

North State

Enabling Intelligent GMES Services for Carbon and Water Balance Modelling of Northern Forest Ecosystems



Boreal pine forest on peat land in Finland.

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ABSTRACT

The objective of North State is to develop innovative data fusion methods that exploit the new generation of multi-source data from Sentinels and other satellites in an intelligent, self-learning framework that interfaces state-of-the-art carbon and water flux models with a view to monitor these fluxes over boreal Europe with the aim of reducing their current high uncertainty. This will provide a paradigm for the development of products for future Copernicus services.

MONITORING OF CARBON AND WATER FLUXES FOR PAN-BOREAL EUROPE THROUGH INNOVATIVE METHODS

One of the greatest sources of uncertainty in climate predictions is the feedback between climate and changes in land surface processes, with northern high latitudes being particularly important because of the vast store of carbon in northern forests and peat lands. Such feedback includes the following key land processes: modifications in the spatial and seasonal patterns of vegetation, snow and albedo alter the associated radiative and biogeochemical balances and have major land surface and atmospheric feedback; disturbances, particularly fire, are linked to climate through large-scale atmospheric circulation patterns, and contribute to the inter-annual variations in atmospheric carbon dioxide in the Northern Hemisphere.

A further key factor of change, with associated consequences for greenhouse gas (GHG) emissions, is increased Russian forest activity, with significantly more clear-felling.

Russian forest resources information is largely outdated and the development trend of forest biomass is not well known.

Knowledge on the carbon and water balances, how they change under climate warming and the effects on GHG fluxes is crucial to understanding the resulting feedback. Current estimates of flux rates, based on national forest inventories, are highly uncertain and lack spatial resolution. There is, therefore, an urgent need to develop a system to monitor high latitude changes and to assess their consequences.

Earth Observation (EO) techniques with the Sentinel satellites of the Copernicus program offer a great potential for the monitoring of carbon and water balances. However, more automated data analysis using intelligent algorithms needs to be developed to fully utilise the data and to ensure that European service providers remain competitive.

QUESTIONS & ANSWERS

What is the project designed to achieve?

Novel multi-sensor and multi-temporal approaches will be developed and demonstrated to provide information for the carbon and water balance models. A key output of the study will be recommendations for new Copernicus services and future space missions based on identified gaps in capabilities to serve the needs of carbon and water models.

Why is this project important for Europe and how does it benefit European citizens?

The methodological development of the North State project will lead to the establishment of new Copernicus services. This will create job opportunities, especially in small, innovative service companies oriented on Earth Observation applications. The services will improve citizens' possibilities to stay up to date with the developments in the fragile boreal and arctic areas and potential negative effects of exploitation of their natural resources.

How does the project exceed the current state of knowledge?

The project will provide information that reduces the great uncertainty in climate predictions through providing novel information on the feedback between climate and changes in land surface processes. This will provide a paradigm for the development of products for future Copernicus services that will be applicable far beyond its specific application to the boreal zone.

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- Technical Research Centre of Finland (VTT), Finland
- University of Helsinki, Finland
- University of Sheffield, United Kingdom
- Northern Research Institute Tromsø AS, Norway
- Simosol Oy, Finland
- Institute of Biology of Komi Science Centre of Ural Department of Russian Academy of Science, Russia
- University of Iceland, Iceland

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PROJECT INFORMATION

Enabling Intelligent GMES Services for Carbon and Water Balance Modeling of Northern Forest Ecosystems (North State)

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