Green and vibrant economy

The updated climate roadmap for the forest industry 2025

Introduction:

The forest industry continues its climate action

The first climate roadmap for the forest industry was completed in 2020. Even then, the climate roadmap showed that the industry has a significant responsibility in mitigating climate change and has the potential to deliver solutions with an impact that goes well beyond the industry's scale

The roadmap has now been updated and supplemented with new scenarios. This has provided valuable and complementary information on the industry's current climate impacts and opportunities to implement effective climate action. New data and figures ensure that the roadmap is as up to date and as accurate as possible.

Climate work continues in the forest industry. Through decisions made at national and EU level, Finland can retain its status as an economically strong climate action pioneer also in the coming decades. On the other hand, if competitively priced electricity, reliable supply of wood or any other investment condition deteriorates, we will also lose the climate benefits and economic benefits they would help secure.

Cutting emissions from mills and transport, boosting forest growth

Fossil emissions are the root cause of climate change. They need to be sharply reduced. While energy production is already 92% renewable in forest industry mills, the remaining fossil emissions, low as they may be, must be cut. While Finnish mills are already forerunners in terms of their climate impact, the forest industry seeks to work with the government and other stakeholders to eliminate remaining fossil emissions and develop ways to capture, store and utilise bio-based carbon dioxide generated at the mills.

To comprehensively reduce the forest industry's emissions, fossil emissions must also continue to be reduced throughout the logistics chain. Forest industry raw materials and end products are transported by using forestry machines, freight trucks on the road and work machines in ports and terminals, as well as by rail and sea. There are many ways to reduce emissions throughout the logistics chain.

When the supply of raw materials is secured, the mills have plenty of wood to process and the logistics chain has sufficient cargo to transport. Achieving this requires active and timely forest management that strengthens forest vitality and growth and supports the forests' ability to adapt to future climate conditions.

The forest industry operates in the global market. The industry offers products and services throughout the world. Products made from wood can replace products made from fossil and other non-renewable raw materials. In addition, certain

The forest industry takes concrete climate action on many fronts

1. Mills are reducing their own fossil emissions. Fossil emissions could reach zero in as early as ten years.

2. The growth and vitality of forests is being improved. This promotes both forest adaptation to climate change and the availability of raw materials, whilst also strengthening the carbon sinks of forests.

3. The industry produces climate-friendly products. The products store carbon and are being used to replace products that cause more fossil emissions.

4. Emissions from logistics are being reduced. Larger combination vehicles, the development of work machines and choosing rail transport reduce emissions.

5. Carbon dioxide sequestration is being piloted. The capture, storage and utilisation of carbon dioxide may create new business in the future.

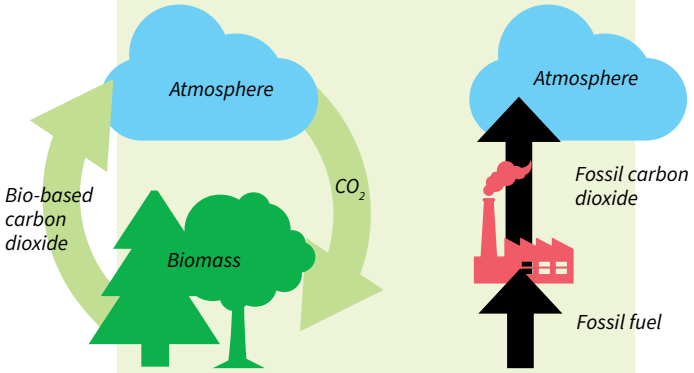
products made from wood can store carbon for decades.

Since the atmosphere is unaffected by national borders, forest industry production should take place where fossil emissions are lower and where industrial know-how and sustainable access to wood and water resources are secured. Likewise, forest harvesting should take place in countries like Finland, where forests are regenerated and where maintaining biodiversity is an integral part of everyday forestry. Therefore, it is in the best interest of the climate to ensure that forest industry production and harvesting do not relocate from Finland to countries with less stringent environmental standards. Such carbon and harvesting leakages should be prevented.

Picture: Shutterstock

Forest industry products are prime examples of the circular economy in practice. As a tree grows, it captures carbon dioxide from the atmosphere. Products made from wood reduce negative climate impacts when they replace products that cause fossil emissions.

Wood-based products act as carbon storage throughout their lifecycle. By recycling this carbon originating from the atmosphere, we can manufacture products, create jobs and maintain a sustainable economy. Carbon circulates between the atmosphere, trees and recyclable products. Export revenues generate wealth for the domestic economy.



Bio-based carbon is part of a relatively fast natural cycle.
Combustion of fossil fuels transfers and cumulates fossil carbon into the atmosphere. It is a harmful one-way process.

Good forest management means more growth and less forest damage

The use of wood in construction must be promoted through public procurement

Renewable raw material

Long and mainly local value chain

Securing the competitiveness of existing industry prevents carbon leakage

Pictures: Rodeo, Adobe Stock, Jaakko Vähämäki, Scanstock, Shutterstock

Efficient and functioning infra-structure for reducing emissions in logistics

Employment and income in Finland

Low-emission products for global consumers

Increasing the share of rail transport

Mill emissions scenario by AFRY

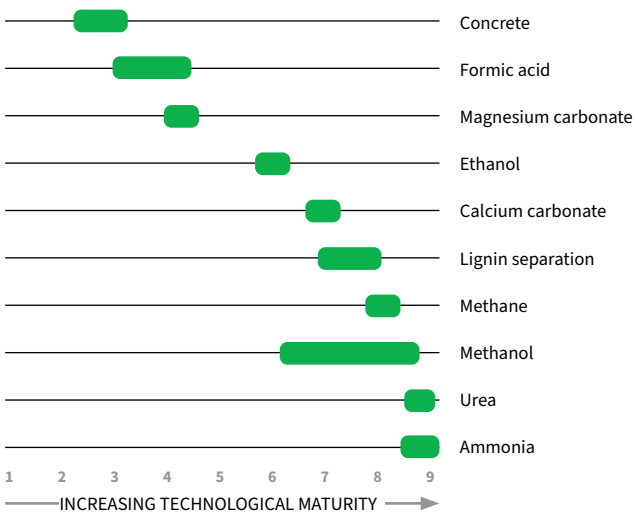
Forest industry mills are defossilising themselves

Forest industry mills in Finland are expected to operate without the use of any fossil fuels as early as 2035. However, the capture and utilisation of biogenic carbon dioxide from bioenergy production requires decision-makers to remove several bottlenecks.

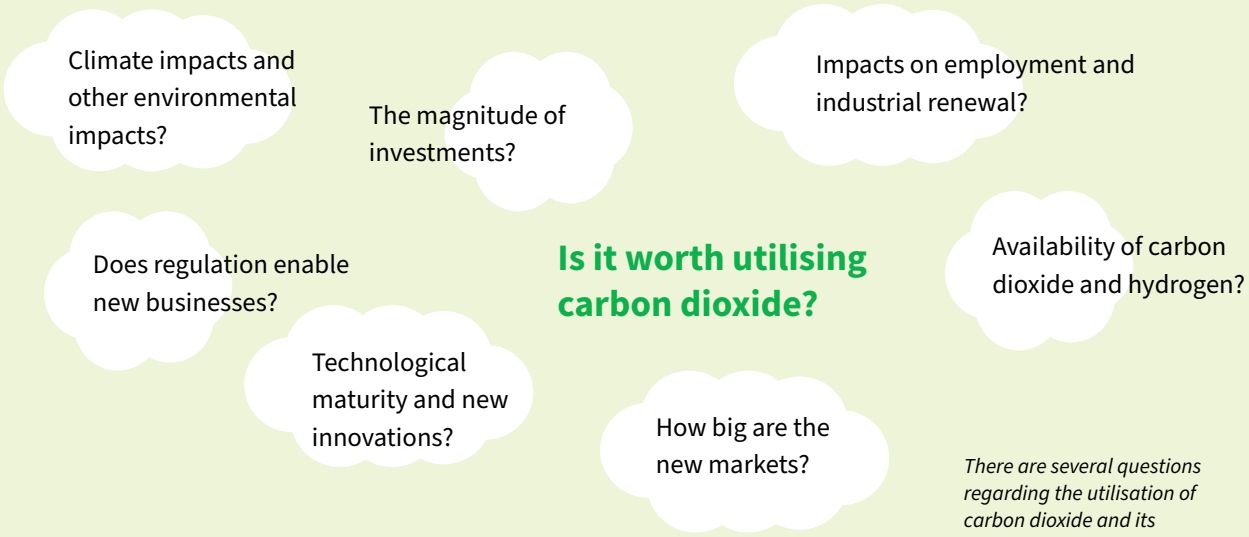
Forest industry mills will be able to operate without fossil energy in approximately ten years and will be carbon negative soon after, provided that the industry's operating environment supports this development and new technology can scale up to industrial scale. The forest industry's mill emissions scenario provides a more detailed overview of this.

By continuously reducing mill emissions, the forest industry has shown that it is on the path described in the mill emissions scenario published in 2020. In 2023, the share of renewable fuels at mills was already 92 per cent. Several factors enable the reduction of fossil emissions, such as the electrification of the industry, replacing fossil fuels with renewables, better utilisation of artificial intelligence and digitalisation, and energy and material efficiency.

Reducing mill emissions and investing in new technology require well-resourced companies and an operating environment that supports them. With the development of technology and product markets, the forest industry may have the opportunity to create new business from wood-based carbon dioxide captured in the manufacturing of wood-based products as a side stream of production without increasing the total use of forests.



The captured biogenic carbon dioxide can be used in the manufacturing of many raw materials. The end products can include, for example, plastics, chemicals, synthetic minerals and fuels for road, sea and air transport.



There are several questions regarding the utilisation of carbon dioxide and its profitability. (Source: VTT Technical Research Centre of Finland)

Scenarios on the national climate and financial potential of carbon capture and utilisation by VTT

There are many bottlenecks to the utilisation of carbon dioxide

– in the long-term, there could be also business opportunities

In the long term, there may be a high demand for products made from carbon dioxide (CCU) in Europe, as a means to achieving climate neutrality. This may represent a significant business opportunity, especially for different industries in Finland, provided that sufficient demand is created and production is both economically viable and technologically feasible.

Carbon capture and utilisation have been identified as one of the possible technologies among the EU's climate change mitigation measures. If technology and the market develop, there will also be opportunities in Finland to capture and utilise biogenic carbon dioxide.

The most promising CCU products include fossil-free fuels for aviation and sea transport, electric fuels for road transport and inorganic materials for industry. Carbon dioxide can also be used to manufacture plastics, chemicals and construction products.

However, new types of production methods do not arise on their own; they rely on the strength and the success of the existing industry. New technologies must operate reliably, and paying customers are needed for new products. In addition, capturing and utilising carbon dioxide as products requires a great amount of low-emission energy and clean hydrogen. The emergence of new business depends on continued technological development, significant investment in production capacity, and the expansion of supporting infrastructure.

Changes resulting from the climate scenario compared to current practices

Growth and destruction scenarios by Natural Resources Institute Finland

Preventing damage to enable more forest growth

Good forest management yields biodiversity and climate benefits

Successful wood processing and strong prospects have created economic value for forests and encouraged efforts to maintain their vitality. The future continuation of this valuable tradition requires forest owners to actively manage their forests and believe in the future of forestry and the forest industry. Inactivity would undermine the climate benefits and economic benefits offered by forests, as the existence of forest resources alone does not create jobs or improve forest growth.

According to the climate scenario, timely forest management will increase the annual growth of growing stock from 103 to 120 million cubic metres in the long term. At the same time, the carbon sequestration and carbon storage of living trees will increase significantly. *

Achieving these benefits relies on well-known forest management practices: rapidly regenerating forests and using suitable improved forest reproductive material, timely tending of seedling stands and increasing targeted fertilisation in mineral lands and peatlands.

Active forest management is carried out whilst safeguarding biodiversity. The climate roadmap for the forest industry and the biodiversity roadmap for the wood processing industry published in 2023 are naturally linked. They show that increasing forest growth does not hinder safeguarding biodiversity. Taking care of forest biodiversity is an integral part of everyday forestry activities, and different goals can and should be reconciled.

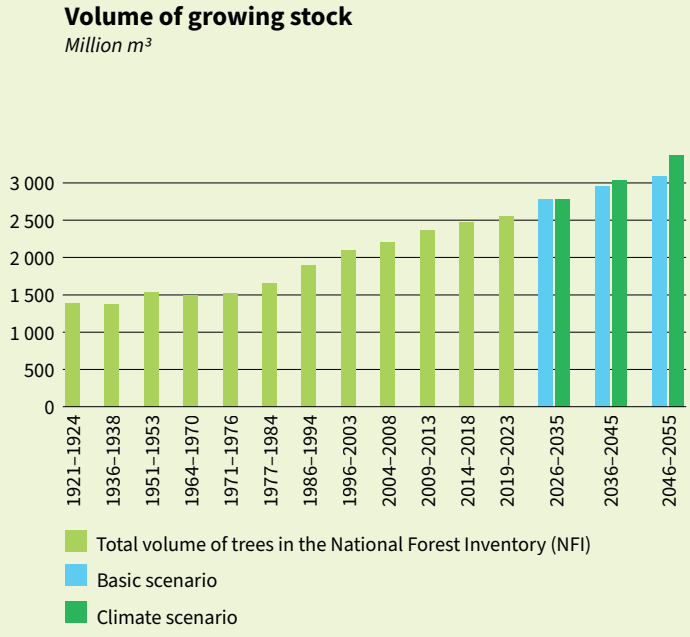
According to the climate scenario, the proportion of broadleaved trees and the growing density of managed forests will increase, which will also increase the volume of dead wood. The projected amount of dead wood is at the same level as those projected in the enhanced nature management scenario of the biodiversity roadmap.

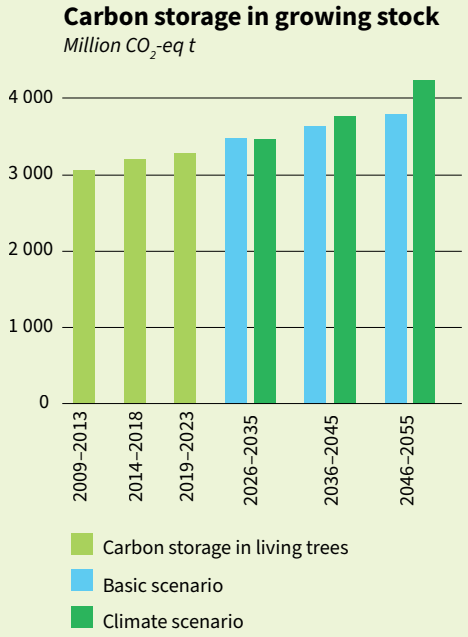
Forests growing on peatlands require special attention, and there is no one single best approach. By increasing continuous cover forestry in fertile spruce-dominated peatland forests and reducing ditch network maintenance, we can balance water economy and peat decomposition. At the same time, however, it must be ensured that a new generation of trees is born in continuous cover forestry sites.

*Due to the large uncertainties related to the inventory and modelling of soil emissions, the scenario review of the climate roadmap does not include the soil carbon balance.

Picture: Shutterstock

Change in the volume of growing stock and carbon storage





The volume of growing stock in Finnish forests has grown rapidly since the 1970s. According to the scenario by the Natural Resources Institute Finland for the Finnish Forest Industries Federation, the development can be continued thanks to active and timely forest management. Hereby, the carbon storage in living trees will also continue its strong growth. In the scenario, the felling volumes are set to increase from the current level towards the highest sustainable level of roundwood removal (Natural Resources Institute Finland 2025).

Kuvat: Heikki Ketola, Henri Koskinen, Markus Melin - Luonnonvara-keskus, Pekka Koskinen, Eeva Terhonen - Luonnonvarakeskus

Forest disturbance can take many forms and can be difficult to predict. According to scenarios simulating the bark beetle outbreaks in Sweden, the total volume of trees destroyed by the European spruce bark beetle alone in spruce-dominated stands can be 1.8–6.3 million cubic metres per year.

Climate change adaptation is a challenge that needs to be taken seriously today, not deferred to the future. Although climate change increases unpredictable risks for forests, these risks can be managed through good forest management.

The scenario review of the forest damage shows that, in Finland, the annual destruction of trees caused by the European spruce bark beetle outbreaks alone could amount to 1.8–6.3 million cubic metres if the damage that occurred in southern Sweden at the beginning of the 2020s were to be repeated on the same scale here. Often, there are many causal relationships to the damage. In the case of the spruce bark beetle outbreaks, long periods of drought, storm damage and root rot increase the risk of damage.

Forest adaptation to the climate change is promoted by managing forests actively, whilst taking biodiversity into account throughout the forest's rotation period. The early-stage management of forests is of great importance for the further development of growing stock. Therefore, incentives for the management of seedlings and young forests must be secured also in the future, as must support for ash fertilisation of peatlands.

Taking care of forest vitality and adaptation is part of joint climate work. It is not only linked to forests, but also to wood-processing mills and products that reduce fossil dependence.

It would be important for the climate that deforestation, i.e. the transformation of forests into other forms of land use, is critically examined in social discourse. For example, solar and wind power projects permanently eliminate the carbon sink of forests when built on forest land, even if they produce clean energy. In the construction of power plants, deforestation should be minimised. At the same time, the reforestation of unproductive lands must be significantly increased.

Carbon neutrality target 2035 in Finland

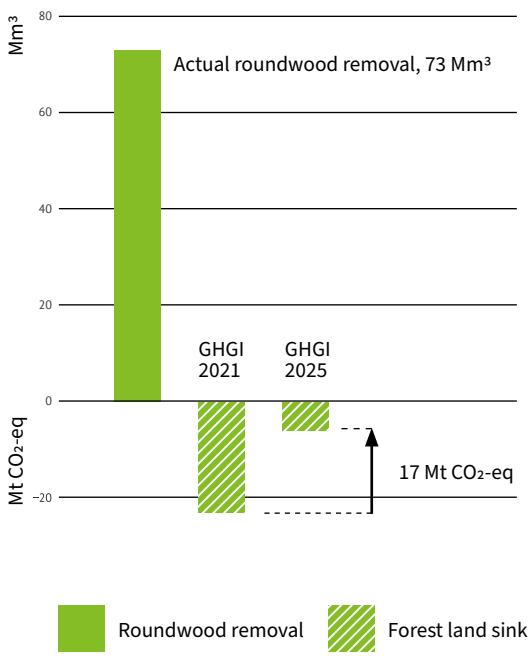
How did 17 million tonnes of carbon dioxide disappear?

A report prepared by the Natural Resources Institute Finland and commissioned by the Finnish Forest Industries Federation shows that, of the forest land (growing stock + soil) sink in 2019, which was the basis for Finland's carbon neutrality target, 17 Mt of CO2 was lost between the 2021 and 2025 greenhouse gas inventories (GHGI).

The sinks continue to slip away. In the scenarios used as the basis for the Climate Act, the forest land carbon sink was estimated to be -25 Mt CO2, but based on the scenarios published in 2025, the sink will become a source of emissions of +10 Mt CO2 by 2035.

The change in harvesting volumes does not explain the significant differences in the calculations for the different years, on which Finland's carbon neutrality target is based. An explanation for the lost sinks can be found in the changes in calculation methods and new information on growing stock, soil and global warming.

Carbon sinks in different greenhouse gas inventories in 2019



GHGI = greenhouse gas inventory

Source: Natural Resources Institute Finland

Logistics emissions scenario by AFRY

Harvesting and transporting with less emissions

Increasing the share of rail transports would be a significant opportunity to reduce emissions

The forest industry is a transport-intensive industry where raw materials and products are transported all year round both domestically and to global markets. The industry's carbon dioxide emissions from transport were 1.9 Mt CO2 in the reference year, which is at the same level as the mill emissions in the industry. Timber procurement, i.e. harvesting and transport, as well as export transports were the greatest causes of logistics emissions.

The scenario examined the emissions reduction potential of logistics is the first in Finland in terms of its comprehensiveness. The potential for reducing emissions has been examined across all modes of transport, from the forest to the world markets.

The measures to control emission reduction already included in national and EU legislation will reduce carbon dioxide emissions from the entire transport chain of the forest industry by approximately 20% by 2035. The scenario considers national distribution obligations, the EU-wide emissions trading system for fossil fuel distribution (ETS2), the obligation to use a mix of fuels in maritime transport (FuelEU Maritime), and maritime emissions trading.

The scenario also identifies other additional measures to reduce emissions from domestic logistics and halve emissions from roundwood transport. Based on the examination, the greatest potential for additional emissions reductions lies in moving timber transport from roads to rails and improving the energy efficiency of forestry machinery, which can significantly increase the emissions reductions. The realisation of additional emission reductions requires the implementation of cost-effective energy efficiency measures throughout the transport chain, and the fulfilment of the distribution obligation in accordance with the current legislation.

In domestic logistics, there are only limited cost-effective and market-based means available for reducing emissions. Nevertheless, the industry has also wanted to investigate the potential of these emission reductions.

In the climate roadmap scenario, the carbon intensity of the forest industry's domestic logistics chain will decrease by 2035

Emissions development of the forest industry's domestic logistics chain
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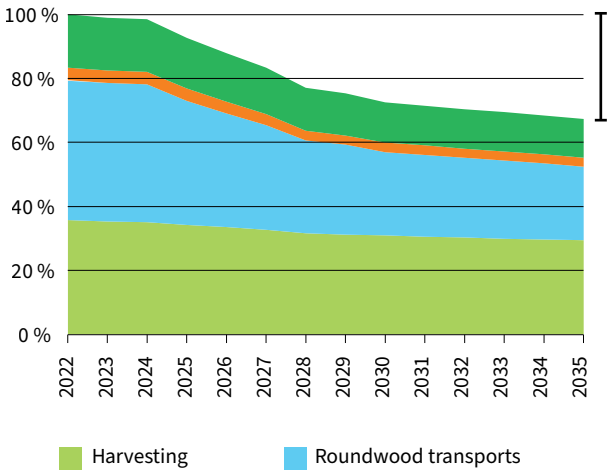
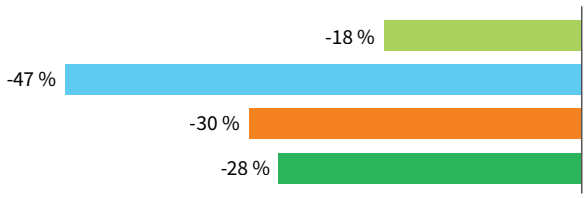


Emission reduction at different stages of the logistics chain



Reducing emissions by increasing rail transport is a real opportunity and a shared objective of the industry. However, this also requires commitment and action from the various operators. As per the scenario, removing real obstacles to competition is a climate policy issue that cannot be left up to industries alone. Finland should prepare a goal-oriented strategy to improve the conditions for rail freight traffic as soon as possible.

Among the measures, maritime emissions trading and ETS2 will only reduce emissions marginally, while increasing costs significantly. Their relative cost impact is greater in Finland than in the key reference countries. It is important that the compensation measures of ETS2 are introduced in Finland in the form of an energy tax refund for both for commercial transport and forestry machinery.

In export logistics, every effort must be made in advocating in the IMO and the EU in order to secure a fair competitive position in global trade. Improving the efficiency of export logistics would require a separate RDI programme to achieve cost-effective national emissions reduction solutions.

The way forward – how to achieve the benefits?

How can Finland maintain a strong bioeconomy and create the conditions for its future development?

The bioeconomy must be incorporated into industrial and climate policy in the EU and Finland, to enable the benefits of the forest bioeconomy. The continuous, reliable availability of wood must be ensured, and for example, wood construction must be promoted through public procurement.

The competitiveness of the existing forest industry must be ensured – only profitable companies can invest in new technologies.

How to approach forest sinks for the future?

Realism is needed when it comes to issues concerning forest sinks. Uncertainties must be considered in the carbon sink targets. Reducing fossil emissions must be the top priority in climate policy.

In forestry, active measures that improve forest growth and vitality must be promoted instead of choosing a passive approach. This will also improve adaptation to the climate of the future.

Greenhouse gas monitoring among EU Member States should be harmonized in a way that figures between countries could be reliably compared.

Picture: Susanna Seitakallio

How to further reduce the fossil emissions of the industry?

Industrial policy must combat carbon leakage and respond to measures taken by competing countries. The support for electrification must be continued in Finland, and the electricity tax for industry must be kept low.

The competitiveness of the energy-intensive industry must be ensured. Emissions trading revenue must be channelled to the decarbonisation of industry.

How to promote opportunities for carbon capture, storage and utilisation?

The carbon-neutral and tax-free status of bioenergy must be retained. This is a basic prerequisite for creating negative emissions and utilising biogenic carbon dioxide through technological sinks.

BECCUS projects with major technological and economic uncertainties should be promoted without obligations. Sufficient incentives for demonstration plants must be created, and opportunities for creating lead markets must be explored.

How can we reduce transport emissions?

The cost-effectiveness of harvesting and transport must be ensured. We need to improve the opportunities for increasing the share of rail transport, along with rapid adoption of professional diesel and an energy tax refund for forestry machinery.

Mill emissions

Rather than actual predictions or commitments, the scenarios introduced in the roadmap for the forest industry describe the opportunities regarding forests, transport and wood use. The scenarios are based on the following reports (available in Finnish):

Update to the climate roadmap for the forest industry: mill emissions scenario. AFRY 2024. Authors: Petri Vasara, Hannele Lehtinen.

Report on the national climate and financial potential of carbon capture and utilisation. VTT 2024. Authors: Sampo Mäkikouri, Lauri Kujanpää, Juha Lehtonen, Niko Heikkinen, Onni Linjala, Eveliina Jutila, Kati Koponen, Matti Reinikainen.

Forest management scenarios for the update to the Finnish Forest Industries Federation's climate roadmap. Natural Resources Institute Finland 2025. Authors: Hannu Salminen, Soili Haikarainen, Mika Lehtonen, Saija Huuskonen, Anssi Ahtikoski and Jari Hynynen

Products

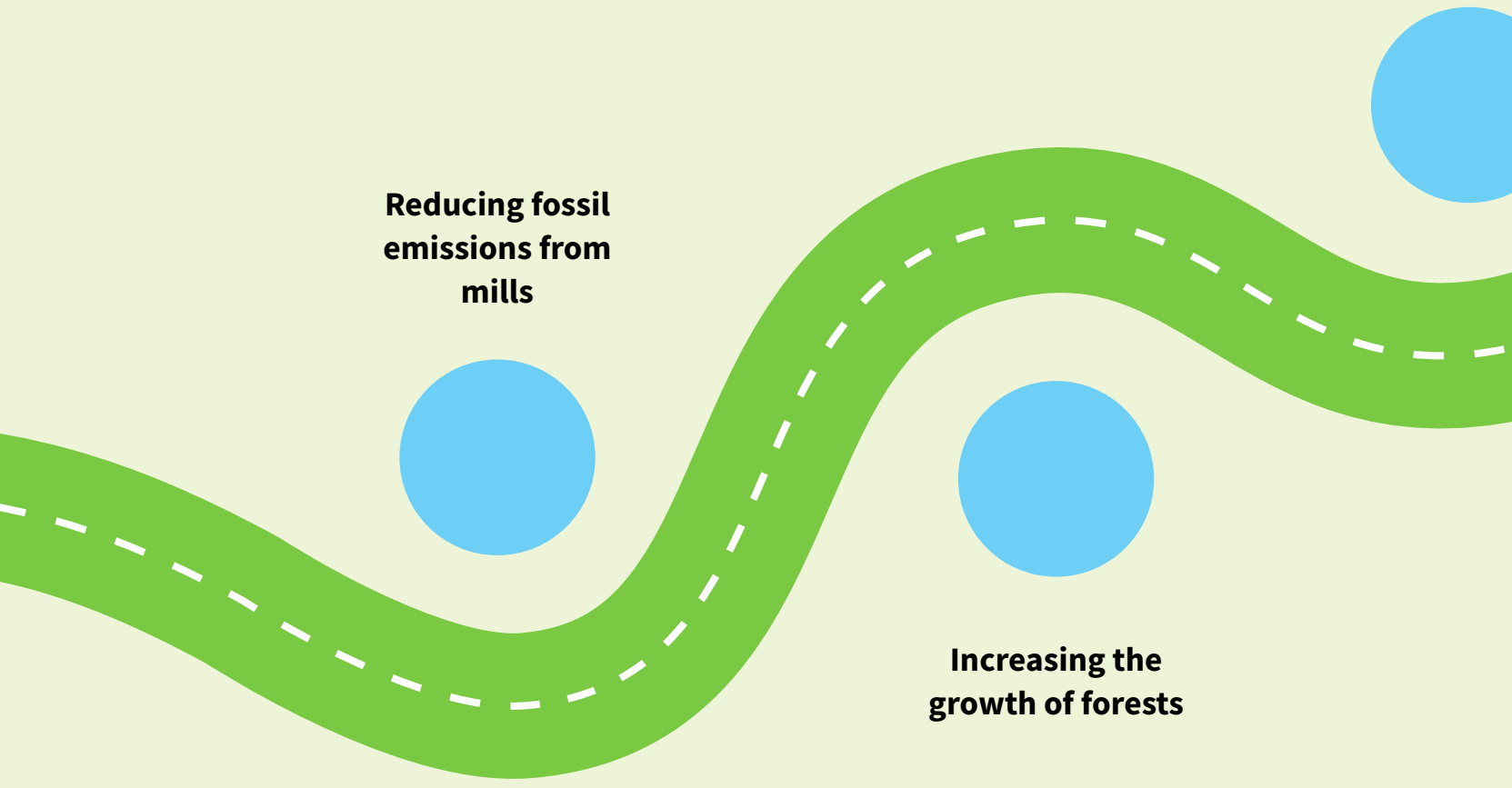
Logistics

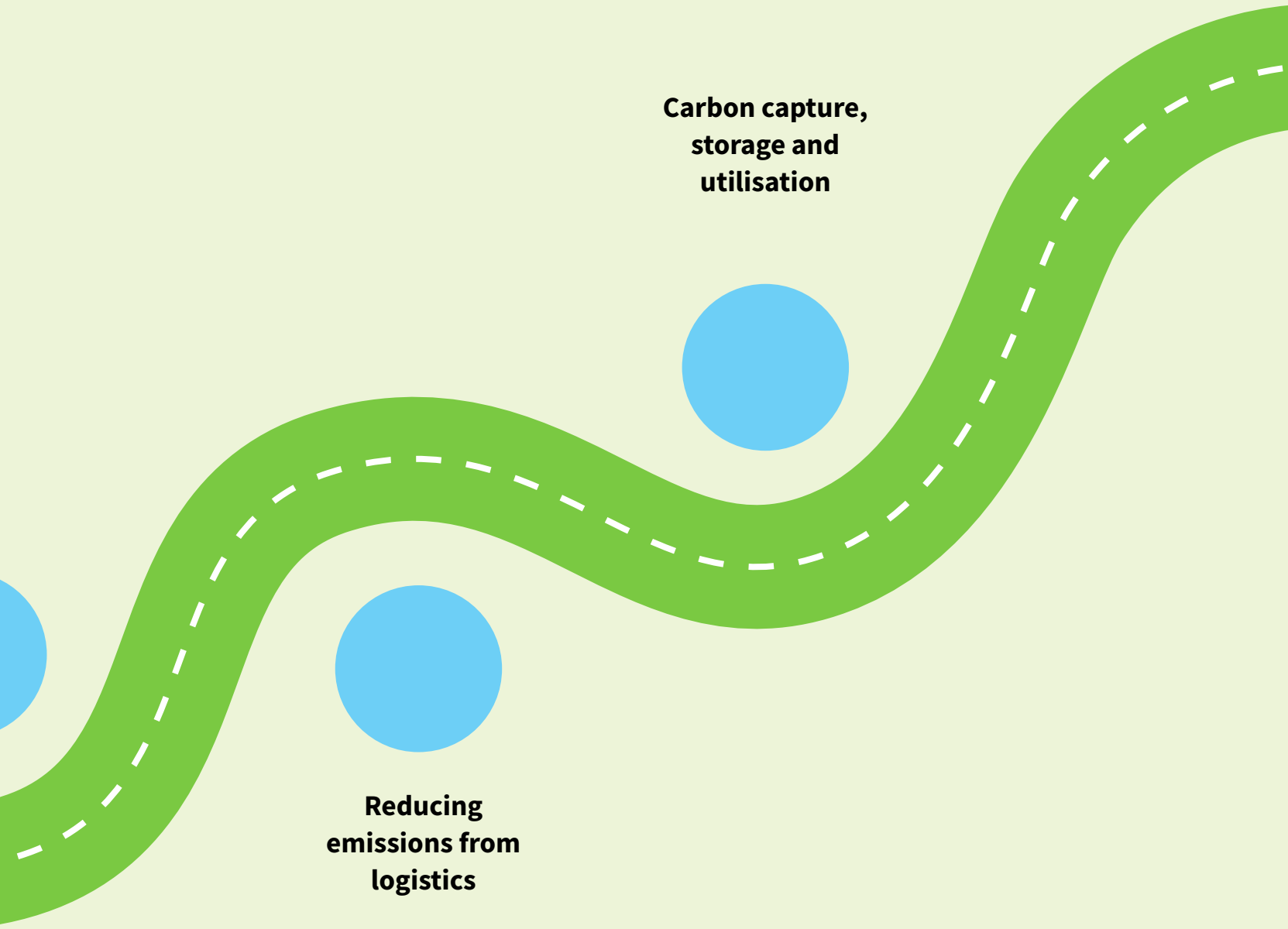
Differences in carbon sink estimates of forests included in climate scenarios, and the factors explaining them. Natural Resources Institute Finland 2025. Antti Mutanen, Tarja Silfver, Juha Mikola and Hannu Hirvelä.

Emissions scenario for forest industry harvesting and transport as part of the climate roadmap work. AFRY Management Consulting 2025. Authors: Esa Sipilä, Karina Puurunen, Siiri Kalliovalkama, Ilya Bezuglov.

Pictures: Shutterstock, Rodeo

Long-term climate work is being done in the forest industry




Carbon capture, storage and utilisation
Reducing emissions from logistics

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