

Joint Nordic efforts to increase **carbon storage in soil**

Increasing carbon storage in soil is potentially one of the most cost-effective climate measures, and one that will have a positive impact on aspects such as biodiversity and soil fertility. However, the use of soil as a carbon sink is linked to a range of perspectives and fields of expertise, which creates a complex policy landscape. In addition, because knowledge is developing at a fast pace it is challenging to comprehend what is going on, where, and by whom.

Decelerating climate change and preserving the planet's ecosystems requires a transition to more sustainable use of our natural resources.¹ In this context, carbon is central, and the potential to use soil as a carbon sink has been gaining interest.

“Globally, soil contains about three times as much organic carbon as plants and twice as much as the atmosphere”²

Soil carbon sequestration is high on the agenda in the Nordic countries. Several initiatives are underway, from the development of models and methods to measure and calculate the carbon content in soil to more practically oriented training sessions for farmers and advisors on how to increase the take-up of carbon in soil. The topic is, however, challenging in terms of both designing effective

policy and implementing the identified methods and solutions in practice. And time is limited if we are to reach the ambitious Nordic climate targets.

Increased Nordic collaboration is key in addressing the challenges associated with carbon storage in soil, and the potential for joint Nordic efforts looks promising. A combination of similar soil types and climate, existing interactions, as well as related goals in terms of climate policy, creates favourable conditions for joint efforts. Collaboration can provide significant Nordic benefits in terms of resource optimisation, reinforced and extended networks, and a stronger voice in international settings. In the long term, the benefits of Nordic collaboration may also be extended to other countries, thus accelerating soil carbon sequestration globally.

Suggestions for increased Nordic collaboration on carbon storage in soil

- Prepare a joint Nordic strategy on soil as a carbon sink
- Create calls specifically targeting Nordic projects on soil carbon sequestration
- Develop Nordic soil advisory services
- Investigate the potential for a Nordic certification for soil carbon credits
- Support the development of Nordic methods and models for soil carbon measurements
- Establish a Nordic network on soil as a carbon sink

¹ Naturvårdsverket. *Agenda 2030 och de globala hållbarhetsmålen.*

² European Commission. (2019). *EIP-AGRI Focus Group Moving from source to sink in arable farming final report.*

Nordic knowledge sharing

To increase Nordic collaboration on soil as a carbon sink, Nordic Forest Research, Nordic Agri Research, and the Nordic Council of Ministers' working group for climate and air initiated and funded a Nordic seminar series on soil carbon sequestration.

From November 2020 to May 2021, seminars were arranged with the aim of strengthening knowledge exchange among researchers, officials, and other relevant actors to increase the take-up of carbon in soil. These seminars, and the discussions they generated, form the basis for this policy brief.

Focus point: Soil science

Soil is linked to a range of ecosystem services and several sustainable development goals (SDGs), as illustrated in Figure 1. However, it is important to acknowledge that most of these links are not direct but rather indirect, where soil contributes to the general ecosystem services that lay the foundation for land-related SDGs.³

The importance, complexity and fragility of soils therefore need to be considered carefully in policy development on topics ranging from food production to forest management.

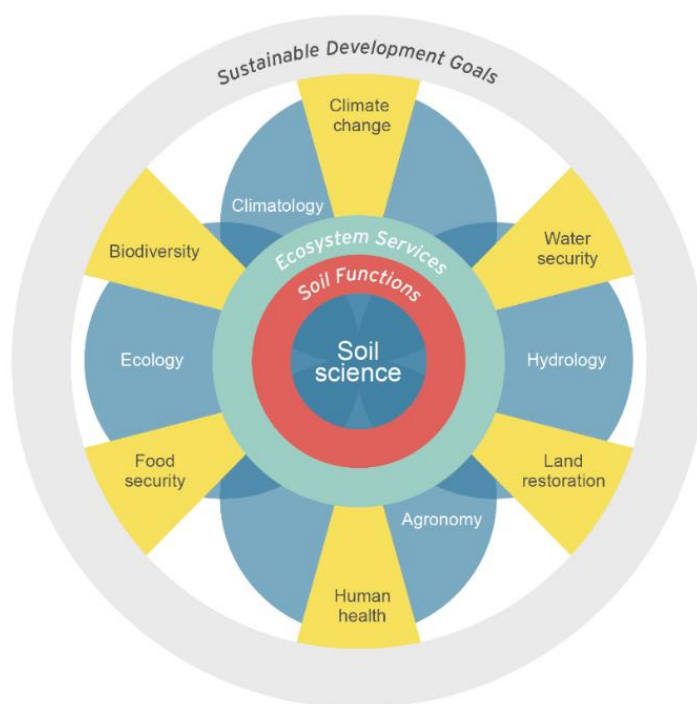


Figure 1: Illustration of soil science's contribution to ecosystem services and the SDGs³

Soil as a carbon source and sink

Carbon dioxide is one of the main greenhouse gases, which accelerates climate change when released into the atmosphere. Emissions of carbon dioxide arise mainly from anthropogenic activities, such as the consumption of fossil fuels, deforestation and, to some extent, farming. Depending on the land-use method, however, soil may contribute to both emissions and storage of carbon. When carbon is stored in arable and forest land, we talk about carbon sinks. These bind carbon and thus mitigate climate change while providing other positive impacts related to biodiversity and soil fertility, for example. Creating carbon sinks in soil is difficult, however. Results from

long-term experiments show that it is hard to maintain carbon levels in cultivated soil.⁴ Although many questions remain, and findings need to be validated, some methods are suggested to have a positive effect on the storage of carbon in soil. For example, these include restoring peatland to wetland, reducing tillage, establishing grass ley, using cover crops, as well as afforestation.⁵

Policy challenges and opportunities

Soil carbon is an important part of the debate on how arable and forest land should be used and how climate targets can be met. However,

3 Keesstra, S. D., Bouma, J., Wallinga, J., Tittonell, P., Smith, P., Cerdà, A., ... & Fresco, L. O. (2016). *The significance of soil science towards realization of the United Nations Sustainable Development Goals*. *Soil*, 2(2), 111-128.

4 Henriksen et al. NIBIO Bok 7 (1), Nationen 21.02.21 «Ta vare på molden du har»

5 Markens-potential-som-kolsänka.-20190521.pdf (nordicforestresearch.org) s. 6-7

it is a challenging landscape for policy makers to navigate. The linkage between soil carbon and a range of different perspectives and policy areas (e.g. biodiversity, production economics and climate aspects) forces policy makers to manage potential trade-offs and conflicting goals. Coupled with the continuously evolving understanding of aspects related to soil as a carbon sink and current scientific knowledge gaps, this creates tough conditions in which to design effective policies for sustainable soil management.

Important policy questions are “How to set ambitious and credible targets for Land use, Land-Use Change and Forestry (LULUCF)?” (including a review of the LULUCF regulation) and “How to bring better incentives to farmers and foresters?” (including carbon farming initiatives and certification of carbon removal).⁶

Methods and models

To reap the benefits from carbon sequestration in soil it is essential to calculate and communicate the effects of different carbon capture activities. Improving the modelling of these activities and carbon levels is especially important, to help tackle the challenges of predicting the long-term effects of soil carbon sequestration.

Different methods and models are used in the Nordics today, and collaborations and data sharing are in place to some extent. Experts do, however, emphasise the need for increased collaboration to develop existing and new methods and models. By sharing data across

the Nordic region, methods and models can be further validated and improved, and important lessons drawn. This will lead to a better understanding of soil ecosystem processes and provide knowledge that is critical for projecting future carbon stocks.

Knowledge centres and information sharing

Soil as a carbon sink is of interest to a wide range of stakeholders and is a focus point for multiple initiatives. In addition, knowledge is developing at a fast pace. This creates a complex ecosystem of actors, organisations, and knowledge, and makes it challenging to comprehend what is ongoing, where, and by whom. Simultaneously, there is a desire to facilitate increased knowledge sharing and to develop more joint research projects and practically oriented initiatives such as online courses and education for advisory services and farmers.

To facilitate such increased collaboration, investments are needed in structures to enable information sharing. These range from systems and models allowing researchers to share research data, to websites that gather information targeting a wide range of stakeholders, informing them of developments in the field and helping them to find relevant knowledge and contacts. Combining databases, field inventories and other ongoing initiatives across the Nordic countries would enable a harmonised and streamlined approach to soil carbon in the Nordics.

⁶ Presentation by Christian Holzleitner, Head of unit Land Use and Finance for Innovation, European Commission. Soil as a Carbon Sink - Policy challenges with regards to soil carbon sequestration. 20210427.

Next step: Suggestions for increased Nordic collaboration on carbon storage in soil

Prepare a joint Nordic strategy on soil as a carbon sink

A joint Nordic strategy is essential to streamline the various initiatives underway in the field. The work leading up to this policy brief has clearly indicated both the need and the will to increase Nordic co-operation on soil carbon sequestration.

Suggestion: Commission Nordic Agri Research, with the support of Nordic Forest Research, to develop solid strategy propositions for the development of soil as a carbon sink within the Nordics.

Create calls specifically targeting Nordic projects on soil carbon sequestration

Although several research and development projects are ongoing, there are substantial knowledge gaps regarding soil as a carbon sink. To fill these gaps, researchers and practitioners welcome further possibilities to join forces within the Nordics and collaborate on innovative solutions for soil carbon sequestration.

Suggestion: Commission Nordic research funding bodies to create calls for funding specifically targeting knowledge gaps related to soil as a carbon sink.

Develop Nordic soil advisory services

Advisory services may play an important part in providing expertise on soil as a carbon sink and hence supporting the practical implementation of identified solutions and methods. For example, Carbon Action in Finland has developed such an initiative and is interested in sharing its findings.

Suggestion: Investigate the potential to learn from the Finnish initiative on training advisors in soil carbon sequestration and transfer the findings to other Nordic countries.

Investigate the potential for a Nordic certification for soil carbon credits

In developing soil as a carbon sink it will be important to investigate the potential for standardising definitions and methods and developing certifications. This will be useful in several ways, such as to enable new business models to finance environmental services such as carbon storage in soil.

Suggestion: Enable the Nordics to take the lead on this issue and investigate the potential for a certification standard for carbon credits in relation to soil carbon.

Support the development of Nordic methods and models for soil carbon measurements

Nordic researchers are emphasising the benefits of increased collaboration to develop methods and models for soil carbon measurements. Shared responsibility and pooling of data, knowledge, etc. would optimise resources, ensure efficient validation of models, and enable a faster development.

Suggestion: Organise workshops facilitating co-ordination and knowledge sharing on the development of methods and models for soil carbon measurements.

Establish a Nordic network on soil as a carbon sink

The seminars and dialogues leading up to this policy brief have showcased the need for increased knowledge sharing and contact among existing Nordic actors regarding soil as a carbon sink. Multiple initiatives are underway, and it is challenging to keep up to date with the latest knowledge.

Suggestion: Commission Nordic Agri Research and Nordic Forest Research to investigate how best to organise relevant actors and initiatives, with the aim of supporting knowledge sharing and optimising resources in the Nordics, and ultimately extending the potential to use soil as a carbon sink.