# Examining the future of Finland's forests and peatlands as a carbon sink

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Piitsonsuo project. Credit: Varpu Heiskanen and Eeli Gröhn/University of Eastern Finland

In climate-smart forestry, forests and peatlands should provide livelihoods for their owners, but also sequestrate carbon, safeguard biodiversity, and provide recreation. At the same time, they should adapt

to the changing climate and to the increased risk for damage, while also producing more wood to replace fossil materials and fossil energy.

The level of ambition in such forestry is high.

"It is quite a challenge to sustainably and simultaneously safeguard different interests in forest management and forest use. Climate-smart forestry does not provide a single model for all; instead, different models must be tailored to temporal and local conditions," Professor of Silvicultural Sciences Heli Peltola says.

"As climate change progresses, I don't think the annual increase in temperature will stop at two or so degrees in Finland over this century, because our temperature increase is higher than the global average. In Finland, we should prepare for the annual mean temperature to rise by up to three or four degrees."

Researchers have created various climate models to assess global warming, but there are many uncertainties associated with these calculations. For instance, it is very difficult to predict the development of greenhouse gas emissions globally. In northern Finland, global warming does not pose a similar threat as in southern Finland, where it is expected to increase several risks associated with forest damage.

However, human activity may have an even greater impact on forests and peatlands than global warming. Enhanced forest management, such as using fertilizers, can be used to increase tree growth and carbon sequestration. By adapting forest management, it is also possible to reduce soil emissions from forests and drained peatlands.

Especially for spruce, however, climate change increases many risks for damage simultaneously, including damage caused by strong winds, European spruce bark beetles and the tree decay fungi Heterobasidion.

"Lower felling volumes increase carbon sinks in forests and peatlands more than higher felling volumes. However, very low felling volumes can also increase the risk of damage as the forest ages," Peltola says.

"Increased risk for damage makes decision-making complicated."

## Drying of peatlands may already have begun

Finland is a country of not only forests, but also peatlands. They, too, play an important role in mitigating global warming. Peatlands store around 500 gigatonnes of carbon, which is equivalent to more than half of the current atmospheric carbon.

In Finland, peatlands cover almost one third of the country's area, making them the most important carbon storage.

"However, if conditions change, they can end up releasing huge amounts of carbon into the atmosphere. This is why their role is significant, both for Finland and globally," Professor Eeva-Stiina Tuittila explains.

In peatland, water level controls the entire ecosystem, the distribution and function of plants and microbes, as well as ecosystem services, such as climate regulation.

"Forests are able to regulate their loss of water to atmosphere in evapotranspiration better than peatlands do. In peatlands, drying might be already ongoing. Further, it is not a linear process: even short spells of drought may cause changes in peatland vegetation."

Nina Kumpulainen and Brunella Palacios Ganoza. Credit: Varpu Heiskanen and Eeli Gröhn/University of Eastern Finland

Changes taking place in peatlands have been studied by experiments modifying temperatures and water levels. The project Restoration of Low-productive Drained Peatlands—With Well Targeted Site Selection and Good Practices Towards Safeguarding of Soil Carbon Storage and Improved Functional Biodiversity is funded by the Recovery and Resilience Facility of the EU through the Ministry of Agriculture and Forestry, and it is coordinated by UEF.

"In Finland, peatlands have been restored on a rather small scale since 1980, but with the EU's increasingly ambitious climate targets and goals to restore and conserve nature, there is an urgent need to identify the optimal areas and methods for restoration, and the effects sought,"

Tuittila says.

"In another peatland restoration project, Return of Sphagnum, we are, for the first time, testing the transplantation of sphagnum moss in the restoration of a forestry drained peatland. The aim is to speed up the return of peatland vegetation to the area under restoration and thus to ensure that carbon sequestration begins also on disturbed surfaces devoid of vegetation, such as in the ditches."

"Moss transplantation is thought to bring in methane-oxidizing bacteria that can reduce methane emissions from the peatland."

In October, the first experimental transplantation of sphagnum moss was carried out by volunteers on the Piitsonsuo peatland in Ilomantsi. The area is owned by Tornator Plc. Most of the trees growing on the peatland were cut down and the ditches were filled, after which moss propagules were scattered on the area. Next spring, we'll be able to see how well the method works and if the moss transplantation methods should be expanded to other areas.

## Forest owners' attitudes are changing slowly

From the viewpoint of Finnish forest owners, the requirements for the protection and restoration of forests may seem harsh. Earlier generations would eagerly dig ditches and turn their scrubby peatlands into forests, as was customary at the time. And now, these very same ditches should be filled again.

A small number of forest owners is still skeptical about global warming, and researchers have studied their attitudes and readiness for change for several years.

"We analyzed the reasons possibly underlying forest owners' behavior,

and how easily they'd change their attitudes," says Professor of Forest Bioeconomy Foresight Teppo Hujala.

As part of the Finnish Forest Owner 2020 study, researchers from the Natural Resources Institute Finland, the University of Helsinki and Pellervo Economic Research PTT investigated the willingness of forest owners to increase carbon sinks in their forests, if this were to be compensated in an appropriate manner. Forest owners are mainly interested in continuous cover forestry and delayed final felling.

"Our research shows that some forest owners don't know how to take climate change into account in their own forest. Climate-smart forestry offers demonstration forests that are one way of communicating clear guidelines," Hujala notes.

Luckily, forest owners' decision-making is facilitated by the rapidly advancing digitalization of the forest sector. Forest owners now have access to more information on their forest, more easily than ever before.

However, the warming climate also poses additional challenges to forestry. Summers grow longer and hotter, which shortens the traditional harvesting season, i.e., when the ground is frozen. The condition of forest roads will deteriorate, which means that harvesting needs to be planned more carefully.

"On harvesting sites, it is possible to use AI to optimize the main logging roads to avoid soft terrain. This will maximize productivity while minimizing harvest damage," says Professor of Forest Technology Kalle Kärhä.

"Automated documentation, on the other hand, provides reports on harvesting quality. This also makes the carbon footprint of wood deliveries transparent."

Provided by University of Eastern Finland