2023 Research report summary

The role of forests in the energy and climate transition

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Summary

Forests offer many utilities for individuals and society alike. Timber production has for a long time represented the primary use, while other areas have been added gradually. The expansion of renewable energy production, driven by commercial and political forces, has increased the demand for solid forest fuels and liquid biofuels. Furthermore, industrial product developments, such as biochemical products, will have an impact on the social benefits of forests. At the same time, increasing forest tourism coupled with general economic developments tend to increase the demand for forest recreation areas. In addition, the effect on biodiversity and carbon sequestration must be assessed and included in the different trade-offs. The ability of forests to sequester carbon makes them an important part of the climate transition.

When making decisions regarding the utilisation of forests and forestry, all these utilities must be considered simultaneously and sometimes put in relation to one another. The relevant starting point for any analysis in this area is to integrate the utilities where climate benefits as well as production, biodiversity and recreational values are included. This means that to fully understand the complexity of these issues, an integrated approach is needed rather than separate analyses of isolated aspects. A solid and comprehensive understanding of these issues is also needed to make well-informed decisions. Research may offer insights to increase our understanding, not least in terms of the necessary trade-offs, but in the end, political decisions will be the prevailing force. The purpose of this report is to present an economic analysis of the role of Swedish forests in the energy and climate transition.

The utilisation and value of forests

There are many areas of utilisations while the forests are scarce. The supply of roundwood is positively affected by aspects such as growth-enhancing measures and negatively affected by aspects such as conservation efforts. The areas of forest set-asides have increased, sometimes with the purpose of improving biodiversity, thus leading to a decrease in the supply of roundwood. If the climate benefits of forests are partly or completely internalised, the supply is expected to decrease further. At the same time, the future demand for forest products is expected to increase when fossil fuels and emission-intensive materials are replaced by renewables from forests.

Forests are important from a climate perspective as they sequester carbon dioxide from the atmosphere when growing. Land use, land-use change and forestry (LULUCF) offer a net carbon uptake of approximately 41.6 million tons of carbon dioxide per year in Sweden, of which forest land accounts for 36.2 million tons of carbon dioxide per year. This amount may be compared to Sweden's total carbon dioxide emissions of 47.8 million tons of carbon dioxide in 2021. With a price on carbon dioxide emissions of SEK 1,200 per ton, the net uptake on forest land may be valued at almost SEK 43.4 billion per year. This value is close to the annual value added of the forest industries of SEK 46.2 billion.

Forest products may also serve as a substitute for emission-intensive materials and fuels in, for instance, the construction, transport or energy sectors. By replacing emission-intensive materials such as steel, cement, plastic and aluminium with renewables, it is possible to reduce the carbon footprint of the economy. What determines the climate benefit is the magnitude of the substitution factors. A previous literature review presents an average substitution factor of 1.2 kilograms of carbon per kilogram of carbon in wood products. That is, for each additional cubic meter of wood products replacing emission-intensive materials, emissions are reduced by 0.899 tons of carbon dioxide. Therefore, the value of the substitution effect is approximately SEK 1,079 per cubic meter of wood products.

Continuous harvesting is needed to stimulate substitution. However, stimulating forests as a carbon sink requires reduced harvesting. The outcome depends on the applied time horizon, size of the substi-

tution effects and the forests' ability to continue sequestering carbon even as they grow older. When assessing the climate benefits of forests, it is also important to account for potential leakage effects. Leakage may occur if harvesting increases in other countries due to Swedish measures to reduce our domestic harvesting. The magnitude of such leakage depends on several factors, but a previous literature review shows an average leakage of approximately 48 percent. Consequently, the climate benefits of unilateral policies are almost cut in half.

Forests represent one of the most biodiverse land types in Sweden and provide a considerable social benefit. Studies aiming to estimate the value (willingness-to-pay) of protecting threatened species are mostly done on sensitive forest areas (i.e., they have a local character and are difficult to generalise). However, the preservation value of three hundred threatened species in Swedish forests (both flora and fauna) has been estimated at SEK 2,500 per person and year. Given a total population of 10.5 million, the total estimated value is SEK 26.3 billion per year.

Forests also represent a high recreational value. In this context, recreation refers to everyday recreation in surrounding forest areas, such as spontaneous play, walking, outdoor activities and recreational fishing, exercises or competitions. This kind of recreation often occurs in urban forests and its annual value has been estimated at SEK 12–16 billion per year. Factors affecting the recreational value include forest management, proximity to urban areas and composition of different tree species, where areas with a high share of deciduous trees exhibit an increase in recreational value.

Why does the research tell us different things?

Research indicates that forests should be left standing for the climate but also that they should be harvested for the same reason. These results might seem contradictory and have caused an intense debate, both scientifically and politically. It is also interesting that Sweden's official statistics have been questioned in the debate. The main reason for these differences is that different assumptions are used to describe the temporal (time horizons) and spatial (forest stand, landscape) characteristics. There may also be significant uncertainties affecting the results. Despite the polarised debate and the fact that it has been

difficult to reconcile, there is still a consensus that forests represent an important carbon sink, that an increase in forest growth has climate benefits and that wood products provide climate benefits if they replace emission-intensive materials such as concrete, metals and fossil fuels.

Trade-offs

Short-term climate benefits need to be compared to the long-term benefits. Reduced harvesting would provide greater short-term climate benefits but at the expense of reduced long-term benefits. The time horizon is a pervasive and key factor to consider regarding the necessary trade-offs.

Assessments of the substitution effects must allow for dynamic changes. The properties and manufacturing processes of the emission-intensive materials that wood products are expected to replace change over time. New processes are continuously developed reducing the emissions per produced unit. If these emissions decrease (e.g., due to new innovations), the substitution effect will also decrease. Furthermore, preferences and consumption patterns change over time and will affect the substitution effects. Providing an accurate analysis of which products that will be demanded in the future is a daunting task.

Assumptions concerning system boundaries affect analyses of the social benefits of forests. This includes the applied spatial resolution. The dynamic carbon balance looks different for an individual forest stand compared to an entire landscape. A landscape consists of many individual forest-stands of different ages. Therefore, they compensate each other's carbon sequestering and emissions at a given time-period. This also encompasses when in the rotation period the analysis begins. If the analysis begins when a mature forest stand is harvested, an immediate carbon deficit occurs since carbon having been previously sequestered in the biomass and soil is removed. A climate benefit does not occur until the new trees have grown up and the net carbon sequestering is positive. On the other hand, if the analysis starts when the trees are planted, they have already sequestered carbon when they are ready to be harvested.

Internalising the climate benefits

To consider the climate benefit of forests, its economic value should be internalised in decisions regarding forest management regimes. This may be implemented by using policy instruments such as financial support for extending the rotation periods or similarly imposed taxes if harvesting occurs before a specific stand age. Both approaches would create incentives for forest owners to extend the rotation periods, which will result in a positive climate benefit at the expense of a short-term reduction in timber supply. However, deviations from an optimal rotation period result in a lower economic return. If, however, the support is designed to cover the difference in return, then the forest owners are unaffected. In general, the support should be calibrated based on the difference between the social value of extended rotation periods and the forest owners' private value of the measure. A simple calculation indicates that financial support should be around SEK 1,890 per hectare and year, given an interest rate of three percent. Another policy instrument is so-called reversed auctions. A reversed auction is like a normal auction but with many sellers (forest owners) and only one buyer (the government) in which carbon credits are traded. The purpose of reversed auctions is to procure measures that will increase the carbon sink of forests. Advantages of reversed auctions include that the forest owners can choose appropriate and cost-effective measures to implement, and that the government can set explicit targets for the carbon sink. Australia is one country having implemented a system for reversed auctions to reduce its net emissions.

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