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Carbon Action science webinar brought out novel research results on soil, carbon sequestration and water protection

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The soil, carbon sequestration and water protection -webinar was organized on 9th of March 2021 at 9 -11.30 (UTC+2). The webinar gathered around 200 participants from different backgrounds and countries. The webinar was moderated by **Laura Höijer**, Content Director of the Baltic Sea Action Group (BSAG). The webinar was organized as part of the [MULTA](#) project. The MULTA project is funded by the Strategic Research Council, and it is on the [Carbon Action](#) platform. SEB provided facilities for the webinar as part of the Baltic Sea co-operation with BSAG.

The Minister of the Environment and Climate Change **Krista Mikkonen** highlighted in her opening words the importance of the webinar's theme: *'we cannot separate our actions to safeguard the growing conditions in fields from those that safeguard the status of waters'*. She pointed out that our common goal should be both healthy fields and healthy water bodies. Nutrients need to be captured and recycled efficiently so that we can reuse them as energy where they are needed, rather than releasing them where they are not needed, such as into water bodies. In agriculture, the main measures proposed are those affecting runoff and soil condition. Along with these measures, we need to expand the range of water management tools and renew our thinking from local-scale management to catchment-based water management. Mikkonen reminded that Finland's government provides significant support for water protection. With the Water Protection Programme from 2019 to 2023, it is possible to accelerate the protection of water bodies and marine areas. Other innovative approaches are also needed. She pointed out that the Carbon Action Platform, a network of over a hundred farms taking part in pilots for carbon farming, is also a great achievement. Mikkonen stated that we need to manage soils to increase carbon (C) sequestration and to reduce phosphorus (P) losses. Synergies can be found, and she was looking forward that in this webinar, the scientific experts will guide us more about these synergies.

The multi-disciplinary research of Carbon Action was presented by **Jari Liski**, Research Professor of the Finnish Meteorological Institute and Carbon Action scientific coordinator. Carbon Action platform brings together and conducts scientific research to enhance soil carbon sequestration and improve agriculture's climate impacts. The platform contains multiple research projects and a multi-disciplinary network of researchers. The research work includes collaboration with farmers to develop regenerative agricultural practices that enhance soil health and productivity, soil carbon sequestration, biodiversity and nutrient retention. Liski pointed out that Carbon Action is developing a scientifically ambitious measurement and verification system to quantify regenerative farming impacts. This system uses various data and models and forecasts carbon sequestration even in areas

where measurement data are scarce. A [Field Observatory](#) has been created to illustrate the methods developed in the project and their results. The Observatory is an open-access online platform for visualizing measurement data and calculations from intensive study sites and 20 pilot Carbon Action farms. On a societal level, scientific verification provides a basis for agricultural and climate policy instruments, carbon credit markets, and carbon footprint estimates. Economic and policy analyses are also carried out to develop feasible, effective and practical regenerative farming solutions.

Senior Research Scientist **Tuomas Mattila** from the Finnish Environment Institute (SYKE) continued with a presentation about mechanisms and processes involved in managing soils for increased carbon sequestration and reduced phosphorus losses. Mattila stated that the big picture is that agricultural practices that enhance soil structure and hydrology can play part in both climate change mitigation through carbon sequestration and water protection through minimizing nutrient runoffs. This is also known as carbon farming and regenerative agriculture that is a hot research topic at the moment. The detailed picture is that agricultural soils have accumulated large phosphorus reserves. While carbon farming practices such as reduced tillage, and cover crops may concentrate this P reserve to the soil surface and increase P loss to water in short term, in the long run regenerative practices enable the use of legacy phosphorus for plant growth and storing P in increased organic matter. Mattila pointed out that a site-specific approach is needed. Local soils should be characterized based on their emission risks and carbon sequestration potentials and definite hotspots targeted for management action. This requires understanding the key mechanisms and processes of biogeochemical cycles of both carbon and phosphorus. Referring to the Minister Mikkonen's opening speech, Mattila confirmed that synergies can be found, if carbon sequestration can maintain a negative phosphorus balance and store P in increased organic matter. By integrating multiple benefits we are heading towards carbon farming and regenerative agriculture, which MULTA and Carbon Action project is all about.

Senior Scientist **Kimmo Rasa** from the Natural Resources Institute Finland (Luke) presented how pulp and paper mill fiber sludges can be used in agricultural water protection. The pulp and paper industry produces large quantities of organic sludges as side stream. Organic sludges are used on farms to give soil more structure (decreases soil erodibility) and prevent nutrient leaching. Rasa told us about a field experiment in Jokioinen, where composted pulp mill sludge, lime stabilized pulp mill sludge and fiber sludge were added in the agricultural soil. The results show sludge addition reduced particle and P losses from soil to percolation water over a four-year period of time. Sludges decomposed quickly and had minor effects on soil C content after four years. Interestingly, sludge addition clearly altered soil bacterial and fungal community composition. There was also a positive association, but no direct evidence, that microbiological activity would explain the improved soil stability. This effect on microbes will be further studied in future projects. Finally, as an answer to a question from the audience, Rasa told that fibers have been used on ca 1 500 ha of fields and there is an increasing interest in this.

Matias Scheinin, researcher and project leader representing the City of Hanko, took as to the Baltic Sea. He gave a presentation about the importance of northern Baltic coastal waters in determining the fate of carbon and nutrients. In his talk Scheinin introduced [Havsmanualen](#) projects, that are now on the Carbon Action platform. He started out by promoting the need for a change of perspective, when it comes to understanding the structure and function of our coastal ecosystems and the services they can provide. The main message here was, that emphasis in research should shift towards covering horizontal and seasonal variation. Scheinin then proved his point by demonstrating their novel methodological approach, that is based on high-resolution water surveys in a vast coastal area. He illustrated how variation on these particular scales in the physical limitations and biochemical foundations of life, indeed, characterizes the coastal environment. Then, Scheinin moved on to show the practical implications of the approach. By relating data on a set of central status indicators in their (physical) environmental context, that is, defining environment-specific reference values for the indicators, gradients reflecting the flow of carbon and nutrients can be revealed. Scheinin told that his information has already been applied in concrete environmental management, in collaboration with the local authorities. As an example, Scheinin showed a coastal catchment area, where treatments with soil amendment fiber had been targeted based on the information from Havsmanualen. He also showed how subsequent surveys with their approach can be applied for evaluating the impact of the treatments on water quality. The preliminary results were in accordance with Kimmo Rasa's presentation showing that pulp and paper mill sludges have a positive effect on water quality. The apparent, general outcome of these examples was, that the applied methodological approach provides a cost-efficient and reliable tool for monitoring and evaluating the impacts of virtually any anthropogenic activities in the coastal zone. Before ending his talk, Scheinin showed how terrestrial loading into coastal waters is associated with unprecedentedly high, horizontally and seasonally variable, surface-water concentrations of the greenhouse gases methane and carbon dioxide. The main take-home message from the talk was, that evidence-based targeting and evaluation of countermeasures against terrestrial loading can and should lead to a win-win-win situation, mutually beneficial for the economical profitability of land use, as well as its impacts on the water, and thereby, on the climate.

Finally, a commentary talk was given by **Airi Kulmala** from The Central Union of Agricultural Producers and Forest Owners (MTK). She told us, that she appreciated the research presented in the webinar and, also the aim to bring research results into concrete use. Water protection is important for farmers and forest-owners as they depend on water. She pointed out the importance of measured data and research results when planning action. She highlighted also that we need to improve soil fertility and nutrient cycling. The better the crops utilize given nutrients, the smaller is the risk of leaching. She concluded the talk by telling us how we can move towards a good status of waters: through agricultural and forestry practices that reduce loads, using cost-effective and well-targeted water protection solutions, through catchment area-specific planning and by applying more precise research data and by increasing know-how.

The discussion was active throughout the webinar. It was concluded that it is important that the farmers really can see how different practices effect carbon sequestration, and for

example the Field Observatory makes this possible. The farmers are nowadays really interested on the research results on carbon sequestration, and to develop farming accordingly. The audience also asked about the future of carbon markets. The bottleneck is that we need a reliable and practicable verification system, such as the one developed in the Carbon Action. It was concluded that the interest is so high at the moment, that it most likely will grow very rapidly, and many different actors will be involved. To the last question '*What are the best ways to get persistence/stable carbon into agricultural soils*' Mattila gave a simple answer: *increase photosynthesis time*, that is how you get carbon into soil. In Finland we could double the amount of 'greentime' with for example covercrops. Liski added that the other thing is that 'if you get it there, how to keep it there'.

Kulmala commented that is important to inform the farmers on the best methods. It was reminded that a free [e-college for regenerative farming](#) has been opened. It provides research and farmers' first-hand experiences in an easy-to-grasp format, accessible to all.

The webinar brought out novel, and very interesting and also practical, research results on soil, carbon sequestration and water protection. The webinar audience also contributed well, and thus made the event interactive. Warm thank you to all who attended – and also to the SEB bank for providing such excellent facilities and technical support for the webinar.

The [webinar recording](#) can be found on BSAG's Youtube-channel.

For more information:

Carbon Action platform, publications: <https://carbonaction.org/en/materials/>

Kimmo Rasa, Taina Pennanen, Krista Peltoniemi, Sannakajsa Velmala, Hannu Fritze, Janne Kaseva, Juuso Joonas & Risto Uusitalo. 2020. Pulp and paper mill sludges decrease soil erodibility. Journal of Environmental Quality, vol 50:

<https://access.onlinelibrary.wiley.com/doi/full/10.1002/jeq2.20170>

MTK's and SLC's Water Programme:

https://www.mtk.fi/documents/20143/310288/MTK_vesiohjelma_ENG_A5.pdf/47aefa6e-6140-97ee-26df-c5cfd27f60e3?t=1608038470076



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