Geophysical Research Abstracts
Vol. 17, EGU2015-12854, 2015
EGU General Assembly 2015

Uncertainty about future nitrogen availability dominates boreal forest growth projections

Annikki Mäkelä (1), Tuomo Kalliokoski (1), and Mikko Peltoniemi (2)
(1) University of Helsinki, Helsinki, Finland, (2) Natural Resources Institute Finland, Vantaa, Finland

There is broad consensus among scientists that the capacity of forests in the boreal zone to take up carbon will increase as a result of climate change. However, boreal forests are strongly nitrogen limited. This may hamper the potential increase in GPP for forest productivity and carbon sequestration, but little is known about the impact of climate change on nitrogen availability in forests.

Here we use OptiPipe, a model of optimal carbon and nitrogen co-allocation to analyse the role of nitrogen availability in growth limitation under climate change in Finland. We predict changes in metabolic rates related to the C balance using existing models and data, and we explore three alternative, plausible scenarios of N availability under climate change.

Three climate scenarios based on three SRES emissions scenarios - B1 (low), A1B (moderate) and A2 (high) - are used for projecting changes of daily temperature, precipitation, vapour pressure deficit and solar radiation for periods 2011-2040, 2041-2070 and 2071-2100. We use a mean among 8 climate models. CO_2 concentrations corresponding to the SRES scenarios come from (IPCC, 2007: Climate Change 2007: The Physical Science Basis) The results will be presented across Finland on a 10 km x 10 km grid.

The results indicate that NPP and woody growth will increase under climate change if N availability is also increasing. If N availability is limited, volume growth will to reduce, because maintenance costs (respiration and turnover) increase. If N availability increases relatively as much or more than C availability, reduced allocation requirements to fine roots will lead to more foliage with higher photosynthetic capacity, thus increasing woody volume growth disproportionately.

These results are attributable to optimised carbon and nitrogen co-allocation. In order to reduce the uncertainty of growth predictions, a better understanding of the mechanisms related to N availability is needed.