Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Environmental change impacts on the C- and N-cycle of European forests

Project ID: 27

Contact person: Dr. David Cameron (dcam@ceh.ac.uk)

PROJECT DESCRIPTION

Forests are important components of the greenhouse gas balance of Europe. There is considerable uncertainty about how predicted changes to climate and nitrogen deposition will perturb the carbon and nitrogen cycles of European forests and thereby alter forest growth, carbon sequestration and N20 emission. In our previous study (Cameron et al. 2012) we aimed to quantify the carbon and nitrogen balance, including the exchange of greenhouse gases, of European forests over the period 2010-2030, with a particular emphasis on the spatial variability of change. The analysis was carried out for two tree species: European beech and Scots pine. For this purpose, four different dynamic models were used: BASFOR, DailyDayCent, INTEGRATOR and Landscape-DNDC. These models spanned a range from semi-empirical to complex mechanistic. Comparison of these models allowed assessment of the extent to which model predictions depended on differences in model inputs and structure. We found a European average carbon sink of 0.160 ± 0.020 kgC m-2 yr-1 (pine) and 0.138 ± 0.062 kgC m-2 yr-1 (beech) and N2O source of 0.285 ± 0.125 kgN ha-1 yr-1 (pine) and 0.575 ± 0.105$kgN ha-1 yr-1 (beech). The European average greenhouse gas potential of the carbon source was 18 (pine) and 8 (beech) times that of the N_2O source. Carbon sequestration was larger in the trees than in the soil. Carbon sequestration and forest growth were largest in central Europe and lowest in northern Sweden and Finland, N. Poland and S. Spain. No single driver was found to dominate change across Europe. Forests were found to be most sensitive to change in environmental drivers where the drivers were limiting growth, where changes were particularly large or where changes acted in concert. The models disagreed as to which environmental changes were most significant for the geographical variation in forest growth and as to which tree species showed the largest rate of carbon sequestration. Pine and beech forests were found to have differing sensitivities to environmental change, in particular the response to changes in nitrogen and precipitation, with beech forest more vulnerable to drought. There was considerable uncertainty about the geographical location of N10 emissions. Two of the models BASFOR and LandscapeDNDC had largest emissions in central Europe where nitrogen deposition and soil nitrogen were largest whereas the two other models identified different regions with large N20 emission. N20 emissions were found to be larger from beech than pine forests and were found to be particularly sensitive to forest growth.

This document has been downloaded from the ICP Forest webpage http://icp-forests.net/page/project-list
For further information please contact the Programme Coordinating Centre (PCC) of ICP Forests
pcc-icpforests@ti.bund.de

In our present study, we aim to extend our predictions of BASFOR to the year 2100 and to all major European species to estimate how the carbon and nitrogen balance of forests will change in this present century. The study will have a greater emphasis on uncertainty in both climate change through use of different climate scenarios we will also aim to quantify model parameter uncertainty using a Bayesian probabilistic uncertainty quantification (van Oijen et al. 2011). Our previous study demonstrated that growth in forest models is highly but not exclusively dependent on soil nitrogen content. Thus we are keen to drive our forest models with the most extensive and accurate soil nitrogen observations available. In addition, to calibrate our models and thereby quantify parameter uncertainty we need to compare BASFOR with good quality forest observational data. We believe that the ICP level I and level ll forest data is some of the best observational data for forests currently available. Therefore to improve our predictions and assessments of uncertainty in those predictions we would like to request the use of ICP level I and level II data as detailed in the application form.

This document has been downloaded from the ICP Forest webpage http://icp-forests.net/page/project-list
For further information please contact the Programme Coordinating Centre (PCC) of ICP Forests
pcc-icpforests@ti.bund.de