Project acronym: SOCRATES

Project title: Soil Organic Carbon Research in Alpine Tundra EcoSystems

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Discipline: Earth Sciences & Environment: Other - Environment

Station(s): Abisko Scientific Research Station (Sweden), Finse Alpine Research Centre (Norway)

The aim of the project is to assess the impact of microbial activity and the properties of organic matter on the stability of soil organic matter of Fennoscandian alpine tundra. We plan to investigate the effect of the natural temperature and humidity gradient in different parts of Fennoscandia (Abisko, Finse and Khibiny) on the carbon cycle parameters. We will focus on the total carbon stocks in soils, as well as the stability of its labile pool. We are planning to study the impact of the geographical location of alpine tundra ecosystems (from North to South) on the parameters of sequestration and stability of soil organic matter and microbial activity in the same type of ecosystems.

First of all, we are interested in ecosystems that have formed under different conditions of temperature and humidity on similar rocks. As the objects of our study, we have chosen the soil of two types of Fennoscandian alpine tundra ecosystems. The first is the soil of Betula nana shrubs community which there is a lot of poorly decomposed organic matter, but little available nitrogen. The shrubs soil freeze through in winter. The second object is the soil of graminoid meadows. The soils of this ecosystem are opposite to the heath. These two types of ecosystems are chosen not only because they are widespread in the alpine tundra, but also because climate change is stimulated to rapid expansion of Betula nana shrubs. We hypothesized that (1) the geographic location of ecosystems will have a greater impact on carbon cycling and sequestration than the type of ecosystem (shrubs heath or meadow) and these differences can be used to predict the impact of climate change on the carbon cycle; (2) organic matter of Betula nana shrubs community soils under the existing conditions is less susceptible to microbiological transformation due to the limitation of microbiological activity by low nitrogen availability; (3) the expansion of shrub ecosystems in the Subarctic will contribute to a reduction in the rate of new low-molecular carbon (from litter and root exudates) turnover, which will help to reduce CO2 emissions from soil to the atmosphere during climate warming.