The Climate Value of Forestry

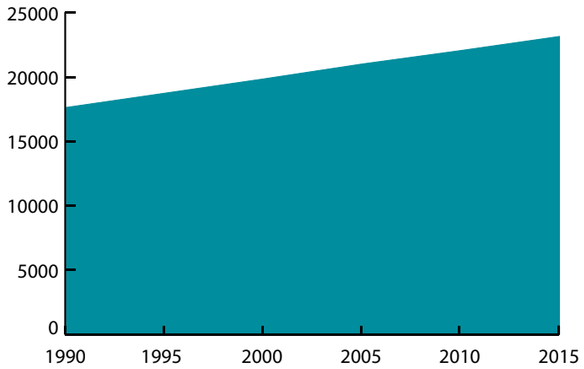
The 2015 Paris Agreement on climate change is a worldwide commitment to control global warming by keeping the temperature rise well below 2°C above pre-industrial levels and implementing measures to adapt ecosystems to climate change. Sustainable forest management and wood use are playing a crucial role in reaching the goals of the climate deal: while forests remove CO2 from the atmosphere, acting as carbon sinks, wood can substitute for non-renewable materials and fuels.

Writer: Salvatore Martire

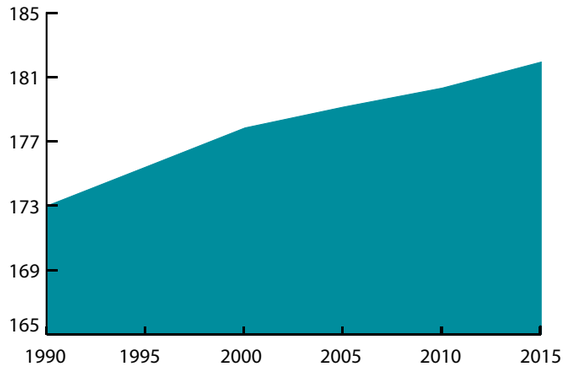
Sustainable managed forests by Statskog SF, the Norwegian state-owned land and forest enterprise, near Overhalla (Norway).
Source: Eustafor

The 194 countries that signed the Paris Agreement committed to achieving a balance between emissions and removals of greenhouse gases by the second half of this twenty-first century. Greenhouse gas emissions globally have increased in the energy, industry, transport and building sectors. Forests and wood use are crucial for reaching the goals of the climate deal. Forests are carbon sink, they remove (CO_2), the principal greenhouse gas, from the atmosphere, and wood can substitute non-renewable materials and fuels.

To be effective for climate change mitigation and adaptation, forests need to function as carbon sink well into the long term.



Growing stock in forests available for wood supply (Mm^3)
Source: Eurostat, 2016



EU-28 Forest area (Mha)
Source: Eurostat, 2016

Growing Forests Absorb CO_2

Forests globally absorb about one trillion tons of carbon. Trees are carbon sinks thanks to the process of photosynthesis in which CO_2 from the atmosphere is processed. The carbon from CO_2 is integrated into the mass of the trees and the oxygen is released back into the atmosphere. In other words, forests absorb greenhouse gases if they grow.

Forest carbon sink

A carbon sink is a reservoir that accumulates and stores carbon. Forests function as carbon sinks when they increase in either volume or area.

It is good news that European forests are increasing both in volume and in area. Over the last 25 years (1990-2015), the forest area of the European Union grew by about 9 million hectares – equivalent to 3 times the surface of Belgium. Forests now cover near 40% of Europe's land surface area.

About 1 cubic meter of wood grows every 0.16 seconds in European forests. The carbon sink function of forests is dynamic and varies throughout the life cycle of the forest. One very important factor is the age of forests: young trees absorb more CO_2 than old trees. Since European forests are in general getting older, their capacity to absorb CO_2 is decreasing. Therefore, a vital European forest-based sector is the best answer to boost forest ecosystem resilience and to fully benefit from their climate mitigation potential. According to scientists,[1] EU-27 forests could absorb an additional 1,750 million tons of carbon by 2100 if biomass increment is maximized.

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Non-exhaustive List of Forest Ecosystem Services

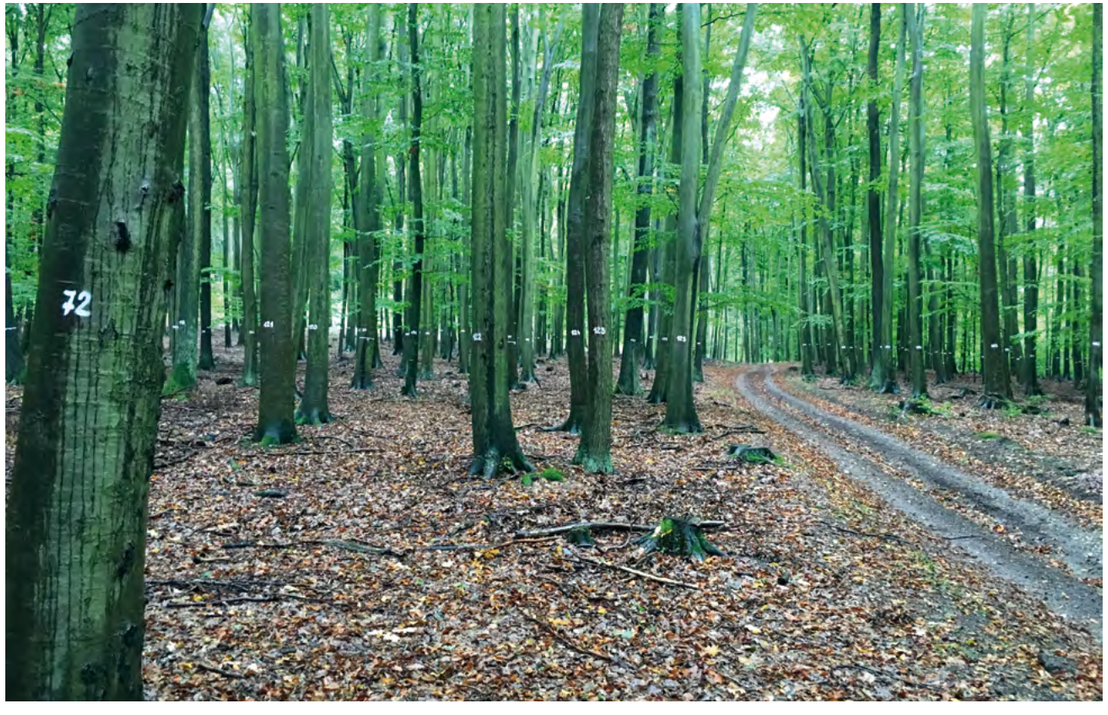
- Provision of wood
- Provision of non-wood products (e.g. mushrooms and berries)
- Biodiversity
- Pollution control
- Nutrients cycling
- Water regulation
- Climate regulation
- Erosion control and soil protection
- Recreation and tourism

State Forest Management Organizations are committed to ensure the long-term life cycle of forests by balancing their many functions. Forests can have a prevalent function, for example productive or protective. However, forest functions are not mutually exclusive. On the contrary, forest managers constantly apply and improve sylvicultural techniques in order to maximize the multiple values of forests and the provision of ecosystem services.

One essential element of a sustainable and multifunctional forest management is the harvesting of wood which is crucial to maintaining a stable and positive forestry carbon balance. If left unmanaged, forests become sources of carbon because the CO_2 emissions from decaying wood exceed the uptake from growing trees. Harvesting in state forests is carried out according forest management plans which include most advanced knowledge available in terms of sustainable and multifunctional forestry, including the protection of natural habitats as well as wild flora and fauna in order to enhance biodiversity. The long-term production capacity is ensured by safeguarding soil quality and by advancing sylvicultural innovation to design resilient forest ecosystems.

"Serit arbores, quae alteri saeclo prosint" (plant trees for the benefit of future generations) wrote Cicero in 44 BC. Forest life cycles are relatively long. Some tree species have very long life spans (about 200 years in the case of oak). Others have shorter life times (about 40-50 years in the case of birch). For this reason, it is important to have a long time perspective when we consider the role of forestry for climate change mitigation.

Biodiversity enhancement in forest management near Křivoklát (Czech Republic). State-owned forests managed by Lesy České republiky, s.p.
Source: Eustafor



Q&A: Per-Olof Wedin

President of the European State Forest Association (EUSTAFOR) Chief Executive Officer of Sveaskog

What products can be made with wood?

Wood is a great material for making products of various forms and aesthetics that are of high quality and resistant to damage. Nowadays, innovation and technology allow us to make almost anything out of wood. We all know that paper, panels and furniture are made from wood. But not everyone is aware that wood fibers can be used in many other products such as cosmetics, textiles, bio-plastics and even medicines. In the future, we will be able to make things from wood that are unimaginable today.

Why should we use wood?

Why not? It is a feedstock that we have in Europe and it would make us less dependent on imports. Wood from sustainably-managed forests is a renewable and environmentally-friendly material. Forests grow by consuming atmospheric carbon, while wood products store carbon and together with bioenergy are a substitute for non-renewable materials and fossil fuels. Using wood instead of other materials and fuels is very good for the climate and actually by using more wood we contribute to mitigating climate change, allowing us to develop a low-carbon economy.

> Together, EUSTAFOR member organizations employ about 100,000 people.

Are there enough trees to do all this?

European forests are constantly growing both in size and in the volume of wood they can make available for use. As foresters, it is our duty to carry out long-term management planning in order to ensure the production capacity and resilience of forest ecosystems as a whole, including many other forest ecosystem services such as regulating the water cycle and climate and providing biodiversity as well as cultural and landscape services and values. Constant innovations in sustainable forest management and wood mobilization will continue to ensure a sufficient wood supply to support the development of the bioeconomy in Europe.

What are the specific contributions of state forest managers?

European state forests belong to all citizens and it is our mission and duty to manage these incredible and diverse resources on their behalf. State Forest Management Organizations manage over 49 million hectares of land, which represents around 30 percent of EU forested land. We are committed to responsible forest management, which will fulfill the various needs of society at large. Employing approximately 100,000 people, EUSTAFOR members together provide about 120 million m^3 of wood to downstream value chains.

What challenges lay ahead for the forestry sector?

Moving towards a low-carbon economy, we need to shift from non-renewable to renewable materials and energy. Therefore it is important to allow for the mobilization of our forest resources. In this regard, forest owners and managers are key actors of the economic transition because they provide raw materials for the bio-based industries.

EU policy should support the use of wood and foster innovation in the forest-based sector while EU forest owners and managers need to make their expertise and knowledge available, so that the full potential of European forests can be effectively acknowledged and unlocked. In addition, the European bioeconomy should be based on domestic resources in order to decrease our dependence on large-scale imports of non-sustainable resources and goods.

Forests are at the core of the transition towards a low-carbon economy. Let's make them part of the solution!

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Pilke Science Centre and Metsähallitus premises in Rovaniemi (Finland). The carbon emissions of Pilke, which is made of wood, are only one-third of those of a steel or concrete building of the same size.
Source: Tiedekeskus Pilke / Jussi Tiainen

Climate Reasons to Use Wood

Wood has been a construction material for a long time and there are many ways it is used in construction, depending on local building practices and needs as well as technological developments.

Many Scandinavian cottages have walls, floors, roofs and finishings made of wood, while traditional stone Mediterranean houses depend on the mechanical features of wood for use as slabs and roofs, as well as window frames and doors. Over the past decades, steel and reinforced concrete have tended to replace wood. But innovations in architecture and the need to lower energy consumption are now bringing back the use of wood. The most developed construction techniques use wood because it is naturally elastic and can more easily tolerate a slight deformation. In fact, it is one of which make it one of the preferred materials for building in seismic areas. Its high heat storage capacity is appreciated as well as its lightness and mechanical features.

State Forest Management Organizations manage about 30% of European forests.

State forest annual increment is about 200 million cubic meters of wood, of which about 130 million are used to produce a wide range of wood products

Source: EUSTAFOR database, 2017

It is not only matters of engineering; tree species and wood grains make unique every piece of wood. Despite the high variability, the chemical components are quite similar and about half of the weight of wood is given by carbon. This means that one kg of wood is "holding" half kilo of carbon that without forestry would be in the atmosphere. The carbon storage time depends on for how long the product will be used and reused. Clearly, products with longer life cycles store carbon for longer time. Wood used in construction can be preserved for hundreds of years. At the same time recycling increases the carbon storage of wood products. For example, even when paper is used for some years it can be recycled numerous times.

Wood has great potential to displace carbon if it is used to substitute for non-renewable and high-energy intensive materials. The substitution effects vary widely and they depend on case specific features. For example, Canadian scientists[2] estimated that using sawed wood and wood panels instead of steel and concrete in their country has a carbon displacement factor of the 54%, taking into account all the emissions connected with the value chains. Using wood in construction instead of materials that require high-energy consumption along their value chains can have even higher impacts. A scientific review[3] of many studies reported that one cubic meter of wood in substitution of non-renewable materials can displace almost 2 tons of CO_2 emissions.

In essence, using as much wood as our forests can offer sustainably would help to rebalance the carbon cycle and to achieve the temperature target of the Paris Agreement.

Positive Bioenergies

Global emissions of CO_2 rose by about 10 giga tons in just 10 years (2000-2010),[4] and almost half of the increase comes from the energy supply. To reduce CO_2 emissions we need more energy efficiency and we must replace fossil fuels with renewables.

Forests provide raw materials and residues to produce renewable energy. Woody biomass is the most important renewable energy source in Europe. Currently, renewable energy sources cover approximately 16 % of the EU's energy consumption. Bioenergy represents 63 % of renewables' consumption and wood covers approximately 70 % of bioenergy consumption.[5] In Europe bioenergy consumption doubled from 2000 to 2014, reaching about 105 millions of toe (ton of oil equivalent), and it is expected to reach a consumption of about 140 millions of toe.

> Woody biomass is the most important renewable energy source in Europe.

Bioenergy from woody biomass is very important not only for climate but also for the development of rural areas and for strengthening rural value chains. Forest bioenergy is often made from low quality wood or harvesting residues that cannot be used for other products. And the development of local forest energy chains is the right way to activate and make economically feasible forest management in many areas in Europe. This can result in the enhancement of the management of abandoned forests often at high risk from wild fires.

Closing the Loop

The bioeconomy enables the shift towards a low-carbon society. In fact, the bioeconomy is based on the use of biological resources from both land and sea; hence it embraces many sectors and activities. In a circular economy recycling and reuse are maximized within sustainable limits and waste production minimized, by going beyond the linear 'exploit-transform-consume-throw away' model.

While promoting sustainable and resource efficient production and consumption patterns, we need to use renewable resources for materials, energy and food. In these regards, managed forests provide the input for the bioeconomy, as renewable materials as well as the other ecosystem services. Sustainable forestry merges the two concepts of circular and bio- economy, by providing renewable and bio-based resources for products, energy and services.

By making productions less dependent on fossil raw materials and fuels, a forest-based bioeconomy has a positive impact on climate change, since forests, wood products and energy can reach the compensation of about 20% of European greenhouse gas emissions.[6] There is great availability of forest biomass in Europe to develop a strong bioeconomy, which would be based on to use domestically available raw materials and it will then have a positive impact on the security of supply of energy and goods, as well as lower impacts from transportation and higher job opportunities along the value chains.

A vibrant European forestry sector can make the bioeconomy the next major economic development and it can bring real benefits to face climate change.

Sustainably harvested wood in Kelheim by the Bavarian State Forest Enterprise (Bayerische Staatsforsten)
Source: Eustafor

Notes:

1. G. E. Kindermann, S. Schörghuber, T. Linkosalo, A. Sanchez, W. Rammer, R. Seidl, and M. J. Lexer, Potential stocks and increments of woody biomass in the European Union under different management and climate scenarios. Carbon Balance Manag., vol. 8, no. 1, 2013.
2. C. Smyth, G. Rampley, T. C. Lempriére, O. Schwab, and W. A. Kurz, "Estimating product and energy substitution benefits in national-scale mitigation analyses for Canada," GCB Bioenergy, ,2016.
3. R. Sathre and J. O'Connor, A Synthesis of Research on Wood Products & Greenhouse Gas Impacts, 2010.
4. IPCC, Fifth Assessment Report (AR5), 2014.
5. Eurostat, Energy from Biomass, 2013. [Online]. Available: http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/natural-resources/energy-resources/energy-from-biomass.
6. G. Nabuurs, P. Delacote, D. Ellison, M. Hanewinkel, M. Lindner, M. Nesbit, M. Ollikainen, and A. Savaresi, A new role for forests and the forest sector in the EU post-2020 climate targets. From Science to Policy 2. European Forest Institute. 2015.

The European State Forest Association (EUSTAFOR) is based in Brussels and represents state forest companies, enterprises and agencies that have sustainable forest management and sustainable wood production as major concerns. The goal of EUSTAFOR is to promote the common interest and sustainable development of state forests. The association currently has 32 members in 22 European countries. They manage approximately 42 million hectares (i.e. ~30 % of EU forests) and deliver annually more than 130 million m^3 of wood to downstream industries (or value chain).

EUSTAFOR is recognized as a strong and well-coordinated voice of European state forest management organizations at EU and pan-European level. The association shares the pan-European definition and principles of sustainable forest management developed by FOREST EUROPE (www.foresteurope.org) as well as the objectives and guiding principles of the EU Forest Strategy.

EUSTAFOR member organizations provide valuable, professional and experience-based knowledge about the sustainable and multifunctional management of state-owned forests in order to support Europe's forestry-relevant policy objectives.

European State Forest Management Organizations (SFMOs), members of EUSTAFOR, perceive themselves as key enablers of the current and future bioeconomy, using their experience in sustainable and multifunctional forest management practices to provide a wide array of products and services. Through careful stewardship, European state forests contribute to safeguarding sustainability and serve as predictable partners in the long-term business strategies of forest-based value chains.

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