nesting boxes for birds and bats, help foresters protect important habitats from cutting, determine where to do prescribed burning as to not destroy the habitat of rare plants and animals, and much, much more! So, my work is done as to conserve the biological diversity of the forest.

1 Activity 1: Biodiversity for You

General objective:

Learn about biological diversity, what it is and how to define it.

Specific objectives:

Think about what makes up biodiversity.

Establish conclusions on how to relate the concept of biodiversity with the context it occurs in.

Duration:

45 minutes

Skills:

Online research; critical thinking and relational reasoning; Presentation, defense and debate

ONLINE ACTIVITY

Peter tells us that that he is spends his time studying biodiversity.

Do you know what this word means?

Peter knows it very well. But what is it?

Individually or in a small group, **go online** and find 3 different definitions of Biodiversity.

Definition 1. — .....

.....

Definition 2. — .....

.....

Definition 3. — .....

.....

After the research, come up with one definition of what is biodiversity for you.

.....

.....

.....

INDOOR ACTIVITY

You can now discuss the definition you chose with your colleagues/other groups. What can you conclude in regards to defining what biodiversity is?

With your class, discuss what aspects need to be included when you are defining biodiversity and write below the conclusions.
Example: “Species are different from each other.” “There can be significant differences between individuals or groups from the same species.”
(Try to use other aspects)

Conclusion 1. — .....

.....

Conclusion 2. — .....

.....

Conclusion 3. — .....

.....

Conclusion 4. — .....

.....

2 **Activity 2**: Biodiversity for You

General objective:

Observe the concept of biodiversity in practice, looking for species in a forest and experiencing what is like to be a biologist working in a forest.

Specific objectives:

Observe different species in different environments.

Identify different species that occur in the forest.

Duration:

1hour and 30 minutes

Skills:

Observation skills, empathy, collaboration skills, technical skills (related to Biology), fieldwork experience

OUTDOOR ACTIVITY

Peter tells us that he studies living organisms.

Let’s help him out, finding as many different species as we can.

Material you will need:
- Printed checklist (see 1., below) or tablet/smartphone with editable checklist
- Notepad and pen
- Bag to collect plants or plant elements.
- Species identification guide (can be general or specific to a group - plants, birds)

1 - Let's make a checklist so we don't forget to look for any group of species:
Example: you can add other sections if relevant

Plants	Yes/No	If yes, where?	Species (if you know)
Trees			
Shrubs			
Aquatic plants			
Herbaceous plants			
Algae			
Animals	Yes/No	If yes, where?	Species (if you know)
Birds			
Mammals			
Amphibians			
Reptiles			
Fish			
Insects			
Mollusks			
Crustaceans			
Footprints or other marks			
Mushrooms* (see question below)	Yes/No	If yes, where?	Species (if you know)
Other living organisms	Yes/No	If yes, where?	Species (if you know)

2 - In the forest, look for all the different organisms you can find and fill out your list with the species and where you found it
Example: flying in the sky, on a tree, in a pond, etc.

3 - Comparing notes: compare your registries with the ones from your colleagues. Who found the most species and where?

4. Individually or in a small group: Collect in a responsible way elements/samples from the plants that will later help you identify them (see online activity in Activity 3).
Tip: collect leaves, or flowers (if they have them), or fruit (pinions, for example). As an alternative to obtaining samples from other species, you can also take pictures and make an album.

ONLINE ACTIVITY

Use your creativity to share the pictures you took in exercise 4 from the previous activity, on social media. Don't forget to use the hashtags #careforest, #biodiversity and #environmentaleducation!

3 Activity 3: Your plant guide

General objective:

Learn to identify, organize and classify species.

Specific objectives:

Make a quick plant identification guide to use in the forest;

Classify samples of plants by species;

Exploring the concept of native and exotic species.

Duration:

1hour and 30 minutes

Skills:

Online research; Motor and handicraft skills

ONLINE ACTIVITY

Let's identify the samples of plants you collected in the forest, on Activity 2.

1 -Go online and search for methods that will help you identify the plants that your samples (leaves, flowers, fruits) belong to.

.....

.....

2 - Once you found a method you are comfortable using, use the samples to start identifying the plants.

Make a list

Plant 1:

Common/local name: .....

Scientific name: .....

Plant 2:

Common/local name: .....

Scientific name: .....

Plant 3:

Common/local name: .....

Scientific name: .....

Plant 4:

Common/local name: .....

Scientific name: .....

3 - Label all the samples with the correct name and organize them.

4 - Now classify the plants you identified as native (if they are native to your country) or exotic (if they are non-native). If the plant is exotic, you can classify it as invasive* or non-invasive.
Again, use your online research skills to find this out!

*What is the definition of an exotic invasive species? What is the problem with them?

Peter tells us that he studies a lot of different organisms in the forest.

Let’s help him out in identifying those with leaves or flowers, such as trees, shrubs or grasses.

Let’s build a quick guide with the elements/samples we collected from the forest!

Material you will need:
- Laminating sheets, laminating machine OR transparent self-adhesive film roll
- Scissors
- Sticker labels
- Key-rings

Let’s identify the samples of plants you collected in the forest, on Activity 2.

1 -Gather the organized botanical samples that you collected in the forest.

2 - Make nice clear labels to accompany each of the samples you’re including in your quick guide, with the information you organized in the previous online activity.

3 - Together with the label, put the leaves or flowers within two laminating sheets.

4 - Put the two laminating sheets through the laminating machine.

Note: If you don’t have a laminating machine, use the transparent adhesive plastic film to seal the leaves or flowers between two sheets with the label. (see the example picture below).

5 - You’re all set! Now you have a nice tool to identify all the most interesting plants in the forest, while knowing if they’re native or exotic.

Enjoy, and don’t forget to bring it with you next time you visit a forest!

CAREFOREST

e-book