

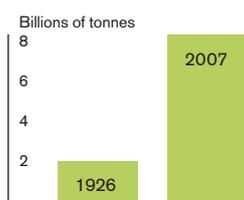
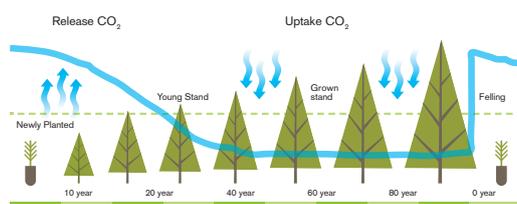
The Climate Impact of Forest Biomass

Over the last 100 years the standing volume in Swedish forests has almost doubled and carbon stocks in forests and forest soil have quadrupled. At the same time, more than 4 billion cubic metres of timber have been felled and delivered to the industry. Sustainable forest management has in other words proven to have a positive impact on climate change mitigation.

The positive relationship between sustainable forest management, growth and CO₂ uptake can be illustrated by developments in Sweden over the last 100 years, where silviculture has focused on long-term sustainable production. During this period, the standing volume in Swedish forests has almost doubled and carbon stocks in forests and forest soil have quadrupled. At the same time, more than 4 billion cubic metres of timber have been felled and delivered to the industry.

Growing forests absorb carbon dioxide

Already from when the saplings start to grow there is an uptake of carbon dioxide. When a forest is felled it has stored the carbon in the wood but the uptake of CO₂ is interrupted and instead CO₂ is released for the following ten years. It takes up to 30 years before a newly replanted forest can store as much CO₂ as was released in the years after felling. (after that more and more carbon dioxide is absorbed.) It would be a major problem from a climate point of view if the entire forest was felled at the same time. However, only 0.8% of Swedish forests are felled annually, while the remaining 99.2% continue to absorb CO₂. Carbon dioxide that is released at felling is absorbed by



Net CO₂ stocked in Swedish forests has increased dramatically over the last decade due to sustainable forest management.

A growing forest removes CO₂ from the atmosphere through photosynthesis, converting it into organic carbon which is stored in woody biomass. A forest's ability to do this, decreases with age. When mature trees are harvested, CO₂ is released until the newly planted saplings increase their uptake. Overall, the sustainable management of forests ensures that the overall flow of forest CO₂ remains carbon positive.

surrounding forests which makes the wood raw material climate neutral.

Most of the standing forest in different landscapes has good growth due to earlier management and therefore absorbs considerably more carbon dioxide than would be possible in the old undisturbed forests. This is the reason why the ongoing absorption of carbon dioxide in a sustainably managed forest landscape can be far greater than in an unmanaged reference landscape. When the forest gets old it grows less and absorbs less carbon dioxide and it might even start to decay. This may result in a carbon sink saturation.

Forest products extend the storage of carbon

Forests are, due to their absorption of carbon dioxide, generally regarded as carbon dioxide sinks. They can also be seen as carbon dioxide neutral, since they have absorbed carbon dioxide from the start of their life cycle and when the forests are harvested the same amount is released again. Wood products from forests continue to act as

► In short

Forests make a positive contribution to the climate in three ways: 1. Growing forests absorb carbon dioxide (CO₂) through photosynthesis, transforming it into biomass and releasing the remaining oxygen back into the atmosphere. 2. Wood products from forest harvests continue to store carbon. 3. The use of renewable wood raw material, as a replacement for fossil-fuel products, reduces the volume of new CO₂ that would otherwise be released into the atmosphere.

significant carbon stores in society and extend the carbon sink until the day the product decays or is burned. This also means that an increased use of wood will help us to counteract the release of carbon dioxide at felling. By replacing materials such as concrete, metal or those derived from fossil fuels by wood products wherever possible – for example in building, furniture making, packaging – even greater carbon gains could be achieved.

By using renewable biomass we can reduce CO₂ emissions

Carbon sequestration in forests and forest products creates an important buffer against the greenhouse effect.

However, most of the positive climate effects from the Swedish forest have been shown to come from utilization of the renewable wood raw material to replace fossil-based products and materials.

The carbon dioxide that is released when the tree biomass decomposes or is burned can be part of a relatively fast biological cycle where compensation occurs when the growing forest absorbs a corresponding amount of carbon dioxide.

Carbon which is derived from fossil energy sources has laid buried deep in the ground for tens of millions of years. When this is burned, a new and lasting addition of carbon dioxide to the atmosphere takes place.

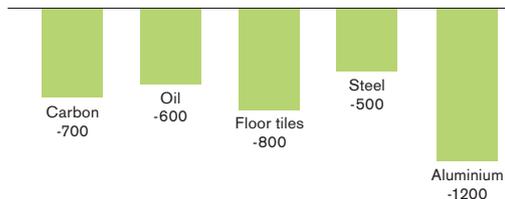
By using biomass from the forest and allowing fossil fuels to remain in the earth's crust, we can reduce the volume of new carbon dioxide that is added to the atmosphere. Managing forests and replacing fossil material with renewable biomass leads to a lasting reduction in emissions.

The climate benefits of fossil replacement

New Swedish research shows that with current management focus, the Swedish forest will provide an annual climate benefit that corresponds to a 60 million ton reduction in carbon dioxide emissions. It shows that most of this gain will come from replacing fossil fuel inputs with renewable raw material from forests. The positive climate mitigation effect of replacing fossil fuels with renewable energy, such as biomass, is estimated to be greater than the temporary gains that could be achieved by reducing felling in order to build up the carbon sinks in forests and forest soil. On average, every cubic metre of timber that is harvested for use as a wood product, eliminates 470 kg of carbon dioxide emissions. By far, the biggest positive effect is when the wood raw material is used for building wooden houses. But only a certain proportion of a tree can be used for timber and in Swedish forest management, we try to utilize different parts of the tree as well as possible. This means for instance the majority of biomass for energy purpose comes from felling residues.

Sveaskog can provide even more climate benefits

Our company is currently strongly focused on using some of the felling residues branches and tops – to produce forest biomass for energy. Currently, Sveaskog harvests biomass for energy in the form of felling residues from approximately half the annual regeneration area. Stump harvesting is being carried out on a trial basis and with careful environmental monitoring.



Reduction of carbon dioxide emissions if 1 m³ of renewable wood raw material is used in relation to non-renewable material.

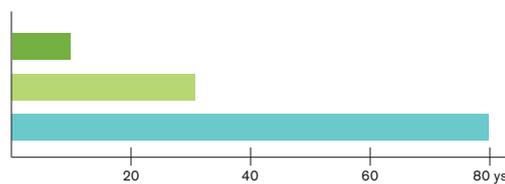
Source: Norsk Treteknisk Institutt and Norsk Byggforskning

At the same time, Sveaskog remains dedicated to the conservation of the forest ecosystem, including biodiversity. In addition to observing Swedish legislation, we have established our own guidelines for biomass harvesting. The harvesting restrictions include:

- Regulations on preservation of tree groups, sensitive biotopes, protective zones and cultural values which apply to all land use. Compromising on environmental considerations in order to increase biofuel extraction is not permitted.
- Where felling residues are extracted, at least 40% of the material must be left in place. Among other things, this ensures a sufficient supply of dead wood in order to avoid the risk of changing the long-term nutrient status of the soil.
- No biomass harvesting may take place on dry nutrient-poor soils or wetlands.

Even with these restrictions, Sveaskog assesses that it can increase biomass harvesting from its forest lands without increasing its annual felling.

- Where felling residues are extracted, at least 40% of the material must be left in place. Among other things, this ensures a sufficient supply of dead wood in order to avoid the risk of changing the long-term nutrient status of the soil.



Prolonged storage time of carbon in different products.

Other wood products (formwork)
Interior works including furniture
Building construction

► More Information

Martin Lindell, Senior Director Strategic Development.
martin.lindell@sveaskog.se

More facts sheets available at www.sveaskog.se/factsheets

Customer service: +46 771 787 100 / info@sveaskog.se / www.sveaskog.se

Sources:

Lundmark, et al. Potential Roles of Swedish Forestry in the Context of Climate Change Mitigation, *Forests* 2014, 5, 557-578.
Naaburs, et al. First signs of carbon sink saturation in European forest biomass, *Nature Climate Change* 3 2013, 792-796.
World Bioenergy Association. (Factsheet) The carbon neutrality of biomass from forests, <http://www.worldbioenergy.org>.