

An aerial photograph of a dense forest, showing a mix of green deciduous trees and darker evergreens. A large circular cutout on the right side of the image reveals a white background.

Environmental services from Nordic-Baltic forests: CAR-ES

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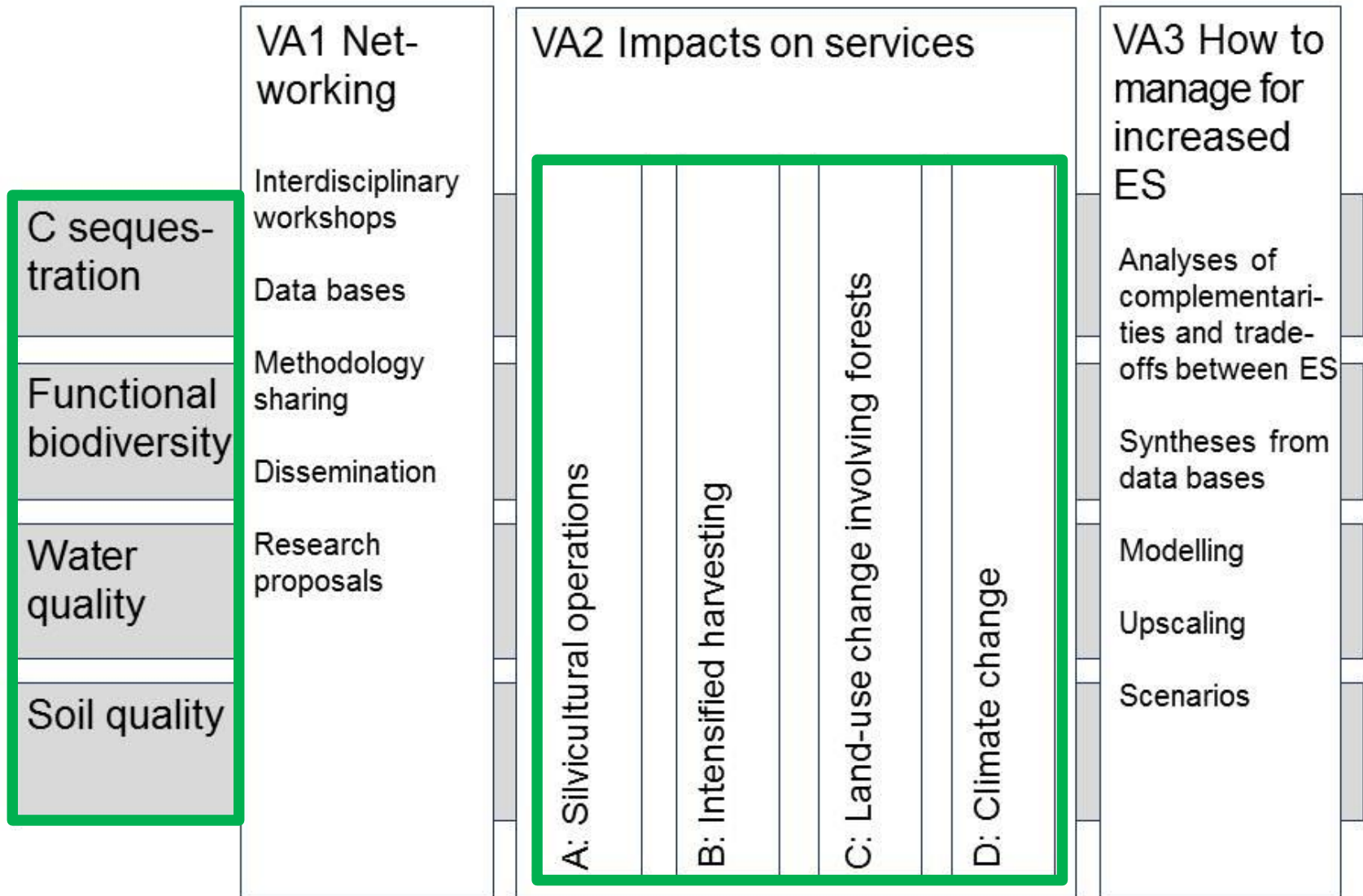
Nordic Forest Research
(SNS)

Centre of Advanced Research on Environmental Services from Nordic Forest Ecosystems CAR-ES III (2016-2020/1)

- Network funded by SNS under the Nordic Council of Ministers that brings together Nordic and Baltic forest researchers
- Aims to provide the best scientific knowledge for informed decision-making on forest management, concerning provisioning of environmental services
- Focus: carbon sequestration, water and soil quality, biodiversity
- Core partners:



CAR-ES activities

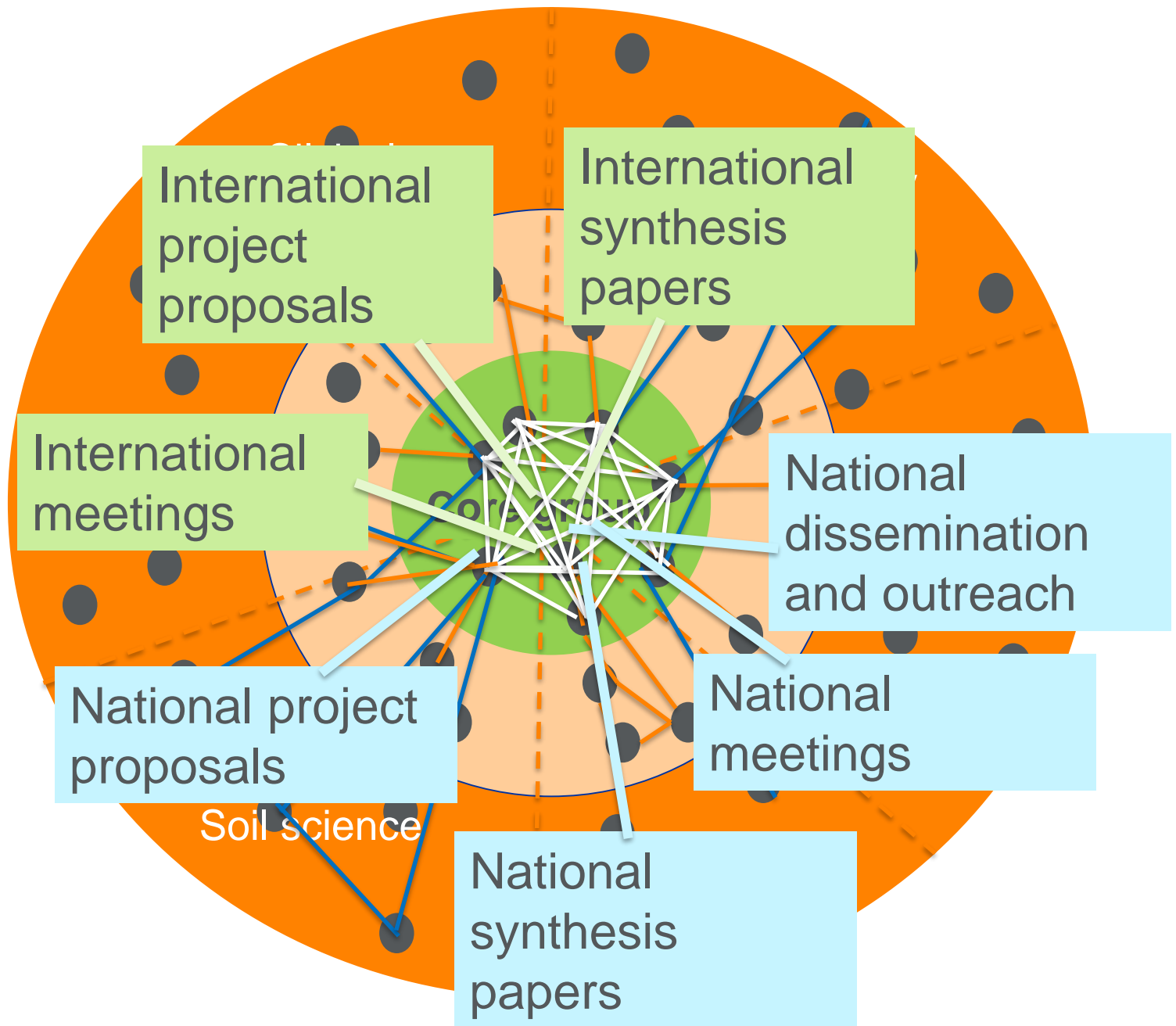


Scientific aims

- Analyze how different forest management operations and strategies influence the supply of ES
- Analyze how ES respond and can be sustained at different forest management intensities
- Analyze how ES change, and the potential to enhance them, following land-use changes involving forest
- Analyze the status and interactions of ES under changing climatic conditions
- Develop communication and decision tools for taking into account the ES in forest policy and management

Operational aims

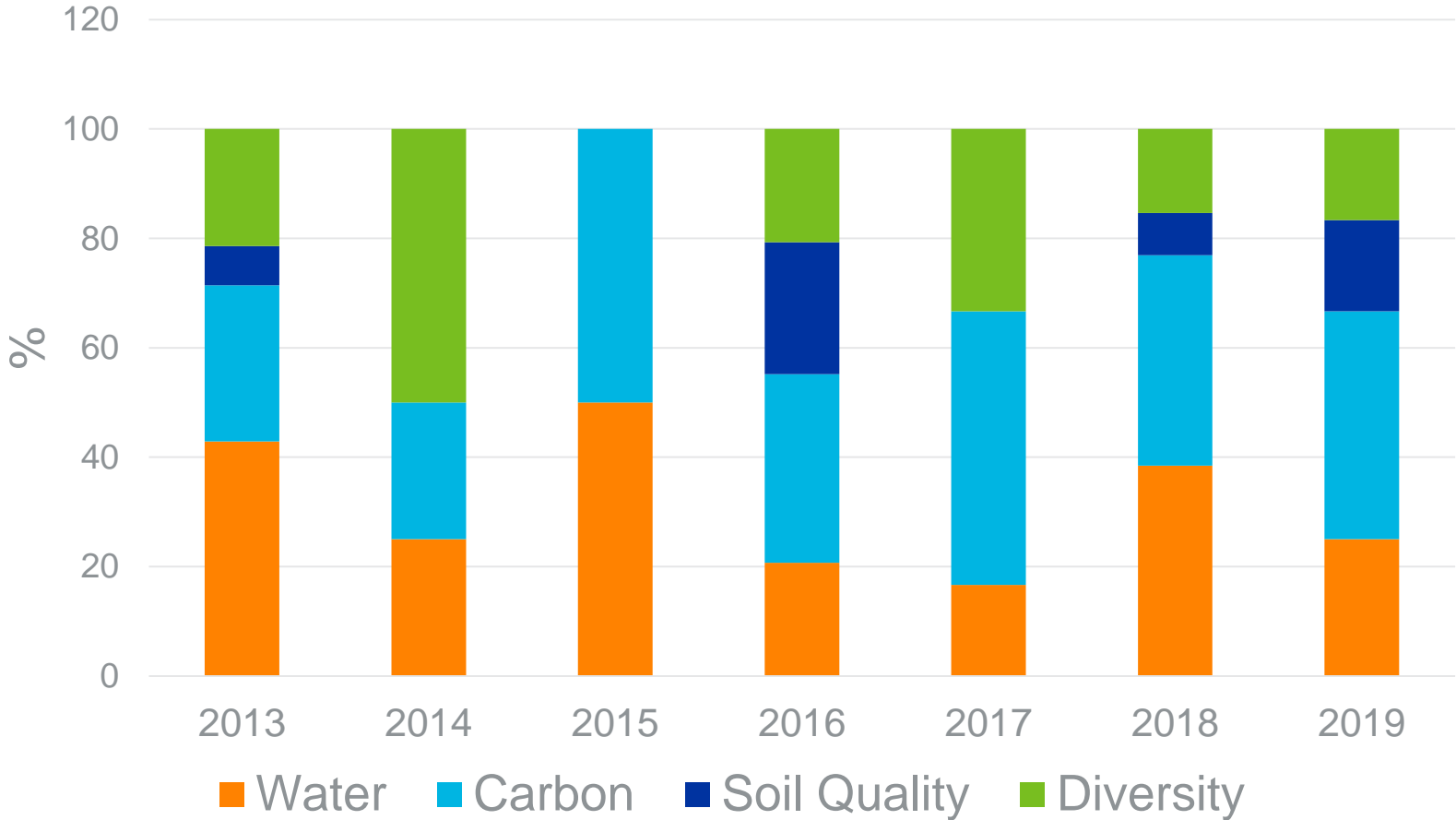
- Provide a platform for interdisciplinary communication in Nordic and Baltic countries
- Integrate and share knowledge on ES
- Coordinate research, i.e. reduce overlap, recognize gaps, improve the comparability of national research and contribute to national and international research agenda
- Share scientific tools, methodologies and data
- Identify hot issues requiring urgent scientific response, and initiate new research projects at the Nordic-Baltic scale, and/or at the European scale with a strong Nordic-Baltic component



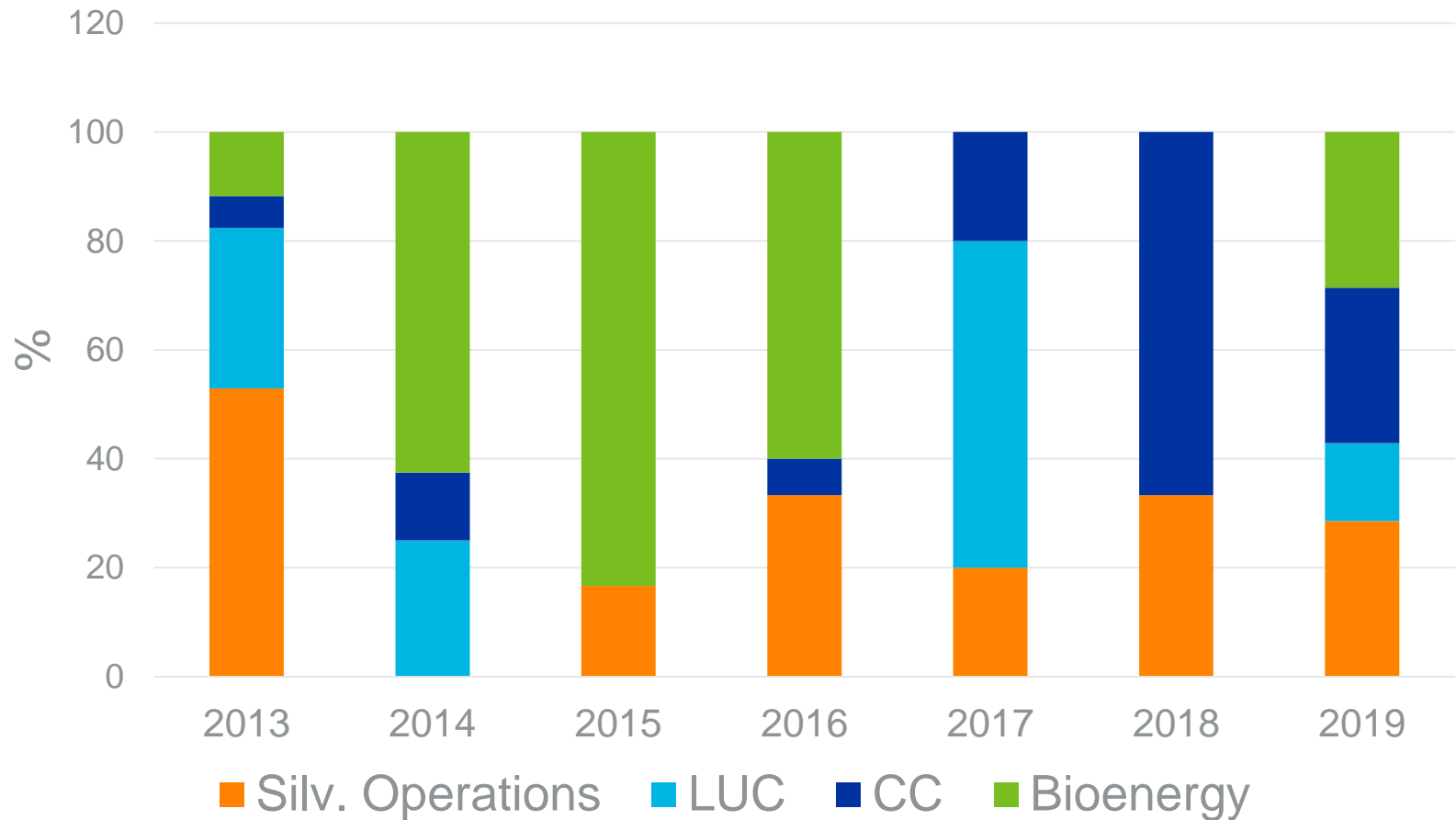
Typical output per year

- 1-3 scientific meetings (workshops, seminars, congresses) organized alone or jointly with other networks, projects, etc.
- 5-10 scientific papers directly from CAR-ES; 10+ indirectly contributed to by CAR-ES
- 1-5 international project proposals; plus national proposals
- fact sheets, national communications
- contributions to practical guidelines, training events, and other forms of extension, often through projects

Trends in focus areas (% ES topics in scientific publications reported)



Trends in focus areas (% "activity" topics in scientific publications reported)



Examples of spin-off projects / projects with strong links to CAR-ES

- SNS-102 Environmental impact of shorter forest rotations
- SNS-106 Ash recycling – long-term effects on tree growth
- SNS-110 Leaching of carbon, nitrogen and phosphorus from forest land in the Nordic and Baltic countries
- SNS-118 Ecological effects of intensive biomass harvesting in the Nordic and Baltic countries
- SNS-120 Anthropogenic greenhouse gas emissions from organic forest soils: improved inventories and implications for sustainable management
- LIFE18 CCM/LV/001158 LIFE OrgBalt Demonstration of climate change mitigation potential of nutrient rich organic soils in Baltic States and Finland
- Interreg project Water management in Baltic Forests (WAMBAF)

Examples of outputs from CAR-ES and spin-off projects; trends over time

- Gundersen P, Laurén A, Finér L, et al. (2010) Environmental services provided from riparian forests in the Nordic countries. *Ambio* 39: 555–566, <https://doi.org/10.1007/s13280-010-0073-9>
- Launiainen S, Futter MN, Ellison D, et al. (2013) Is the water footprint an appropriate tool for forestry and forest products – the Fennoscandian case. *Ambio* 43: pages 244–256, <https://doi.org/10.1007/s13280-013-0380-z>
- Ring E, Johansson J, Sandström C, et al. (2017) Mapping policies for surface water protection zones on forest land in the Nordic–Baltic region: Large differences in prescriptiveness and zone width. *Ambio* 46: 878–893, <https://doi.org/10.1007/s13280-017-0924-8>
- [Skogforsk \(2019\) – Forest Buffers in The Baltic Sea](#) (educational YouTube film by WAMBAF)

Examples of outputs; diversity of topics

- Parts K, Tedersoo L, Schindlbacher A, et al. (2019) Acclimation of fine root systems to soil warming: Comparison of an experimental setup and a natural soil temperature gradient. *Ecosystems* 22: 457–472, <https://doi.org/10.1007/s10021-018-0280-y>
- Callesen I, Clarke N, Lazdinš A, et al. (2019) Nutrient release capability in Nordic and Baltic forest soils determined by dilute nitric acid extraction – Relationships with indicators for soil quality, pH and sustainable forest management. *Ecological Indicators* 96: 540-547, <https://doi.org/10.1016/j.ecolind.2018.09.027>
- Jauhiainen J, Alm J, Bjarnadottir B, et al. (2019) Greenhouse gas exchange data from drained organic forest soils – a review of current approaches and recommendations for future research. *Biogeosciences* 16: 4687-4703, <https://doi.org/10.5194/bg-16-4687-2019>
- Clarke N, Kiær LP, Kjønaas OJ, et al. (2021) Effects of intensive biomass harvesting on forest soils in the Nordic countries and the UK: A meta-analysis. *Forest Ecology and Management* 482, 118877, <https://doi.org/10.1016/j.foreco.2020.118877>

Recent factsheets summarize some main aspects of the work – some more will follow

- Centre of Advanced Research – Environmental Services (CAR-ES)
- Effects of intensive biomass harvesting on soil organic carbon and nutrients
- How much carbon is sequestered in soil after afforestation of agricultural land in Northern Europe?
- Forests and waters in the Nordic-Baltic region—highlights from the CAR-ES network
- CAR-ES Key to soil quality: texture and mineralogy

Thank you