Project Database of ICP Forests

PROJECT DESCRIPTION

PROJECT INFORMATION

Project title:	Biogeochemical cycle of manganese in forest ecosystems: implications for soil organic carbon storage
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Abstract

Soil organic matter dynamics is a key process to monitor the organic matter stock in terrestrial ecosystems, which constitutes one of the main players for limiting climate change. However, it has recently demonstrated that manganese, essential trace metal for living organisms, plays an important role on the soil organic matter decomposition through various redox reactions. This element is also known to be largely influenced by vegetation, promoting an important recycling inside the vegetated ecosystems compared to other chemicals. A better understanding of manganese cycling and its controlling factors is thus required to evaluate the evolution of organic matter stock in forest soils and, therefore, anticipate the consequences on climate change feedbacks.

Objectives

The objective of this PhD project is to evaluate the influence of manganese canopy recycling through both litterfall and atmospheric deposition (bulk deposition, throughfall, and stemflow) on the fate of soil organic matter and the related climate consequences. For this purpose, three research axes are proposed to:

1. Evaluate the manganese cycling (stocks and fluxes) in forest ecosystems, and related controlling factors on local (in situ sampling) and large (through ICP soil and vegetation data) scales;
2. Identify the role of manganese forms (litterfall vs. throughfall) on the soil organic matter decomposition;
3. Assess the evolution of soil organic matter stock with climate and land cover changes at the Europe scales.

Purposes for which the data shall be used

The PhD project attempts to measure manganese and fluxes in a central Belgium forest (bois de Lauzelle, Louvain-la-Neuve). To operate a scaling-up from this Belgian forest (four species, one soil type, one climate type) to all European forests, we plan to compare with a larger manganese stock and flux data set using the ICP network. This will allow us to include various forest species, climate zones, and soil types in order to identify the best controlling factors on manganese cycling in European forest ecosystems.

Hypothesis:

Manganese cycling in forest ecosystem is influenced by tree species, climate conditions, and soil parameters. The up-scaling of manganese cycle will be possible after considering all these influencing factors.

Method:

- Compiled manganese data to calculate stocks and fluxes for each ICP site.
- Evaluate the influence of tree species on manganese concentrations and fluxes (litterfall, throughfall, and stemflow) comparing different sites.
- Identify the influence of environmental variables (soil type, climate region, etc.) on manganese concentrations and fluxes comparing sites characterized by the same tree species.
- Characterize the relationships between manganese and dissolved organic carbon concentrations in the different compartments (litterfall, throughfall, and stemflow).
- Map the current manganese soil concentrations and fluxes in forest ecosystems at the European scale.
- Map different manganese soil concentrations and fluxes according to different scenarios (global change and land use management) at the European scale.
- Initiate the mapping of soil organic carbon content evolution according to manganese cycling modifications.