



N deposition and forest C sequestration at local to regional scale

F. Magnani (1), M. Borghetti (2), M. Mencuccini (3), D. Stevenson (3), T. van Noije (4), S. Raddi (5), and J. Grace (3)

(1) DCA, University of Bologna, Italy (fmagnani@agrsci.unibo.it), (2) DISCOFA, University of Basilicata, Italy, (3) School of Geosciences, University of Edinburgh, UK, (4) Royal Netherlands Meteorological Institute, The Netherlands, (5) DiSTAF, University of Firenze, Italy

Forests are one of the main biomes on Earth and contribute substantially to C sequestration from the atmosphere, countering the effects of anthropogenic greenhouse gas emissions. In contrast with tropical deforestation, expanding forests in temperate and boreal regions are also immobilizing C in soils and biomass. From the analysis of 54 time-integrated datasets from new (n=25) and established (n=29) forests, we suggest that forest C sinks are determined to a large extent by atmospheric N deposition, largely the result of anthropogenic N emissions from agriculture and fossil fuel combustion. A comparison of forest inventory data from boreal and temperate forests in 49 countries worldwide with corresponding N deposition rates, as simulated by the TM4 atmospheric chemistry transport model, also suggest a strong correlation between forest C sequestration and atmospheric N deposition. A retrospective analysis of forest inventory data from European countries for the period 1950-2000 also demonstrates a strong and coherent association of increasing forest growth and C sequestration rates with N deposition, as resulting from TM4 simulations.

A simple biogeochemical model is presented to demonstrate the likely mechanism of such an effect, and to explain the apparent high sensitivity to N deposition, as a result of long-term changes in soil C:N and fertility.

The results point to an important negative feed-back cycle, as N emissions could stimulate terrestrial C sequestration and thereby alleviate the effects of anthropogenic CO₂ release into the atmosphere, and have important implications for environmental policies aimed at managing the various components of anthropogenic global change as a whole.