Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Development, parameterisation and testing of the N14CPW model

Project ID: 21

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Objectives of the project

The overall aim of this research is to enhance the N14C model so as to include the nutrient effects of P, pH dependence, and improved temperature dependence. This will be done by fitting the model to as many natural or semi-natural temperate and boreal sites as possible, with the aim of deriving (i) a general parameter set for each of 4 plant functional types, and (ii) site specific parameters, falling within narrow specified ranges. The work relies on the availability of field observations, of the kind exemplified by activities in ICP Forests.

Scientific background of the project

Long-term anthropogenic nitrogen deposition to natural and semi-natural terrestrial ecosystems has caused profound changes in the plant-soil dynamics of both nitrogen and carbon. To simulate these changes, with the aim of accounting for contemporary conditions and providing a forecasting tool, we developed the dynamic model N14C. The model operates with four plant functional types, namely broadleaved and coniferous trees, herbs and dwarf shrubs. It simulates net primary production, plant and soil C and N pools, leaching of dissolved organic carbon and nitrogen (DOC, DON) and inorganic nitrogen, denitrification, and the radiocarbon (^{14}C) contents of soil organic matter (SOM) and dissolved organic matter (DOM), on an annual timestep. Soil organic matter comprises three pools, undergoing first-order decomposition reactions with turnover rates ranging from *c.* 2 to *c.* 1000 years. Nitrogen immobilisation by soil organic matter is assumed proportional to the residual inorganic N flux (after plant uptake) and the amount of SOM. Inorganic N leaching occurs when plant growth and immobilisation demands are fully met but leave excess inorganic N. Soil organic matter accumulates in the deeper soil, via transport and sorption of DOM. The model was run to build up soil pools starting 12,000 years ago, with N inputs only by fixation until 1800, at which point anthropogenic N deposition is assumed to begin.
So far, we have parameterised N14C with data from 42 published plot studies carried out in northern Europe, together with more generalised data on N deposition trends, soil radiocarbon contents, N fixation and denitrification. This has demonstrated that the approach of using field data from a range of sites can provide satisfactory fits, and a useful picture of ecosystem responses at large scales and over long times. The next step is to enhance the model by representing the nutrient cycle of phosphorus and pH dependences of biogeochemical reactions, and also to estimate more precisely the temperature dependences of the processes. For this, data from a larger collection of field sites is required.