Forest in Austria






MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

BFW. bfw.ac.at

BFW. Austrian Research Centre for Forests

PHOTO: BAYERISCHER WALD NP

Contents

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Our forests are doing well!

Austria is a country of forests. The manifold services provided by the forest and wood sector are essential for a bright future of our rural areas. Forests are an important economic factor, are working area ensuring green jobs, protect the population from natural disasters, are suppliers of energy and have a positive impact on the climate. Forests are important repositories of biodiversity, are living environment for animals and plants and are used for recreational purposes.

Global climatic changes are challenging our forests. Extreme weather events led to massive bark beetle invasions in summer 2015. Timely and substantial measures were taken and kept the negative impacts down.

Forest monitoring is crucial to ensure the stability and health of forest ecosystems. The revised national forest inventory of 2016 will provide sound data for decision making processes in time of climate change. Austria's forest monitoring programme is advanced in its technique and role model for many other countries. It guarantees a constant supply with information on our forest resources and sustainable forest management as well as biodiversity and air quality. It is also a measure to control forest pests in the years to come.

Austria needs resilient and vital forests. Their ecological, economical and social benefits are of inestimable value.

PHOTO: BMFLUW, STRASSER ROBERT

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

Andrä Rupprechter
Federal Minister for Agriculture, Forestry, Environment and Water Management

About us

Six research departments

Two forest training centres

With about 13 450 course participants per year

281 staff
(176 men, 105 women)

22.4 million Euro turnover

Austrian Research Centre for Forests

The Austrian Research Centre for Forests' (BFW) mission is to improve knowledge on forest ecosystems, enhance communication on the importance of sustainable forest management, and to raise awareness about protection against natural hazards, and nature conservation.

Forest Management | BFW aims to support forest owners and foresters in every day decision making by providing science-based information and training opportunities. Forest health, soil sciences, forest genetics, and implementation of silvicultural methods are some areas of BFWs' expertise.

Forest and Climate | Climate change poses new challenges for Austrian forests. Future changes to forest sites and habitats need to be taken into account in the selection of future tree species.

Forest and Water | Forests and water are inextricably linked, primarily through the filtering effect that forests provide. The effects of climate change means that this aspect is growing in importance, especially in regard to drinking water supply and the prevention of natural hazards.

Forest and Biodiversity | BFW has long-standing experience in the field of biodiversity research, for example the Austrian Natural Forest Reserves Programme. The Austrian National Forest Inventory is also an important instrument in the monitoring and maintenance of diversity.

Forest and Natural Hazards | The protective function of forests against natural hazards such as avalanches, flooding, erosion, or landslides is of increasing importance due to climate change and population growth.

We know all about forests!

Did you know that the region of Lilienfeld in Lower Austria is the district with the highest tree density in Austria, or that the Nothburga-spruce in Tyrol has a height of 58 meters and is therefore the highest tree of the country?

Almost half of Austria is covered with forests and the forest area is still increasing – owned by private owners (82 per cent) and the public (18 per cent).

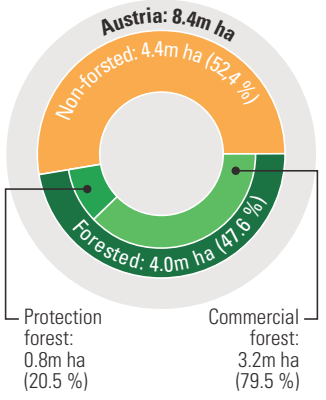
The Austrian Research Centre for Forests (BFW) offers consulting, applied research, monitoring and educational services. BFW carries out the national forest inventory and manages the comprehensive data on forests in Austria. Our vision is to make the outcomes of our research available to everyone. We aim to share knowledge on the manifold benefits of forests and their ecosystems.

The national forest inventory provides up to date data – we therefore know for sure: 3.4 billion trees are growing in Austria and 65 tree species can be found in the forests.

Forests have multifunctional roles: 145 000 forest owners make their living by managing their forests. Forests are important natural measurers to prevent and control natural hazards as avalanches and flooding. They are high in biodiversity and are often visited for recreational uses. True nature experience is often just to be found in forests.

I wish you an interesting read,

Peter Mayer
Director Federal Research and Training Centre for Forests, Natural Hazards and Landscape



Forest area in Austria

Austria has a total land area of 8.4m ha. Approximately 4.0 m ha is forested land (47.6 per cent). This means that almost half of the country is covered with forests. According to the Austrian Forest Act wooded land is counted as forest if it has a minimum area of 1000 m², and a width of at least 10 metres. Furthermore, woody species have to provide a canopy cover of at least 30 per cent.

△△ More wood is growing than is being harvested in Austrian forests each year.
△ Almost half of Austria is covered by woodland. Almost 4/5 of this area is commercial forest.

Austria consists of 9 federal provinces. The province of Styria has the highest forest cover with 61.4 per cent of the land, followed by the province of Carinthia (61.2 per cent). The capital city of Austria is Vienna and - with a forest cover of 21.7 per cent - is one of the greenest cities in Europe. 20.5 per cent of the forests in Austria (820 000 ha) are declared as protective forest.

How many trees per person?

Austria has a total population of 8.7m people. That implies 0.5 ha woodland per inhabitant for recreational use. Today there are about 3.4 billion trees in Austria; this means a total number of 391 trees per Austrian!

Forests are growing

In Austria, the increment of the stocked timber is higher than the harvested volume per year. This is mainly due to the fact that former agricultural land - such as mountain pastures, grazing land or meadows – have again become forest. Woody species also recolonise non forested slopes, deforested areas after soil slipping, swamps, and rocky areas or block fields. Even landfills are becoming reforested.

Ecosystem services

Forest ecosystems regulate climatic conditions, they are important sinks of greenhouse gasses, they ensure biodiversity, and provide areas for recreational use. Forests regulate the drinking water supply of many regions, thus ensuring permanent high quality drinking water. Forest cover helps control spring discharges and drainage of creeks. Trees are therefore inevitable for a sustainable supply of high quality drinking water.


Population of Austria (01.01.2016): 8.7m

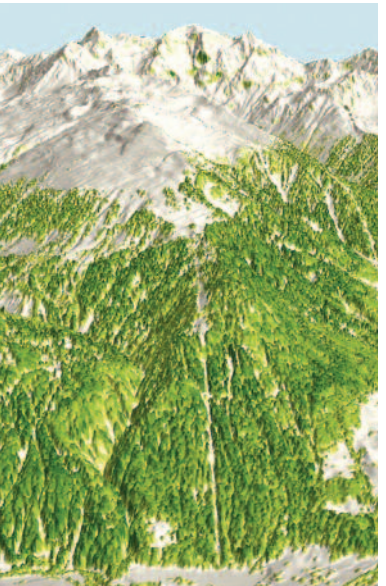

Trees in Austria: 3.4bn (65 different tree species)


391 trees per Austria

We know all about forests !

www.waldzahlen.at

PICTURE LEFT: LANDESVERMESSUNGSAMT FELDKIRCH & STAND MONTAFON FORSTFONDS



National Forest Inventory - You see the wood for the trees

The national forest inventory has provided updated facts and figures on Austrian forests for over 50 years. The condition of Austrian forests is constantly measured and monitored at 11,000 plots. Knowledge is gained on quantities of the stocking volume, resilience of forest ecosystems, as well as the structure and dynamics of forest stands. This information is important for decision making and national forest and environmental policy processes.

△ Flying high –
The Austrian invention "Relascope" is used for measuring trees

◁ Tree height models: first promising results of terrestrial laser scanning methods (Markus Hollaus, 2006)

High technical performance

The logistical aspects of national forest inventories are not to be underestimated. 25 foresters are working in the field from April to October to measure forestry stands every year. When all 11,000 plots are visited and examined the cycle starts again. In the meantime, the data is processed and evaluated at BFW. Modern tools and up to date technical methods are used to collect and assess the information. This perpetual inventory system is continuously adjusted to international reporting obligations related to biodiversity and the Kyoto protocol.

The right combination

In order for the results to be accessible to different target groups, the raw data must be appropriately converted. Validation checks and statistical extrapolations are implemented, similar to those during election polls. Data from field work is supported by remote sensing and satellite imagery. The collected information is then transferred and altered with mathematical formulas to make a holistic overview on Austrian forests possible. The national forest inventory is implemented on behalf of the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management.

We care about the forest!

www.waldinventur.at

All trees placed end to end would form a line of more than 50 million of kilometres. This is equal to 1220 times the equatorial circumference

PHOTOS: ELISABETH JOHANN

The historical context

First interventions in forest ecosystems took place when hunters, fishers and collectors cleared forests to collect fuel material in early times. Later slash-and-burn methods for agricultural clearances caused decreased forest cover. Large forest areas were cut for agricultural uses, shipbuilding and ironworking in roman times and settlement. The collapse of the Roman Empire led to a decline in population and made reforestation of land areas possible.

△ Historical illustration of forest operations: clear-cut without utilisation concept

◁ Historical copper engraving

City versus Forest

Foundations for urban settlements and intensification of mining business triggered clear cutting activities. Innovations in harvesting methods led to increasing exploitation but also less timber waste.

In the 18th and 19th century, overexploitation of forests due to the need for more construction wood caused an increase in natural disaster occurrences, such as avalanches and flooding. The occurrence of these events led to the regulation of forests by law and the concept of sustainable forest management. Intensive afforestation at the beginning of the 19th century led to the increase of forest areas which continues to this day, with a preference for conifer species - especially spruce and pine.

▷ Photo of forest operations near Gmunden (Upper Austria), beginning of the 20th century

Forest and climate – The green lungs of Austria

Forests can act as an umbrella, a filter, and a water reservoir in climate cycles. It collects rain and evaporates part of it. Needles and leaves hold water and send part of it back into the atmosphere via evaporation. In coniferous stands this can make up 50 per cent of the rainfall amount and 30 per cent in broad-leafed forests. This means in a rainfall of 1000 mm, 500 mm to 700 mm arrives on the ground; a small part of which joins the surface runoff.

△ One hectare forest evaporates between 20,000 and 60,000 litres of water daily (Gleirsch Halltal Kette, Karwendelgebiet, Tirol)

◁ Forest soils store water. This is important to reduce risks of flooding.

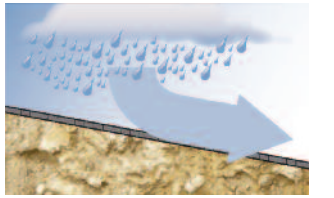
Forest balances regional climates

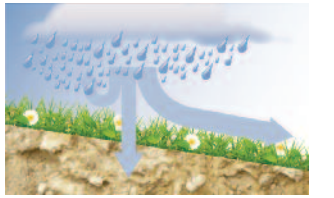
Forests belong to the vegetation forms with the highest water use due to transpiration. Trees can evaporate 20,000 to 60,000 litres of water per hectare during hot summer days. In this way the forest balances the microclimate of complex ecosystems. Austrian Forests cannot be seen – in contrast to tropical rain forests – as "rain makers". But they are important in keeping soil moist and fertile. The relative humidity of air is up to 10 per cent higher in forest areas than in surrounding areas.

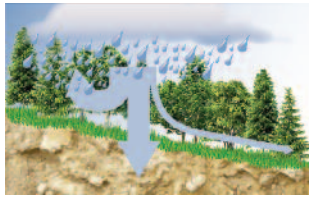
Addressing climate change

BFW applies modern climate modelling techniques and monitoring programs to learn more about the future effects of climate change on forests. The importance of applied research results in this field cannot be underestimated, to prepare practitioners and adapt forest management methods. Researchers from across the alpine region work together to learn about future challenges.

Climate change will have various impacts on forest ecosystems. Events of extreme weather are leading to regional uncertainties and outbreaks of forest insects and pathogens. This means that alpine regions will face different problems in respect to climate change (e.g. increasing number of avalanches and debris flows) than lower altitudes (e.g. more frequent drought).







The condition of soil surface is important for the drainage:

- Sealed areas – large amounts of water runoff
- Grass lands – smaller runoff amounts
- Forest lands and vegetation – minimal amounts of run off

Natural Hazards – Forests and their guardian spirits

21 per cent of Austrian forests have a protective function against natural hazards. Protective forests minimize risk of avalanches or rock fall. Protective forests can even prevent entire slopes from sliding.

△ A good grip: healthy forest can prevent dangerous rock fall.
◁ Forests are highly important in preventing avalanches: they can almost entirely prevent the breaking away of snow packets

Slope, elevations, soils

The most important factor is the gradient: the steeper the slope, the higher the risk of natural hazards. Altitude is a crucial indicator for the risk of avalanches. The more snow in higher altitudes the higher the risk of descending avalanches. Most of Austrian protective forests are located at an altitude between 1300 metres and 2000 metres.

But how do forests reduce the risk of avalanches? Part of the snow is intercepted by the canopy of the trees, and tree trunks prevent the snow cover from sliding.

The condition of the forest soil and vegetation is also relevant for the prevention of flooding and debris flows, as they regulate the runoff of rainfall.

Improved protective function

The complex subject of forests with protective functions is influenced by many different aspects, such as the type of risk or the type of forest. The stability of the protective function depends on tree species and structure of stand. Many and thicker tree stems are for example better for preventing avalanches. Tree species should be long-living, adapted to the climate and regenerate after wounding. Such species are: Swiss pine, larch, spruce, fir, pine, beech and sycamore.

In order to preserve their protective function, necessary measures and management is important in order to secure timely regeneration in protective forests.

Department of Natural Hazards

bfw.ac.at/naturgefahren

820,000 hectares of Austrian forests are protective forests. This is equivalent to the combined area of the provinces Salzburg and Vienna.

PHOTOS: WIKIPEDIA.ORG

Natural forests and their biodiversity

More than half of all species can be found in forest ecosystems worldwide. For this reason forests are often called biodiversity hotspots. Natural forests provide habitat for many rare species, for example Euphorbia saxatilis, which can only be found in the Austrian pine forests of Lower Austria; or the rare alpine salamander (Salamandra atra) which is mainly found in mixed and conifer forests. Documentation of the development of forest stands is important to preserve biodiversity. The Natural Forest Reserves Programme lead by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management has made an important contribution to protecting and increasing biodiversity in forests, and simultaneously provides a basis for their sustainable existence and the fulfilment of their services.

△ Humid mountain forests are preferred habitats of the Alpine salamander.
◁ The *endemism Euphorbia saxatilis* occurs in the northeast of Austrian Limestone Alps.

Natural forest reserves in Austria

The Natural Forest Reserve Programme was established in 1995, with the objective of supporting the biodiversity of natural forest stands. 195 natural forest reserves exist in Austria, covering an area of 8,403 hectares (as of 2015). This is a total of 0.15 per cent of Austria's forest area. The objective of the applied research is to further develop close to nature and ecologically oriented Silviculture. Natural forest stands are good examples of natural forest ecosystems and reference areas for assessments on biotopes and ecological inventories. Good documentation is needed to compare natural and managed forest stands.

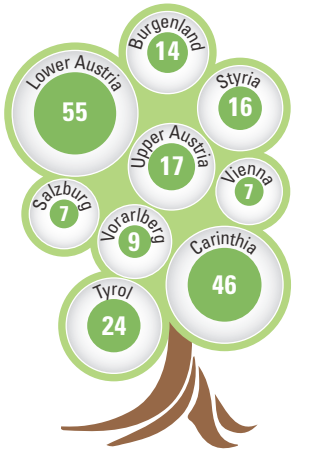
118 forest ecosystems in 22 growth regions

There are about 118 forest ecosystems in 22 growth regions in Austria. Each forest ecosystem represented in one of the 22 regions should be protected by a natural reserve. A close cooperation with forest owners is crucial to realize this voluntary approach. It is important that forest owners identify themselves with the programme and natural forest reserves to guarantee a long-term success of the project.

Natural Forest Reserves in Austria

www.naturwaldreservate.at

Zahlenspiel



195 natural forest reserves in Austria

PHOTO ABOVE: MARKUS MAUTHE/GREENPEACE, PHOTO LEFT: WWW.STADTDATENBANK.DE

Presumed dead but living longer – Deadwood and biodiversity

In past times deadwood was removed from forests. Today it is common practice to leave part of the deadwood in forest ecosystems as it provides important habitats for many organisms, such as fungi, mosses, beetles or birds. There are about 1350 beetle species in Central Europe, living in dead-

△ Deadwood is an important habitat for small animals like beetles, birds and bats

◁ Woodpeckers are called architects of the woods. Their nesting holes are often inhabited by other animals

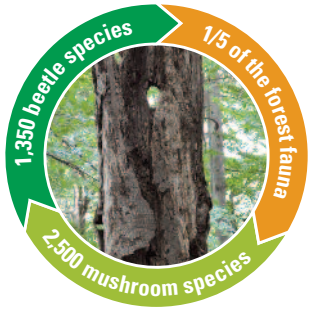
wood and breaking down the material; for example the great capricorn beetle (Cermabyx cerdo) or stag beetle *(Lucanus cervus*). Deadwood loving species prefer different kinds of dead material – standing or lying deadwood, in shade or in the sun, with bark or without bark, or diverse stages of decay. Woodpeckers and bats for example need standing deadwood to form their nesting holes, reptiles use lying deadwood for hiding or winter habitat. Pine martens, dormice and squirrels also live in deadwood.

Slowly increasing

But how much deadwood should be left in forest stands? It is recommended to leave 10 per cent of the total growing stock volume in the forest (about 30m²/ha), as the number of species only slowly increases after this amount. Deadwood patches can be maintained away from visitor paths, to avoid accidents caused by falling branches. In order to achieve the optimal tree age for this purpose (Beech 180 years, Oak 300 years), avoiding the harvest of individual older trees is recommended at a regional scale.

Forest protection worlds apart

Forest protection is often an intersection between biodiversity protection and forest management. Removal of deadwood from forests, or "clean forest management", leads on the one hand to less material for organisms living in deadwood habitats, but on the other hand minimizes the risk to forest health of neighbouring stands. But there are areas where forest protection and biodiversity protection can also benefit from each other! Therefore a balance between "clean forest management" and the leaving of deadwood in the forest for biodiversity reasons is important and needs to be constantly assessed.



Deadwood is livelihood for many species, which keep the forest healthy through their diversity.

PHOTO : PRO HOZ, MARTINEZ

Sustainably managed timber stock: Finding a balance between growth and utilization

At the turn of the millennium the growing stock volume in Austria had already exceeded the billion mark. One decade later the growing stock volume has reached 1.135 billion cubic meters of standing timber in Austrian forests, which has coincided with a growth in the forest area. The volume increased by 13 cubic metres per hectare, however this increase is only half of that in the 90s (30 m³/ha). Reasons for the lower growth rate are intensified logging activities (25.9 billion cubic metres per year)* and a reduced increment (30.4 billion cubic metres per year).

△ Wood is an essential material for construction and fuel known for thousands of years

◁ Forests are working areas: Green Jobs are guaranteeing ecological sustainability in Europe

Strengthening wood utilization

A yearly increase in timber logging activities of 2.1 cubic metres per year was caused by favourable wood prices and successful efforts to promote biomass as a source of energy. Major storm events during the last 10 years have also lead to further increases in wood utilization. An increment in stocking timber volume in small forest properties is expected, but only if no major large-scale calamities lead to over-utilization.

The latest research results indicate that an increase in logging activities until 2020 is possible. This will benefit both the energy sector - which aims to replace fossil fuel with renewable forms of energy - and the forest industry, which can bring more products sourced from Austrian timber to the market.

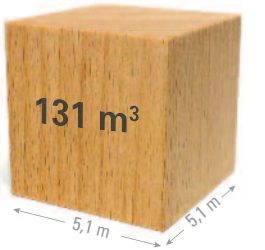
Calculation example

How many cubic metres of wood does a tree with 40 centimetres diameter, measured at breast height (1.3 m) contain?

Empirical formula:

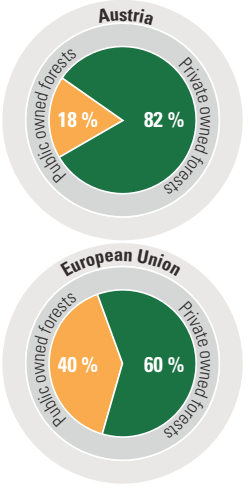
$$\text{Cubic metres} = \frac{\text{diameter}^2\ (\text{cm})}{1000}$$

The solution is 1.6 cubic metres.



Austria has 8.7m inhabitants. This means 131 cubic metre of wood for every Austrian! This is equal to a cube with 5.1 m edge length.

* 17.75 cubic meter timber have been harvested on an annual average between 2011-2015 (Holzeinschlagsmeldung 2015, BMLFUW 2016)



Who owns Austrian forests?

82 per cent of Austrian Forests are privately owned by about 145000 forest owners. This area covers a total of three million hectares of woodland. Forests in Austria are public domain. Everybody is allowed to access and enter forests for recreational purposes, as stated in the Forest Act of 1975. This access can be restricted during hunting or logging activities or on rejuvenated woodland. Before 1975 only forest owners could enter forests.

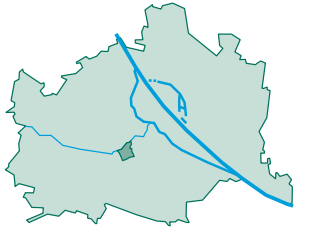
△ Forests in Austria are public domain since the forest act of 1975

Ownership structure – Small scale forests to big forest holders

Private ownership in Austrian forests can be broken down as such: 50 per cent own less than 200 hectares (small scale forests), and 22 per cent own more than 200 hectares (big forest holders). 10 per cent of Austrian forests are owned by communities, for example agricultural co-ops. 18 per cent are state owned. The Austrian federal forests (ÖBf) manage 15 per cent of the national forest area. Demographic changes have led to a decrease in the number of full-time farmers, and to an increase in the percentage of non-farmers as forest owners. This leads to a shift in perception on forest management and forestry.

Forest property in EU 28

Only Portugal has more private owned forests within the EU (93 per cent). Austria is in second place, followed by Sweden (80 per cent), France (74 per cent) and Spain (70 per cent). 16 million private forest owners own 60 per cent of the European Union's forest area.



The area of 200 ha is equal to the area of the 5th Viennese municipal district.

PHOTO ABOVE: FRED FOKKELMAN I FREEIMAGES.COM, PHOTO LEFT: AGRARFOTO.COM

Forest for recreation

For the majority of Austrians, forests are an important part of their cultural identity. A survey carried out by the market research institute GfK Austria found that 70 per cent of those polled are proud of Austrian forests. But not only economic or ecological aspects matter – forests as recreational areas are an indispensable commodity for leisure activities. Almost 40 per cent of the surveys participants claimed to visit the forest at least once per week for recreational purposes. Affinity to nature is reflected in people going for walks, picking mushrooms and berries, and children playing in woodlands.

△ Forests with its diverse elements provide many recreational uses
◁ Forest pedagogic – the understanding of nature should be encouraged from a young age

Forest Pedagogic in Austria

Only those who truly understand the value of nature will care for it. To stipulate this highly relevant message, it is crucial to already teach children the importance of forests and nature. BFW has been a leading body in establishing forest pedagogics in Austria. State certificate training modules for forest pedagogic are offered at the BFW training centres Ort/Gmunden and Ossiach.

Working together

The interests of forest owners and visitors can differ widely and can lead to misunderstandings and conflicts. Opening forest roads for mountain bikers is for example still a debated topic in Austria. Finding common solutions in an open dialogue, with participatory processes, is a good way to facilitating understanding and agreeing on new solutions. For the forest is and shall remain to be an important oasis of recreation for many of us.

Forest Pedagogic

Forest Training Centre Ort I www.fastort.at
Forest Training Centre Ossiach I www.fastossiach.at
Educational and adventure programmes I www.schulewald.com
Association "Waldpädagogik in Österreich" I www.waldpaedagogik.at

A survey found that 27 per cent of forest visitors stay there between one to two hours. 21 per cent stay in the forest for 45 to 60 minutes.

PHOTO LEFT : AGRARFOTO.COM

Glossary

The **diameter at breast height** (DBH) stands for the diameter of a tree at 1.3 m above ground.

Endemism describes an animal or plant, exclusively found in a regional area.

△ Austria has 4m ha of forested land, almost half of the country is covered with forests – 820 000 ha of this area are protective forests. The forests are owned by about 145 000 forest owners. The current volume of standing timber is 1 billion m^3.

Calamities are large-scale natural disasters, causing extensive damage to forest areas. Calamities can be caused by severe weather, storms, diseases or insects.

The "**close to nature**" approach is a forest management method, oriented towards natural forest ecosystems with little human interventions.

Two kind of **protective forests** are differentiated in Austria: forests protecting the forest site and forests protecting objects, for example human settlements or cultivated soil. Protective forests minimize the risk of natural hazards and damaging environmental impacts.

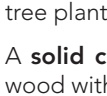
A **steep slope** is a mountain slope with an average gradient above 60 %.

Utilization of **forest litter** is the agricultural use of forest foliage and branches as a fertilizer. Intense harvesting of litter can lead to disturbances in forest ecosystems, especially harming the soil.

The **canopy cover** is the area in forests covered by tree crowns. It is an indicator for the protective function of forests.

Regeneration means the re-growth of forest stands. You can differ between natural and cultivated regeneration through tree planting activities.

A **solid cubic metre** of wood is equal to one cubic metre wood without any gaps in between.



1 hectare = 10.000 m²
1 km² = 100 hectare