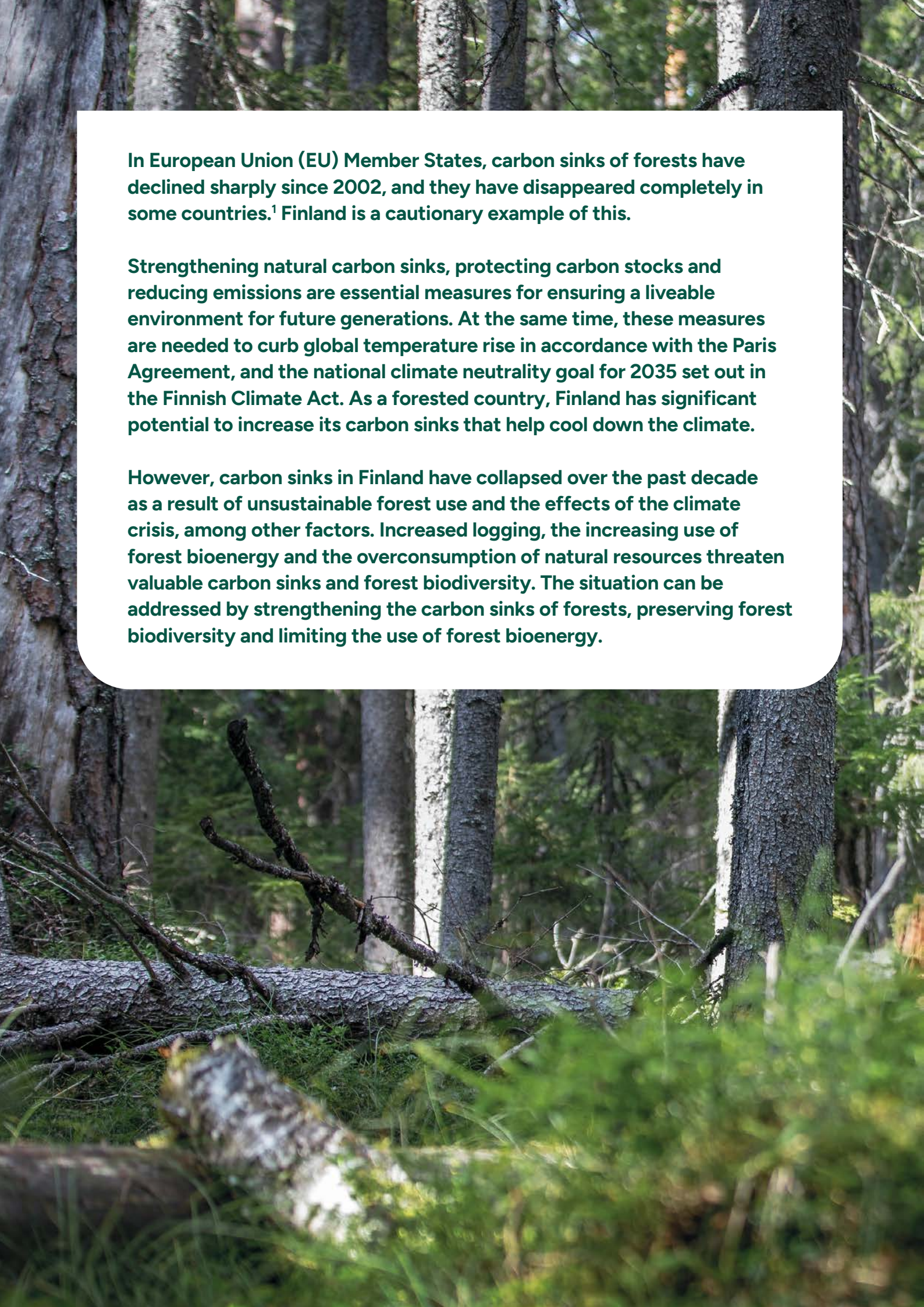
How can Finland save its carbon sinks?

Written by Nelli Immonen, Edda Sundström, Hanna Aho, Antti Heikkinen, Liisa Toopakka

SUOMEN LUONNONSUOJELULIITTO
VUODESTA 1938



In European Union (EU) Member States, carbon sinks of forests have declined sharply since 2002, and they have disappeared completely in some countries.[1] Finland is a cautionary example of this.

Strengthening natural carbon sinks, protecting carbon stocks and reducing emissions are essential measures for ensuring a liveable environment for future generations. At the same time, these measures are needed to curb global temperature rise in accordance with the Paris Agreement, and the national climate neutrality goal for 2035 set out in the Finnish Climate Act. As a forested country, Finland has significant potential to increase its carbon sinks that help cool down the climate.

However, carbon sinks in Finland have collapsed over the past decade as a result of unsustainable forest use and the effects of the climate crisis, among other factors. Increased logging, the increasing use of forest bioenergy and the overconsumption of natural resources threaten valuable carbon sinks and forest biodiversity. The situation can be addressed by strengthening the carbon sinks of forests, preserving forest biodiversity and limiting the use of forest bioenergy.

What is the difference between a carbon sink and a carbon stock?

Carbon sink:

A carbon sink refers to, for example, a stock of trees that sequesters carbon dioxide from the air as it grows. This reduces the amount of carbon dioxide in the atmosphere and, thereby, mitigates climate change. The soil and oceans also sequester carbon dioxide from the air.

Carbon stock:

Carbon sequestered in trees and soil is called a carbon stock. The carbon stock of a forest increases as trees grow, and diminishes as a result of logging and tree decay. However, the carbon stock of harvested wood is retained if the wood is used for long-lived purposes, such as buildings or furniture. Peatlands are Finland's largest carbon stocks. Approximately 70% of Finland's stored carbon is sequestered in peat.

Net sink:

A net sink refers to a situation where, for example, Finland's carbon sinks are larger than the emissions of the land use sector. The size of the net sink is calculated as the sum of the carbon sink and emissions, where the size of the carbon sink is presented as a negative figure.

Natural carbon sinks mitigate climate change — Finland's carbon sinks have collapsed

Strengthening carbon sinks and protecting carbon stocks is key to ensuring a liveable future and is a prerequisite for achieving the goals of the Paris Agreement, the EU's climate commitments and the binding goals of the Finnish Climate Act.

Habitats sequester carbon dioxide from the atmosphere and thus act as a buffer against climate change. However, according to a report[2] by the European Environment Agency, carbon sinks have been declining across Europe over the past decade. The European Commission estimates[3] that the EU will fall short of the -310 Mt CO_2-eq carbon sink target set for 2030 by around 50–70 Mt CO_2-eq unless the Member States take additional measures. If the EU does not achieve its carbon sink targets, its contribution under the Paris Agreement will be jeopardised.

Finland is a cautionary example of carbon sink collapse. The land use sector first turned into a source of emissions in 2018[4], but the alarming decline in carbon sinks has been a recognised trend for over a decade. According to the preliminary information published by Natural Resources Institute of Finland at the beginning of 2025, forests have also been a source of emissions since 2021. Although trees have remained a carbon sink, it is no longer sufficient to cover the increased emissions from forest soil.

The decline of the carbon sink of forests is caused by rising temperatures, increased emissions from peatlands, slower forest growth, and increased harvest levels.[5] Over the past decade, the average harvest volume has been approximately 72 million m3 in Finland. Each increase of one million m^3 in the harvest volume corresponds to an average carbon sink reduction of 1.5 million tonnes.[6]

The role of unsustainable harvest levels in the decline of carbon sinks has been recognised for a decade. For

[1, 2] *European Environment Agency, 2023: EEA's monitoring report on progress towards the 8th Environment Action Programme (EAP) objectives*

[3] *European Commission, 2024: COM (2024) 195 final*

[4] *Natural Resources Institute Finland (Luke), 2025:*

[5] *Haakana et al., 2022: Suomen LULUCF-sektorin 2021–2025 velvoitteen toteutuminen*

[6] *The Finnish Climate Change Panel: Skenaarioanalyysi metsien kehitystä kuvaavien mallien ennusteiden yhtäläisyyksistä ja eroista*

example, as far back as 2017, leading climate researchers in Finland warned that harvesting weakens Finland's net sink and biodiversity[7]. In spite of these warnings, harvest removal levels have not been restricted.

The collapse of carbon sinks jeopardises Finland's carbon neutrality target

The Finnish Climate Act[8] lays down an obligation for Finland to achieve carbon neutrality by 2035 and carbon negativity thereafter. Strengthening carbon sinks is also one of the aims of the Act.

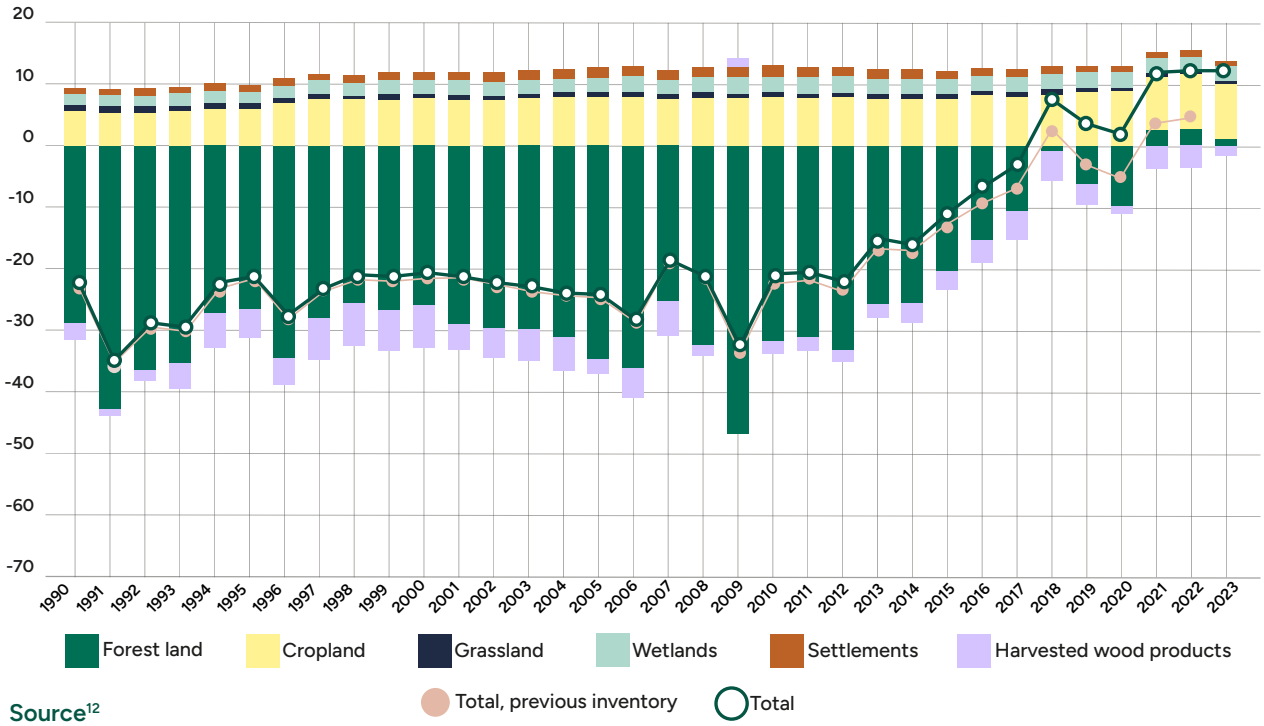
According to the Finnish Climate Change Panel,[9] the net sink of the land use sector should be approximately 12–18 million tonnes of carbon dioxide equivalent (Mt CO_2-eq) by 2030. The growth of carbon sinks should continue thereafter. If emissions reductions are faster than expected, and technological sinks can be utilised in a manner that is cost-effective and environmentally sustainable, the role of carbon sinks in the land use sector could be smaller.

The first Climate Plan for the Land Use Sector[10] in accordance with the Finnish Climate Act, completed in 2022, aims to strengthen carbon sinks by 3 Mt CO_2-eq by 2035. However, this is not sufficient to cover the deficit caused by the collapse of carbon sinks, which exceeds 30 Mt CO_2-eq according to the latest data. The carbon sink of the Finnish land use sector should be a sink of -21 Mt CO_2-eq by 2035, but currently it is an emission source of 11.8 Mt CO_2-eq. In the Annual Climate Report published in 2024 to assess the adequacy of climate measures, it was noted that several of the objectives of the Climate Act have been jeopardised and additional measures are needed, particularly to strengthen carbon sinks.[11]

Although strengthening carbon sinks is vital, it must not replace emission reductions. Instead, both must be promoted separately and in parallel. Carbon sinks cannot compensate for emissions from fossil fuels or peat.

LULUCF sector emissions and removals by land use category (Mt CO_2 - eq)

A positive number is emission and a negative number is removal (sink).



Source[12]

Caption: The carbon sink of forest land has collapsed over the past decade. In 2023, forest land was an emission source of 1.12 Mt CO_2-eq, and the LULUCF sector as a whole was an emission source of 11.84 Mt CO_2-eq.

[7] Luonnonsuojelija: Hakkuiden kova hinta

[8] Climate Act 423/2022

[9] The Finnish Climate Change Panel, 2023: Suuntaviivat kohti hiilineutraalia Suomea

[10] Government Report on the Climate Plan for the Land Use Sector, 2022

[11] Annual Climate Report 202412

[12] Natural Resources Institute Finland (Luke), 2025: Preliminary greenhouse gas inventory results for 2023

Measures Finland and the EU can take to strengthen the carbon sinks of forests

- Update the national Climate Plan for the Land Use Sector in accordance with the Climate Act. With the help of additional measures, Finland increases its carbon sinks in line with the EU's LULUCF Regulation and the national carbon neutrality target.
- Reduce forest harvesting levels.
- Use economic policy instruments to incentivise the lengthening of forest rotation periods.
- Increase the amount of decaying wood in forests.
- Stop the drainage of peatland forests.
- Introduce a fee for land use change to reduce deforestation.
- Ensure the full implementation of the Nature Restoration Law to protect biodiversity and strengthen carbon sinks.
- Do not use carbon sinks to replace emissions reductions from fossil fuels or peat.
- Do not use technological removals as a pretext to delay other climate actions and emission reductions.
- On the EU-level, adopt a separate annual target of at least 600 Mt CO_2-eq. for net sequestration in the LULUCF sector by 2030, and maintain this level up to 2040.

National measures to increase carbon sinks

In order for Finland to achieve its climate targets, carbon sinks must be significantly increased from the current level. Reducing forest harvesting from the current level of approximately 72 million m^3 to 55–60 million m^3 at most would increase carbon sinks and benefit biodiversity.[13] The majority of Finns are in support of reducing forest harvesting in order to achieve climate targets.[14]

Delaying forest harvesting, i.e. extending the rotation period, can strengthen the carbon sink of forests.[15] Extending rotation periods means that forests are grown until they are older than a certain planned harvesting age. In Finland, forests are harvested too early, which means that their full carbon sequestration potential is not utilized. For example, in 2022, almost 40 per cent of regeneration felling was carried out earlier than what is proposed in the Best Practices for Sustainable Forest Management in Finland.[16] The government should financially support the extension of rotation periods by paying forest owners compensation based on carbon sequestration when their trees reach a certain age, for example. The introduction of a forest harvesting tax could also be a cost-effective method of increasing the carbon sink.

In addition to being affected by harvesting levels[17] and the age of harvesting, Finland's natural sinks are also affected by forest management practices. For example, continuous cover forestry (i.e. forest management without clear cutting) has a positive impact on the carbon sink, especially in nutrient-rich peatlands: maintaining continuous forest cover reduces soil emissions.[18] [19] Increasing the amount of decaying wood in forests is another way to protect the forests' carbon stocks.

[13] *Finnish Environment Institute (SYKE), 2024: Hakkuut vaikeuttavat hiilineutraaliuden tavoittelua arvioitua enemmän*

[14] *Taloustutkimus, 2024: kysely hiilinieluista 2024*

[15] *Pellervo Economic Research, 2022: Maankäyttösektorin ilmastosuunnitelman kustannusvaikutusten arviointi*

[16] *Finnish Forest Centre, 2022: Metsiä uudistetaan liian aikaisin*

[17] *Soimakallio et al., 2022 Closing an open balance: The impact of increased tree harvest on forest carbon*

[18] *Peura et al., 2017: Continuous cover forestry is a cost-efficient tool to increase multifunctionality of boreal production forests in Fennoscandia*

[19] *Díaz-Yáñez et al., 2020: Multifunctional comparison of different management strategies in boreal forests*

Increasing the amount of decaying wood is one of the goals stated in the national Climate Plan for the Land Use Sector but, because it is based on voluntary action, there is a need for binding measures to achieve the goal.

The carbon stock is the highest in biodiverse old-growth forests. Old-growth forests also store carbon for centuries. Although tree growth slows in older forests, carbon is still sequestered in the soil. Protecting old forests not only secures the carbon stock, it also preserves habitats for endangered forest species, as called for in the EU's Biodiversity Strategy. The Finnish Nature Panel has proposed increasing conservation funding so that Finland can achieve its forest-related EU-level obligations.[20]

The felling of peatland forests and peatland drainage for agricultural and construction purposes cause significant emissions. Large amounts of carbon is sequestered in the soil of peatland forests, but when the soil is drained and the peat decomposes, it is released into the atmosphere. Large quantities of carbon dioxide are released from peat, especially in mires.[21] For this reason, the drainage of peatlands should be stopped.

In Finland, emissions from deforestation amount to approximately 3–4 Mt CO_2-eq annually. The largest emissions are generated when forests are cleared for agriculture (about half of the emissions from deforestation)[22] and construction (about one-fifth of the emissions from deforestation). Deforestation can be mitigated, for example, by introducing a fee for land use change.[23] This would mean the introduction of a tax-like fee in situations where forest land is permanently cleared, such as for agricultural or construction purposes. This has been in preparation, and according to a joint impact assessment carried out by the Ministry of the Environment and the Ministry of Agriculture

Photo: Paul Stevens

[20] *Finnish Nature Panel, 2021: Metsäluonnon turvaava suojelun kohdentaminen Suomessa*

[21] *Heiskanen et al., 2020: Suometsien hoidon tuet ja niiden ilmasto-, vesistö- ja biodiversiteettivaikutukset: Kestävän metsätalouden määräaikaisen rahoituslain (Kemera-lain) mukaisten tukien tarkastelu*

[22] *Luke, 2022: Metsäkadon ilmastohaitta ja hillinnän ohjauskeinot Suomessa*

[23] *Ministry of Agriculture and Forestry 2024: Maankäytön muutosmaksua valmistelleen työryhmän loppuraportti*

and Forestry, a land use change fee could contribute to the achievement of the land use sector's objectives in Finland.[24] A fee for land use change should be introduced without delay.

Are technological permanent sinks an option?

According to the Finnish Climate Act, the calculation of the net sink would take into account not only the natural sinks of the land use sector, but also potential technological sinks, such as bioenergy with carbon capture and storage (BECCS). According to the Programme of Prime Minister Petteri Orpo's Government, "the Government will set a target for the use of technological sinks to a significant extent already during the 2020s".[25] However, technological sinks do not play a role in fulfilling the obligations laid down in the EU's LULUCF Regulation, so Finland cannot replace the strengthening of natural sinks with technological solutions. It is also notable that Finland has no geological formations suitable for the permanent storage, and therefore captured CO_2 would have to be transported for storage in other countries.

In addition, according to a report[26] by the Finnish Climate Change Panel, technological sinks have limited potential, approximately 5–6 Mt CO_2-eq, when it comes to achieving the national carbon neutrality target. Their implementation also involves a number of challenges and uncertainties. The projects have a long preparation period, at least 6–7 years, so they could only support the achievement of climate targets after 2030.[27] The report emphasises that technological carbon sinks must not be used to delay other climate action or as a reason not to pursue emission reductions.

Producing technological carbon sinks is more expensive than cost-effective sink measures in the land use sector, such as the rewetting of former peat extraction sites. The potential utilisation of technological sinks also needs to take into account social justice and the polluter pays principle.[28]

The European Academies' Science Advisory Council[29] has also cautioned about the uncertainties around BECCS, particularly the impacts of the burning of wood on natural carbon stocks, and whether additional carbon dioxide removals would happen quickly enough from the perspective of the objectives of the Paris Agreement. The European Scientific Advisory Board on Climate Change[30] has highlighted competition between nature's sinks and BECCS. Technological sinks require a significant amount of additional energy, and producing that energy will cause some adverse environmental impacts depending on the production method. For this reason, BECCS should not be used as an excuse to postpone or neglect measures to strengthen natural sinks.

> *BECCS should not be used as an excuse to postpone or neglect measures to strengthen natural sinks.*

It is noteworthy that current definitions of carbon dioxide removal (CDR) often conflate carbon removal from the atmosphere with carbon removal from the biosphere, such as BECCS. Carbon removal from the biogenic carbon stock, meaning land and vegetation, depletes the natural carbon stock and ecosystems' ability to sequester carbon, and it may also harm biodiversity and other ecosystem services. On the other hand, many solutions to strengthening natural sinks have proven benefits for biodiversity.

Finland is not on track to achieve the targets of the EU's LULUCF Regulation

The land use sector is part of the EU's climate commitment for 2030. The EU's LULUCF Regulation monitors the carbon dioxide flows of forests and other ecosystems on an annual basis. In the updated LULUCF Regulation, the EU seeks to increase the EU's total sinks by 310 Mt CO_2-eq by 2030.

National forest reference levels are at the core of the LULUCF Regulation. The reference level is a figure to which the size of the carbon sink of forests in 2021–2025, determined on the basis of a greenhouse gas

[24] Ministry of Agriculture and Forestry & Ministry of the Environment, 2024

[25] A strong and committed Finland – the Government's vision, 2023

[26, 27] Kujanpää et al., 2023: Opportunities provided by technological carbon sinks and the means for their advancement in Finland

[28] Tikkakoski, 2024: Tavoitteena vähähiilinen kaukolämpö

[29] EASAC, 2022: Forest bioenergy update: BECCS and its role in integrated assessment models

[30] European Scientific Advisory Board on Climate Change, 2024: Scientific advice for the determination of an EU-wide 2040 climate target and a greenhouse gas budget for 2030–2050

inventory, is compared. The reference level is based on how forests were managed during the period 2000–2009.[31] The reference level for Finnish forests for the period 2021–2025 is -29.4 Mt CO_2-eq when harvested wood products are also taken into account.[32] Germany, France, Spain and Sweden, for example, have higher reference levels than Finland.

Recent data indicates that Finland's carbon sinks fall significantly short of the required reference level. If forest carbon sinks do not reach the set reference level, Finland must find emission reductions elsewhere in the land use sector. If this is not possible, the deficit will be shifted to the effort sharing sector in 2027 and multiplied by 108%, further raising Finland's emission reduction obligations. In order for the sink deficit to not be transferred to the effort sharing sector, Finland will need to buy credits from other Member States. However, it is very unclear whether other Member States have credits for sale and what their price would ultimately be. If there are no credits available for sale, or the Member State does not want to buy them, the Commission can take the Member State to court.

According to a report[33] by the European Environment Agency, carbon sinks have declined across Europe over the past decade. The European Commission estimates[34] that the EU will fall short of the carbon sink target set for 2030 by around 50–70 Mt CO2-eq unless the Member States take additional measures. If the EU does not achieve its carbon sink targets, its contribution under the Paris Agreement will be jeopardised.

Therefore, the update of the LULUCF regulation plays a central role in ensuring a sufficient protection of natural sinks. The EU should adopt a separate annual target of at least 600 Mt CO2-eq. for net sequestration in the LULUCF sector by 2030, and the level should be maintained up to 2040 in order to align with the EU's climate neutrality goal and ensure long-term climate resilience. Net removals in the LULUCF-sector must be kept under a separate target with no flexibility with the ETS and ESR sectors. Carbon sinks or storage must not be used to compensate for emissions from fossil fuels or peat.

Photo: Antti Partanen, Vastavalo

[31] *Luke: Metsien vertailutaso pähkinänkuoressa*

[32] *Ministry of Forestry and Agriculture, 2020*

[33] *European Environment Agency, 2023: EEA's monitoring report on progress towards the 8th Environment Action Programme (EAP) objectives*

[34] *European Commission, 2024: COM(2024) 195 final*

Measures to strengthen carbon sinks through enhanced forest biodiversity

- To be implemented nationally under the European Union's Biodiversity Strategy:
  - **Increase the protected surface area to 30 per cent.**
  - **Protect primary and old-growth forests.**
  - **Restore at least 30 per cent of degraded ecosystems.**
  - **Increase decaying wood, especially in forests that are in commercial use, promote mixed-species forests and diversify the age structure of stands.**
- The European Parliament, Finland and other Member States actively support the Forest Monitoring Regulation, which creates a common EU-level system for monitoring the status of forests and a knowledge base.
- Support synergies between the LULUCF-sector and biodiversity through sufficient funding.

Biodiverse forests support carbon sinks

Biodiverse forests are vital for both carbon sinks and climate change mitigation and adaptation. It serves as insurance in a changing environment. Biodiversity loss and the climate crisis pose an equal risk to human well-being.[35]

The biodiversity of Finnish forests is in decline. Some 76 per cent of Finland's forest habitats are endangered, and old forests, in particular, are scarce.[36] Approximately 31 per cent of Finland's endangered species live primarily in forests.[37] Increasing forest harvesting levels is among the greatest threats to the biodiversity of forests.

Due to climate change, forests change and become increasingly vulnerable to insect destruction, storm damage and forest fires. It has been observed in Europe that biodiverse forests grow faster, store more carbon and are more resistant to diseases and pests than more homogeneous forests.[38] It has also been observed in Finland that old and protected forests spread minimal insect damage.[39] In northern pine and spruce forests, the risk of damage is estimated to be low.[40] Carbon storage in forests has been estimated to be cost-effective in spite of the risks of forest damage. Delaying harvesting and increasing the carbon sink of forests will remain effective ways to mitigate climate change in the future as well.

EU-level policy instruments for the conservation of forest nature

The Nature Restoration Law (NRL) and its national implementation in nature restoration plans plays a pivotal role in enabling member states like Finland to get back on track with their LULUCF targets. It calls for the restoration of degraded peatlands, such as in agriculture, with potential for carbon capture and storage, and the minimization of GHG emissions from peatlands. There are synergies between restoration and carbon sinks, and investing in restoration addresses biodiversity loss and secures carbon storage at the same time.

According to the NRL, member states should enhance forest biodiversity by increasing characteristics that occur in primary forests, such as deadwood, connectivity

[35] *IPBES, 2018: Regional Assessment Reports on Biodiversity and Ecosystem Services*

[36] *Assessment of threatened habitat types in Finland, 2018*

[37] *Red List for Finnish species, 2019*

[38] *Ratcliffe et al, 2017: Biodiversity and ecosystem functioning relations in European forests depend on environmental context*

[39] *Luke, 2025: Kirjanpainajatuhot luonnonsuojelualueilla ja niiden naapurustossa*

[40] *Ekholm, 2020: Optimal forest rotation under carbon pricing and forest damage risk*

and uneven-aged tree structure. This will boost biodiversity conservation, strengthen carbon dioxide removal and storage, and support the achievement of both NRL and LULUCF targets.

Peatlands and wetlands play a role in strengthening natural sinks. The EU is the world's second-largest emitter of greenhouse gases from drained organic soils. In Finland, a third of the forestry land is peatland, and forestry is a major reason for peatland drainage and degradation. 53 % of Finnish peatlands have been drained.[41] 70 % of Finland's carbon sinks are sequestered in peat, and peatland drainage causes a significant amount of emissions. Restoring agricultural peatlands, for example, as set out in the NRL, could provide significant reductions in greenhouse gas emissions.[42]

The objectives of the EU's Biodiversity Strategy must be promoted in Finland in order to protect forest biodiversity. The protected areas must be increased to 30 per cent, and the focus of protection must be particularly on primary and old-growth forests. Finland must also restore at least 30 per cent of degraded habitats by restoring their natural function; for example, by increasing the amount of decaying wood and blocking ditches.

Furthermore, the proposed EU Forest Monitoring Law could play a key role in following the progress towards the objectives of the biodiversity strategy, and would help with identifying worrying trends. It would enable the development of a holistic picture of the state of biodiversity decline in the EU as a whole, which is lacking at the moment. However, some countries with significant timber industries, including Finland, have been vocal against further EU regulation on monitoring forests. Finland and other member states opposing the act must reverse their position in support of the proposal, and the parliament must adopt a position in favour of the law.

Strengthening natural sinks requires a substantial boost in efforts to protect and restore nature, along with the swift expansion of sustainable forestry methods that benefit both the climate and biodiversity. To maximise effectiveness, strong synergies between the LULUCF sector and the EU's Biodiversity Strategy, the EU Restoration Law and other EU biodiversity related legislation must be ensured. This also needs to be supported through sufficient funding, including closing the €19 billion annual biodiversity funding gap until 2030.

Finnish forests and harvesting in 2023

- Finland's forests grow approximately **103 million** m^3 of roundwood annually.[43]
- The total removal volume (including harvests and natural removals) was **86.8 million** m^3. The breakdown of the drain was as follows:
  - **84% industrial wood; and**
  - **16% energy wood.**[44]
- The average harvesting volume over the past decade has been approximately **72 million** m^3. From the perspective of the Finnish Association for Nature Conservation, harvesting should be reduced to no more than 55–60 million m^3 per year.
- Wood imports from Russia ended in July 2022, but this has not had a significant effect on harvesting levels in Finland in the past couple of years.
- In 2020–2023, the forestry sector in Finland employed approximately 61,000 people. In 2010, the forestry sector employed approximately 10,000 more people, even though the harvesting level was below **60 million** m^3.[45]
- According to a survey carried out by the Finnish Association for Nature Conservation, 55 per cent of Finns would reduce forest harvesting in order to achieve climate targets.[46]

[41] Luke, 2024: Metsävarat maakunnittain

[42] IEEP, 2022: Why Is Nature Restoration Critical For Climate Mitigation In The EU?

[43] Luke, 2024: valtakunnan metsien inventointi (VMI)

[44] Luke, 2023: Total roundwood removals and drain by region 2023

[45] Luke: Bioeconomy in numbers

[46] Suomen luonnonsuojeluliitto, 2023: kyselytutkimus hiilinieluista

Measures for the EU and Member States to limit the use of forest bioenergy

- Establish scientific sustainability criteria for forest biomass as part of the implementation of the Renewable Energy Directive.
- Reduce the total use of forest bioenergy and take into account its climate and biodiversity impacts.
- Prioritise higher-added-value wood products.
- Discontinue the use of peat as an energy source alongside fossil fuels, and replacing them primarily with renewable energy sources that are not combustion-based.
- End subsidies with adverse environmental impacts, such as the tax benefit for wood fuels in Finland.

Is Finland's bioeconomy sustainable?

Finland's bioeconomy is largely based on the use of forests, short-lived products and the energy use of wood. This endangers the climate and the biodiversity of Finnish forests. The bioeconomy must be based on the sustainable use of natural resources, i.e. preventing overconsumption and reducing greenhouse gas emissions. Biodiversity, clean waters and a healthy environment must be considered the highest priority.

In 2023, 61 per cent of the dry matter of wood was burned for energy in Finland.[47] Wood is also used as timber and in the production of pulp and paper, for example. Less than 20 per cent of the roundwood used ends up in long-lived products, such as construction.[48] According to the Finnish Environment Institute, the tax exemption on wood fuels is the most significant environmentally harmful tax subsidy. The tax subsidy for wood-based fuels and the loss of tax revenue amount to approximately EUR 440 million annually in Finland.

With this in mind, long-lived and higher-added-value products should be produced as a priority. In the Finnish national economy, the added value produced by the forest sector per m3 of wood processed has decreased substantially in recent years. At present, most of the carbon in wood is released from processes into the atmosphere as carbon dioxide, which has a negative effect on both climate benefits and the economic yield of forests. Increasing value added and making more efficient use of wood could improve both the environmental impacts and the profitability of the industry.[49] Wood construction and long-lived wood products are the least harmful to the climate of all the uses of wood, as the carbon is released into the atmosphere only after a longer period of time. Successfully increasing the share of timber construction products in forest industry production without increasing the harvesting levels in Finland would lead to climate benefits even in the short term when compared to the current situation.[50]

> *A bioeconomy that is based on the increased harvesting of forests is not justified from the perspective of the climate or the environment.*

Replacing fossil fuels with wood-based products is not a solution to mitigate climate change. Finnish studies have estimated that when the degradation of forest carbon sinks is taken into account, emission reductions

[47] Natural Resources Institute Finland, 2024: Yhä suurempi osa puun kuiva-aineesta päätyy energiaksi

[48] The Finnish Climate Change Panel, 2022: Metsät ja ilmasto: Hakkuut, hiilinielut ja puun käytön korvaushyödyt

[49] VVT & Luke: Päästäjästä tuottajaksi – Hiilidioksiditaloudella arvonlisää Suomen metsäsektorille

[50] The Finnish Climate Change Panel, 2022: Metsät ja ilmasto: Hakkuut, hiilinielut ja puun käytön korvaus hyödyt

in the use of wood have been rare even over a century-long time horizon.[51] If harvesting levels are increased, the use of wood will not have positive climate impacts, even if the wood is used for long-lived products.[52]

The production of biofuels also poses problems. The energy and fertiliser inputs required for their production may cause more emissions than fossil fuels. In addition, replacing fossil fuels with biofuels is challenging due to high costs and technological limitations, for example.

Consequently, a bioeconomy that is based on the increased harvesting of forests is not justified from the perspective of the climate or the environment. Instead, the strengthening of the carbon sinks of forests and the production of long-lived, high-added-value wood products should be prioritised.

Why is the energy-use of wood not carbon-neutral?

Increasing the use of forest bioenergy poses a risk to Finland's goal of strengthening carbon sinks. While it is sometimes argued that the energy use of wood is justified by the material being a renewable resource, the Finnish Climate Change Panel[53] and the European Academies' Science Advisory Council[54] have both pointed out that the energy use of forest biomass is not carbon-neutral. The burning of wood results in carbon stocks in forests and soil being reduced, compared to a scenario in which forest bioenergy is not produced. Fossil fuels and the energy use of peat should, therefore, be primarily replaced by other, non-combustion-based renewable energy sources.

Moreover, switching from fossil fuels to forest bioenergy or increasing the use of forest bioenergy does not reduce emissions from energy production quickly enough. According to the Finnish Environment Institute, the emissions caused by the burning of stumps, large-sized wood and decaying wood, for example, are at least at the level of fossil fuels, especially at the beginning of production of forest bioenergy.[55] Similarly, the energy use of felling and forest residue has adverse impacts on the carbon stocks and biodiversity of forests.[56]

However, wood fuels are very competitive in Finland under the current policy instruments, as the energy-use of wood is not taxed. The tax benefit for wood fuels is an environmentally harmful subsidy because it incentivises unsustainable harvesting.

The climate impacts of tax reforms related to the energy-use of wood have been studied at the national level. According to a working group on energy taxation established by the Finnish Ministry of Finance, taxing the use of timber material for energy would lead to timber material being more likely to be directed to further processing than to energy use.[57] A report prepared by the consultancy firm Afry also found that taxation would speed up the phasing out of biomass combustion nationally. Biomass would mainly be replaced by heat pumps and electric boilers, and not by fossil fuels. Positive effects of taxation would be seen in the land use sector.[58] In addition, the competitiveness of renewable energy forms that are not combustion-based could be improved through further tax decisions and investment subsidies.

> *The tax benefit for wood fuels is an environmentally harmful subsidy.*

Member States should establish scientific sustainability criteria for forest biomass as part of the implementation of the Renewable Energy Directive in order to safeguard climate benefits and minimise adverse impacts on nature. In particular, the energy use of high-risk raw materials — such as stumps, timber material (over 10 cm in diameter), decaying wood, hardwood, imported wood and biomass originating from nature conservation areas and old-growth forests — must end.

[51] Soimakallio et al 2016: Climate Change Mitigation Challenge for Wood UtilizationTheCase of Finland

[52] Seppälä et al 2019: Effect of increased wood harvesting and utilization on required greenhouse gas displacement factors of wood-based products and fuels

[53] Luke, 2024: Puun energiakäyttö 2023 (ennakko)

[54] Tilastokeskus: Energian kokonaiskulutus energialähteittäin (kaikki luokat), 1970-2023

[55] Finnish Environment Institute, 2011: Metsäbiomassan energiakäytön ilmastovaikutukset Suomessa

[56] Repo et al., 2020: Forest bioenergy harvesting changes carbon balance and risks biodiversity in boreal forest landscapes

[57] Ministry of Finance, 2020: Report of the working group on energy taxation reform : A proposal for implementing the intentions and goals of the Government Programme and for further development of energy taxation

[58] Muilu et al., 2024: Biomassan verotuksen laajentamisen mahdollisuudet ja haasteet

The sustainability criteria for biomass in the Renewable Energy Directive were updated again — did anything change?

The sustainability criteria for biomass in the Renewable Energy Directive (RED)[59] have been updated several times, most recently in 2023. In 2021, over 550 scientists[60] called on European Commission President Ursula von der Leyen to end government subsidies for burning wood. While the final Directive does restrict new direct subsidies for burning wood, the necessary changes to existing subsidy systems and indirect subsidies were not made.

The sustainability criteria in the Directive are based on a country-specific risk assessment, the LULUCF Regulation and greenhouse gas emission calculations. The problem is that these calculations do not take into account the decline of carbon sinks caused by forest harvesting in the land use sector.

Finland has implemented the Directive by enacting legislation on biofuels, bioliquids and biomass fuels.[61] The working group established for the purpose of updating the legislation published a report in 2024, according to which the implementation of the criteria will not lead to likely or significant environmental benefits.[62] Consequently, the national implementation of the Directive will still not prevent the adverse climate and environmental impacts of the energy-use of wood.[63]

In recent years, there have been reports of cases in Finland where wood originating from the regeneration felling of old-growth forests has ended up being used for energy. The Finnish Government must draw up robust criteria for the protection of old-growth forests. Otherwise, the sustainability criteria in the Renewable Energy Directive will not prevent similar abuses in the future.

Photo: Paul Stevens

[59] *Renewable Energy Directive, RED III, 2023*

[60] *Land and Climate Review, 2021: Over 500 scientists to world leaders: do not burn trees for energy*

[61] *HE 70/2020 vp*

[62] *RED III kestävyyskriteerityöryhmän loppuraportti*

Measures Finland and the EU can take to strengthen the carbon sinks of forests

- Update the national Climate Plan for the Land Use Sector in accordance with the Climate Act. With the help of additional measures, Finland increases its carbon sinks in line with the EU's LULUCF Regulation and the national carbon neutrality target.
- Reduce forest harvesting levels.
- Use economic policy instruments to incentivise the lengthening of forest rotation periods.
- Increase the amount of decaying wood in forests.
- Stop the drainage of peatland forests.
- Introduce a fee for land use change to reduce deforestation.
- Ensure the full implementation of the Nature Restoration Law to protect biodiversity and strengthen carbon sinks.
- Do not use carbon sinks to replace emissions reductions from fossil fuels or peat.
- Do not use technological removals as a pretext to delay other climate actions and emission reductions.
- On the EU-level, adopt a separate annual target of at least 600 Mt CO_2-eq. for net sequestration in the LULUCF sector by 2030, and maintain this level up to 2040.

Measures to strengthen carbon sinks through enhanced forest biodiversity

- To be implemented nationally under the European Union's Biodiversity Strategy:
- Increase the protected surface area to 30 per cent.
- Protect primary and old-growth forests.
- Restore at least 30 per cent of degraded ecosystems.
- Increase decaying wood, especially in forests that are in commercial use, promote mixed-species forests and diversify the age structure of stands.
- The European Parliament, Finland and other Member States actively support the Forest Monitoring Regulation, which creates a common EU-level system for monitoring the status of forests and a knowledge base.
- Support synergies between the LULUCF-sector and biodiversity through sufficient funding.

Measures for the EU and Member States to limit the use of forest bioenergy

- Establish scientific sustainability criteria for forest biomass as part of the implementation of the Renewable Energy Directive.
- Reduce the total use of forest bioenergy and take into account its climate and biodiversity impacts.
- Prioritise higher-added-value wood products.
- Discontinue the use of peat as an energy source alongside fossil fuels, and replacing them primarily with renewable energy sources that are not combustion-based.
- End subsidies with adverse environmental impacts, such as the tax benefit for wood fuels in Finland.