WKO
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Active Forest Conversion

Use Wood, Protect the Climate

Bioenergy EUROPE

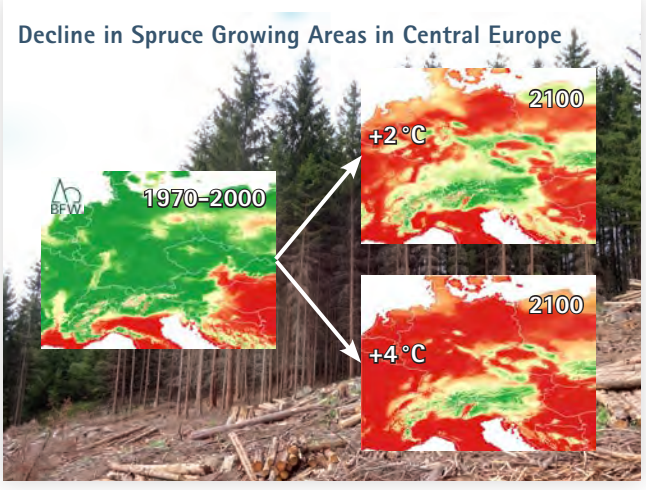
Österreichischer Biomasse-Verband
Austrian Biomass Association

With support of
Federal Ministry
Republic of Austria
Agriculture, Forestry, Regions and Water Management

www.biomasseverband.at

Forest Conversion into Climate-fit Forests

Climate change is putting our forests under pressure. Many tree species cannot cope with rising temperatures and increasing drought. Active forest conversion can transform endangered pure coniferous stands into climate-fit, structured and species-rich mixed stands. Using our large wood stocks reduces the vulnerability of forests to calamities, stores carbon in wood products over the long term and replaces fossil-based building materials and fossil fuels. In contrast, restrictions on use focusing on building up maximum carbon stocks in the forest, should be considered a high-risk strategy.



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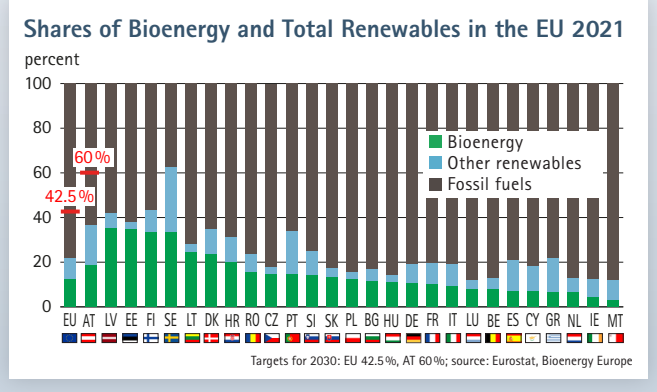
With climate warming, the areas suitable for growing spruce trees are declining sharply – the Alps remain a refuge.

© FAST Pichl

Active sustainable forest management creates climate-fit forests; bureaucratic hurdles hinder forest conversion.



The EU intends to increase the share of renewable energy from 22 % to 42.5 % by 2030, however, without bioenergy – impossible.

Climate Change Means Forest Change

Forests are particularly affected by climate change due to their long lifespan, but are too slow to adapt to its impact. Extreme weather events such as long dry periods, (summer) storms and heavy rains are becoming more frequent and more intense. Forest fires are also increasing. A further temperature rise of 1.4 °C is very likely in Austria by 2050. Pure coniferous stands in eastern Austria and in the lowlands are particularly prone to calamities. Forest owners are required to actively convert their forests into stable and structurally rich mixed stands of vital and site-adapted individual trees in order to be able to prevent disasters caused by drought, bark beetles or windthrow. In dry locations in particular, pure spruce stands should be replaced by the broadest possible mix of tree species that are less affected by higher temperatures and water shortages, such as oak, fir, larch, beech, valuable hardwoods, birch and Douglas fir.

Bureaucratic Hurdles from Brussels

While forest owners who are severely affected by the effects of climate change have to actively convert their forests, bureaucratic requirements from Brussels are restricting sustainable forest management. With an extensive set of rules, the EU wants to strengthen biodiversity and climate protection as part of the European Green Deal. In addition to the EU Forest Strategy, these rules include the EU Biodiversity Strategy, the Renewable Energy Directive (RED III), the Deforestation Regulation (EUDR) and the Nature Restoration Law. The Biodiversity Strategy for 2030, for example, aims at creating protected areas on at least 30 % of the land and marine areas; strict protection should be applied to 10 % of the area. A pilot phase, carried out at the beginning of 2024, showed that the proof of origin, which is required in the Deforestation Regulation for every delivery of wood along the value chain is impractical.

EU Goals: not without Bioenergy

Due to increased amounts of damaged wood and intensive forest conversion measures to more deciduous and mixed stands, ever larger quantities of energy wood are entering the market. As part of the Renewable Energy Directive RED III, the European Parliament recently tried (without success) to deny the climate neutrality of the use of wood for energy and to no longer consider biomass as a renewable energy source. At the same time, the target for the share of renewable energies for 2030 was increased to 42.5 %. Since the share of renewable energy in the EU reached only 22 % in 2021, this target corresponds to almost a doubling. Bioenergy accounts for about 56 % of renewable energies in the EU; without biomass, the share of renewables would not even reach 10 %. Thus, the EU's targets for renewable energies cannot be successfully implemented without bioenergy.

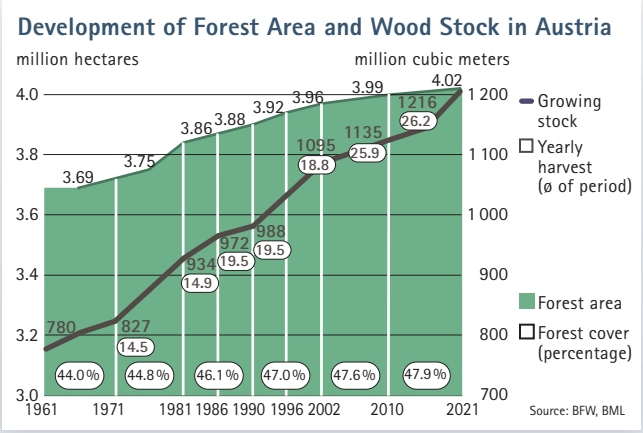
The State of the Forest in Austria

Wood Stocks at a Record High

Austria is one of the most well-wooded countries in the EU. With an area of 4.02 million hectares and a proportion of 47.9 %, forests cover almost half of the federal territory. Since the beginning of the Austrian Forest Inventory in 1961, the forest area has increased by 330 000 hectares. Growing timber stocks have since risen by 50 % to a record high of more than 1.2 billion cubic meters. Forests are managed multifunctionally with regard to their utility, protection, welfare and recreational functions. Approximately one fifth of the forest area is subject to compulsory management as protective forest. In the long term, the level of wood harvest in Austria lies significantly below the increment. In small private forests up to 200 hectares, average timber stocks have increased particularly sharply over the last 30 years: from 290 cubic meters to 357 cubic meters per hectare.

More Large Trees and Deadwood

Large diameter trees and deadwood are a habitat or source of food for many forest organisms. Austria's forests show a positive trend: since the 1990s, the stock of large trees with a diameter at breast height (dbh) >50 cm has quadrupled. Already 27 % of the total wood stock in Austria consists of trees over 120 years old. The average volume of standing deadwood in the productive forest has doubled in the last 30 years and is now around 10 m^3/ha. However, there is a regional shortage of deadwood (especially in the northern Alpine foothills and the Pannonian lowland).



The growing stock in Austria's forests has risen by 50 % since the 1960s – despite an increase in use and calamities.

© Schildorfer

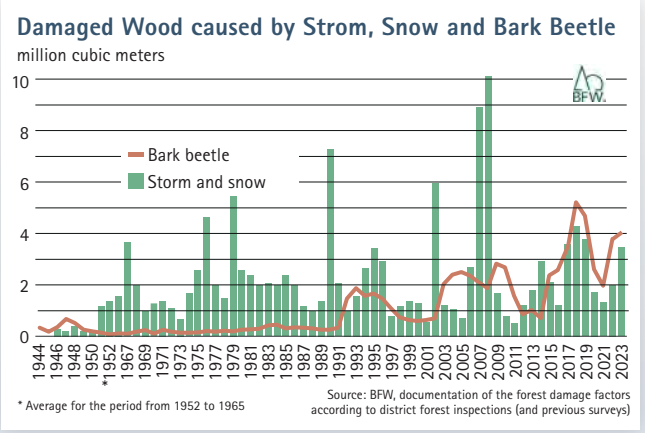
The stocks of deadwood and large diameter trees in Austria's forests have increased significantly in recent decades.

Climate Change Harms the Forest

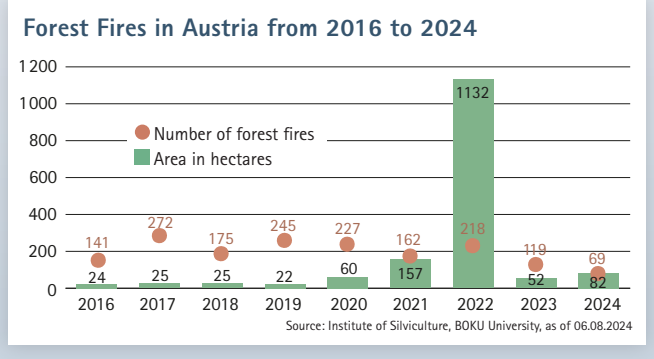
Global warming is becoming increasingly noticeable in Austria. 2023 was (together with 2018) the warmest year in Geosphere Austria's 256-year series of measurements, with an anomaly of +2.5 °C from the long-term average from 1961 to 1990. Due to heat and drought, there was a dramatic increase in bark beetle damages from 2015 onwards, initially with a focus in northeastern Austria, reaching an unprecedented level of 5.2 million m^3 in 2018. From 2022 onwards, the main areas affected shifted to Carinthia and East Tyrol. In 2023, the amount of bark beetle-infested wood nationwide totaled around 4 million m^3, the third highest value ever recorded (documentation of the forest damage factors by the Department of Forest Protection, BFW). Most of the damage was caused to the spruce, but many other tree species are also suffering from drought stress.

Forests are Becoming More Diverse

Norway Spruce dominates the Austrian productive forest, covering 48 % of the area. However, due to windthrow, bark beetle infestation and forest conversion caused by climate change, the area covered by spruce is declining sharply, although this species is part of the potential natural forest community in over 60 % of the productive forest. The forest area covered by deciduous trees has increased and already amounts to 25 % of the productive forest. The biodiversity index for the forest shows a positive trend for tree species diversity, deadwood and veteran trees.



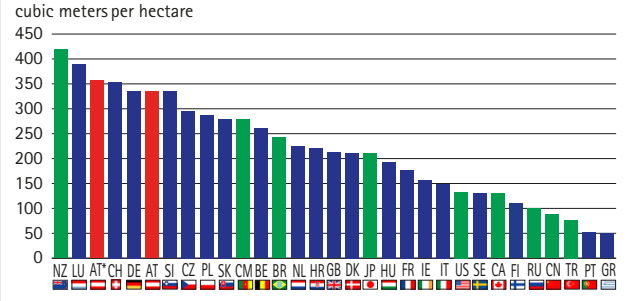
Extreme drought has led to a record amount of bark beetle wood in recent years – in 2023, a total of 4 million m^3 was reached.



Due to heat and drought as a result of climate change, also the risk of forest fires is increasing in Austria.

Wood Stocks reached a Maximum High

Global Forest Growing Stocks per Hectare



* Small woodlands; source: Global Forest Resources Assessment 2020, FAO; www.waldinventur.at, BFW; BWI III, BMEL

Austria, Germany and Switzerland have the highest wood stocks in the world, and they are particularly high in small private forests.

© Liptay / ABA

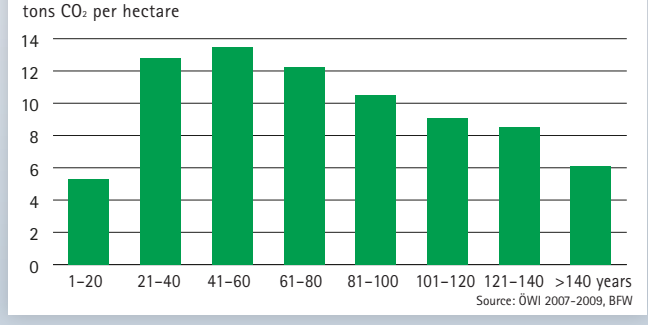
If forest stands are not thinned, they become unstable to drought, bark beetles and storms; trees die and release CO_2.

Deadwood Decay, Logs 4 m long, 31 cm Mean Diameter

Species	Mass loss in years		Species	Mass loss in years	
	50 %	95 %		50 %	95 %
Spruce	7.5	14.3	Birch	6.6	12.6
Pine	9.3	17.6	Poplar	7.7	14.6
Common Beech	6.6	12.6	Horn-beam	6.0	11.5
Maple	7.2	13.7	Cherry	8.2	15.6
Ash	12.9	24.5	Linden	7.3	13.9
Larch	11.6	22.0	Douglas fir	11.6	22.0
Oak	9.2	17.4			

Source: Pascal Edelmann et al. (2023): Regional variation in deadwood decay of 13 tree species: effects of climate soil and forest structure

Annual CO_2 Uptake of Forests by Age



Source: ÖWI 2007-2009, BFW

Forests absorb the most CO_2 between the ages of 40 and 60; their sink capacity decreases with increasing age.

Trees Don't Grow Unlimited

Some environmental NGOs stress that it would be best for the climate to build up as much wood stock as possible in the forest as a carbon store. However, wood stocks and the function of the forest as a carbon sink cannot be increased indefinitely. Austria, together with Switzerland and Germany, has the highest wood stocks per hectare in the world. Managed spruce and beech forests in Central Europe have average and maximum growing stocks that are about as high as wood stocks in unmanaged forests. Old forests with high wood stocks are increasingly threatened by climate change and the risk of collapse due to insect pests, windthrow or forest fires.

Competition Leads to High Losses

When considering growth performance and carbon uptake, people often mistakenly refer to individual trees, which develop freely without competition and can absorb a lot of CO_2 from the atmosphere even in old age. A study conducted with the participation of the Austrian Research Centre for Forests (BFW) shows for the first time that in unmanaged forests, 30 to 40 % of the total wood production is lost as deadwood due to competition-related mortality. Forests reproduce with many thousands of seedlings per hectare. As soon as the canopy closes, competition for light, water and nutrients causes trees to die. Without management interventions, each year between 5 and 20 % of all trees die naturally due to competition, with the CO_2 being released back into the atmosphere.

Usage Replaces Rotting

The half-life period of deadwood decomposition is much shorter than the time it takes for carbon to be released from wood products. It takes an average of just 12.6 years for beech trees and 14.3 years for spruce trees to decay to 95 %. Forest management removes the trees before they die naturally, and the wood can be processed into products or used for energy. Heating with wood does not release any more CO_2 than letting it decay, the only difference is that the place of origin is a furnace instead of the forest. A new study of 64 beech forests, some of which have not been managed for decades, shows that the carbon content of the soil did not change after wood harvest was stopped. Forest management protects carbon stocks in soils because the increased stability of stands reduces the risk of disturbances with greater carbon losses.

High Growth instead of High Stocks

Younger forests are much more effective carbon sinks than old saturated forests due to their higher growth. Timely use and rejuvenation of the forest prevents trees from dying, thereby maintaining high growth and a high sink function. With aging, the net growth of a forest decreases until a flow of equilibrium is reached between annual increment and loss through dying trees. Then, the forest no longer has a sink function. Even with management, the wood stock per hectare can remain close to the natural flow equilibrium because the sum of use and disturbances, such as bark beetles, is less than the growth and because forest management can prevent calamities.

Wood Use Avoids Fossil Emissions

Forests Become a Source of CO_2

The CareForParis study shows that as climate change progresses, forests, including soil carbon, are changing from a CO_2 sink to a source of net CO_2 emissions, because increment is declining in the long term due to poorer growth conditions (heat, dry periods, storms, bark beetle infestation) and the type of management (change of tree species, premature use), and, therefore, the stock is also decreasing. The study proves that it is not possible to maintain the forest as a CO_2 sink, permanently. In the short term, not using wood can increase the carbon storage in the forest, but it sets aside the opportunities for storing and saving CO_2 through sustainable wood products. When wood is being harvested, carbon is transferred from the rather unstable forest storage to the safe storage of wood products.

Substitution Surpasses Forest Sink

While there is a dynamic balance in the long term when storing carbon in wood products (consumption of new products versus disposal of old ones), the substitution of fossil-based products is permanent. The use of wood products avoids emissions since they have lower greenhouse gas emissions over their life cycle than substitute products made from other raw materials. In Austria, these substitution effects are higher than the carbon sink formed by the forest and the stock of wood products. With moderate global warming (+2 °C compared to 1971-2000), the greenhouse gas emissions avoided in the long term through the use of wood are more than twice as high as the savings in the forest and wood product sink. Along with more severe climate change (+4.3 °C), the forest quickly becomes a source of emissions, but the advantages of substitution remain.

Using Wood Saves 17 % of Emissions

Overall, around 12 million tons of CO_2eq can be avoided annually in Austria through the use of wood for material and energy substitution, which corresponds to around 17 % of Austria's annual greenhouse gas emissions. The CareForParis scenarios show that, despite the expected defossilisation of the energy system, emissions of 6 to 8 million tons of CO_2eq per year will still be avoided from 2050 onwards. The emissions saved per harvested solid cubic meter of stemwood currently amount to around 0.46 tons of CO_2eq. In addition, there are 0.14 tons of CO_2eq from the associated net increase in the wood product pool.

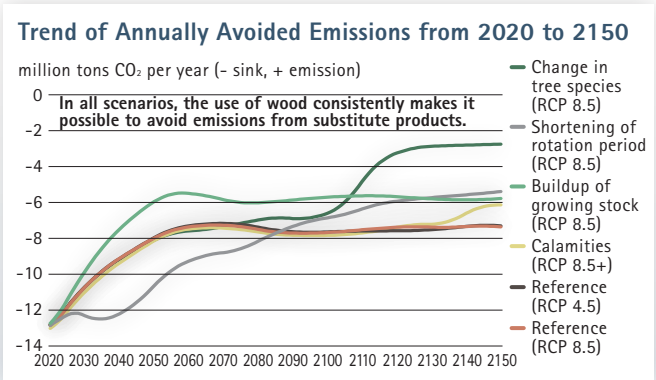
Energy Wood Enables Forest Tending

Forest tending measures are important to ensure that climate-fit tree species are given enough light and water. After thinnings, growth is concentrated on fewer trees, which then grow bigger in diameter and are, later, more suitable for the use as furniture or construction timber. Around the chosen future trees, small-sized stems are removed, which often cannot be used for material. If this harvested wood from thinnings were not used for energy purposes, there would be no incentive for forest tendings, which would greatly increase the risk of forest fires during summer droughts. It would also make it more difficult to produce valuable saw logs, which, then, results in disadvantages for climate protection.

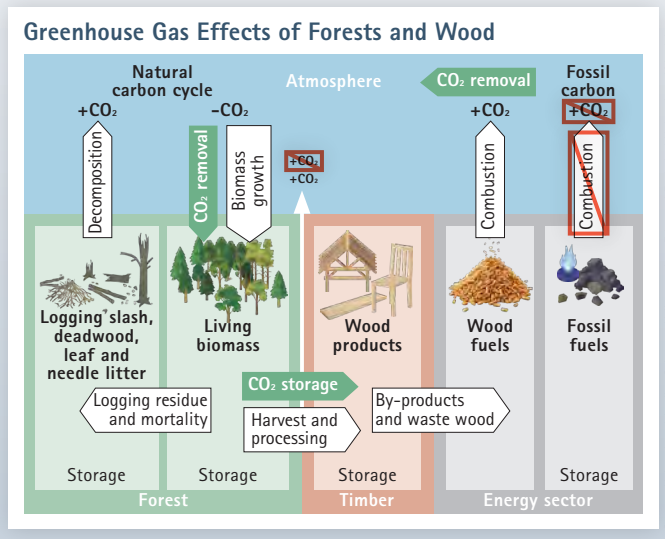
CAREFORPARIS: CLIMATE PROTECTION WITH WOOD USE

In the CareForParis study, the **Austrian Research Centre for Forests (BFW)**, the **Environment Agency Austria**, the **University of Natural Resources and Life Sciences (BOKU)** and **Wood K Plus** examined the possible contribution of Austrian forests, forestry and wood industry to combating the climate crisis in six scenarios with different climate changes up to 2150. The main result is: replacing fossil raw materials with wood products and the emissions thus avoided are the forest sector's greatest leverage for climate protection. Although forests play an important part in the contribution to CO_2 storage on their own, they cannot be a permanent sink.

Building with wood creates a second forest in the city (e.g. a five-storey solid timber building in Vienna) and stores carbon long-term.

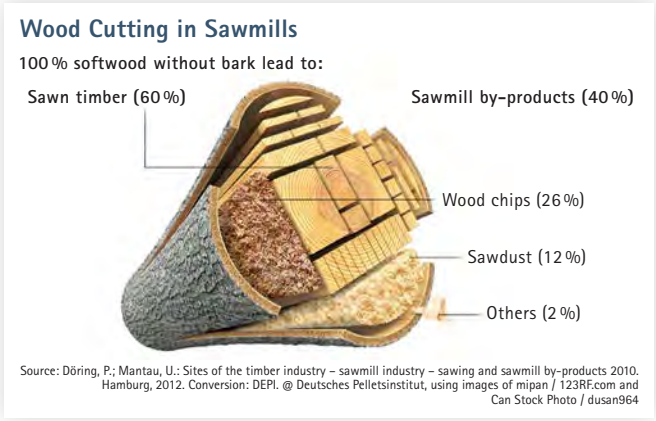


Avoided fossil emissions are permanent; in the long term, they are twice as high as savings in the forest and wood product sink.

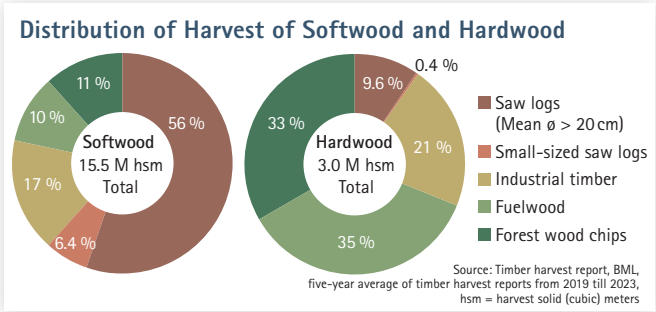


The energetic use of sawmill by-products and waste wood is part of the circular economy and avoids fossil emissions.

Material Use Brings more Energy Wood



Logs are round, boards and beams are square - when logs are cut, by-products of 40 %, which can be used for energy, are generated.



While softwood is primarily used in construction for long-living products, around two-thirds of hardwood is used for energy purposes.

© Reh; Lipsky / ABA

Biodiversity benefits from single tree management, mixture of tree species as well as vertical and horizontal structures and deadwood.

© Ulrich Wasem / WSL; Feichtner

For the future tree species fir and oak, it is often not possible to grow out of the browsing area of roe or red deer without protection.

Building and Heating with Wood

There are often requests that wood should rather be used for timber construction than for energy production; but, as a matter of fact, material and energy use are closely linked to each other. As a by-product of saw log production, the firewood that accrues during forest tending or final cutting cannot be separated from the stem wood that is required for material use. The aim of forest owners is to grow the most valuable stems possible for the sawmill industry from their stands. These chosen future trees are stimulated during thinning by removing neighboring trees that are usually too thin to be used as saw logs. Even for final yield, only the lower part of the stem that is free of branches is suitable as sawmill wood. Thinner parts of the stem are used as industrial wood by the paper and board industry or as energy wood. Strong branches and very crooked or damaged parts of the tree are often used for energy.

Share of Timber Construction Doubled

In the last 20 years, the share of timber construction in Austria has almost doubled. A quarter of all above ground construction is already made of wood. The development of two-dimensional timber construction products makes wood ideal for large-volume and multi-storey building. An increase in the share of timber construction leads to larger quantities of sawmill by-products. For every 1 m^3 of wood used for buildings, about 6 m^3 of by-products are generated during further processing along the value chain, which can be used for energy production.

Hardwood and Softwood

Coniferous wood has a higher overall carbon effect than hardwood, because it is used for material purposes to around 80 %, while hardwood is mainly used for energy. Softwood also has a higher volume increment, while old beech and oak stands are characterized by long-lasting growth. As soon as hardwood is used more in construction, its climate effects will improve. Almost 80 % of the forest growing stocks in Austria are coniferous wood. In the medium term, the Austrian forestry and wood industry must prepare for an increased supply, a more demanding forest management and the material properties of hardwood. In the short term, there is a risk of an oversupply of soft roundwood.

Forest Conversion and Biodiversity

The conversion of forests into mixed stands adapted to climate change and their sustainable use has positive effects on biodiversity. The cultivation of as many site-adapted tree species as possible, the leaving of a minimum amount of deadwood and the application of a single tree forest management system do all promote biodiversity. While older stands are of interest for nature conservation, the risk of disasters tends to favor early use. Major calamities are often associated with forest clearings, which have a negative impact on biodiversity and (soil) carbon storage. Without adapted roe deer and red deer populations, the natural regeneration of important climate-stable tree species such as fir and oak is not possible. The addition of site-adapted foreign tree species such as Douglas fir or red oak can increase the range of suitable tree species in the future.

Bioenergy and Climate Protection

Is Wood Energy Climate-neutral?

Dry wood is made up of half carbon (C), which is oxidized when burned and emitted into the air as carbon dioxide (CO_2). Some environmental NGOs repeatedly claim that felling trees causes a „carbon debt" because the carbon escapes immediately when burned, but the CO_2 is only slowly reabsorbed through regrowth. This would be a burden for the climate for decades. Although it takes another 100 years after a 100-year-old tree is felled for the successor to bind as much carbon as its predecessor, only one out of 100 trees is harvested each year and the 99 remaining trees continue to grow on neighboring areas. The biomass removed during logging is more than compensated for by the accelerated growth of the surrounding trees.

Regrowth Compensates Harvest

In sustainably managed forests, tending or thinning in a specific stand takes place once in about 5 to 10 years in order to free vital and qualitatively appealing future trees from competition from neighboring trees and, thus, increase their growth. By doing so, the area affected by tending or harvesting every year is about 10 % of the forest district and this area moves dynamically across the property. The figure on the right shows a forest property divided into 10 compartments (each with 3 sub-compartments) with different stand ages, which is treated based on a 10-year management plan. Only 3 of the 30 sub-compartments are affected by tending, thinning or harvest every year and only the amount of wood is removed, that grows back on the remaining untouched area. An eddy flux tower (measuring device) in the center of the property does not detect any carbon removal and therefore none of the harvesting measures.

No Carbon Debt

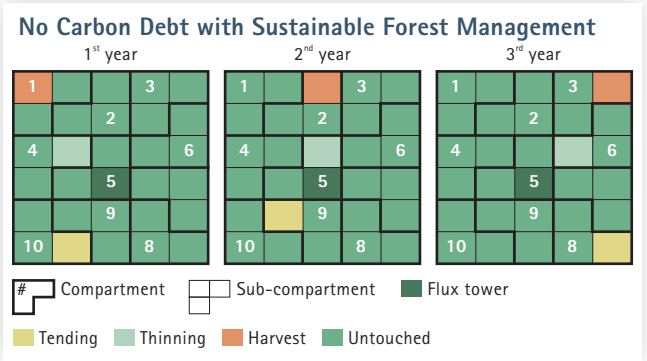
If thinnings are done in hardwood stands, the removed assortments are often not suitable for material use. Thinnings in deciduous stands usually take place in winter, and by the end of the following growing season, the carbon removed by the harvesting of the wood has already been reabsorbed by the regrowth of the trees in the forest landscape. Since firewood should dry for up to two years, the carbon removed by the operation is bound back into the forest before the logs end up in the stove. If wood stocks at landscape level remain the same or increase over the long term, as has been the case in our forests for decades, there is no carbon debt.

The Biggest Domestic Energy Source

Two thirds of Austria's energy system is dependent on fossil energy imports. Biomass is Austria's most important domestic energy source. Bioenergy production in Austria exceeds consumption. Woody biomass, like fuelwood, wood chips, bark, pellets or black liquor, accounts for almost 40 % of domestic energy generation and covers more than 14 % of total energy demand. Domestic production of natural gas, crude oil and coal has fallen to a fifth compared to 1970 and only provides 8.7 % of total domestic energy production. The use of solid biomass fuels has created employment effects of more than 28 000 full-time jobs and sales of EUR 4.9 billion in Austria in 2022.

© ÖBf

The selected future trees react to thinning with increased growth and quickly take up the space that becomes available.

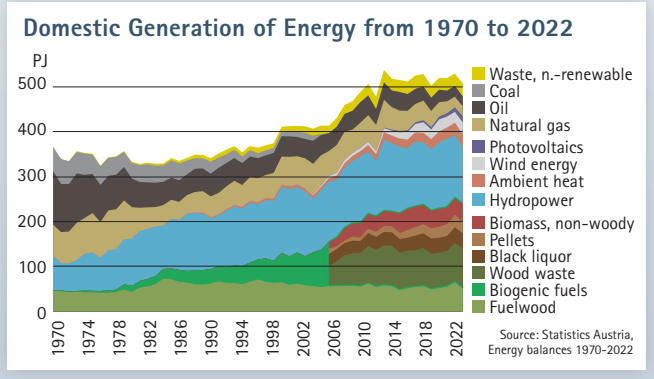


© Schulze, D.; Bouriaud, O.; Irslinger, R. and Valentini, R.

A model property is divided into 10 compartments of different stand age. Each year in only three sub-units the amount of wood that grows back on the untouched area is removed by tending, thinning and harvest. The Flux Tower does not detect any CO_2 flows out of the ecosystem.

© LK Steiermark

Firewood should dry for up to two years, until then regrowing trees will reabsorb the carbon removed during thinning.



Wood energy provides almost 40 % of domestic energy production, while the share of fossil fuels has fallen to 9 % since 1970.

Further Information

Did You Know That ...?

... every second 1 cubic meter of wood grows back in Austria's forests, which amounts up to an entire timber house every 40 seconds?

... wood stocks in the EU have increased by 8.2 billion cubic meters since 1990, in other words by more than the entire forest growing stocks of Austria, Germany and France combined?

... the forest growing stock of older stands (>100 years including hold-over trees) in Austria has increased by a third in the last 30 years according to the Austrian Forest Inventory and that 41 % of the domestic timber stocks are in stands over 100 years old?

... a reduction in logging of just 1 % as a result of the decommissioning of forest areas in the EU would result in a loss of EUR 10.3 billion in gross value added and the loss of around 162 000 jobs?

... the forestry and wood industry, with an export surplus of EUR 5.2 billion (in 2022), is the second largest earner of foreign exchanges in Austria after tourism?

... unavailable wood products, as a result of a reduction in wood harvesting, must be replaced through wood imports and a shift in emissions and environmental impacts to countries with much lower forest management standards or by fossil-based alternatives?

... one cubic meter of beech firewood billets replaces the greenhouse gas emissions of 200 liters of heating oil or 200 cubic meters of natural gas?

... chipping and using infested wood for energy production is an important control measure against bark beetles?

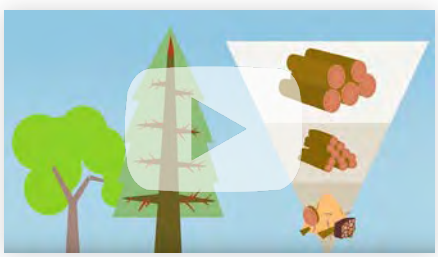
Bioenergy Clips

YouTube www.youtube.com/user/waermeausholz

Combating Climate Crisis with Managed Forests

Heating With Wood Adds Value to the Region

The Power of Wood – Cascade Use



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