Geophysical Research Abstracts
Vol. 18, EGU2016-7862-1, 2016
EGU General Assembly 2016

Tree species influence soil-atmosphere fluxes of the greenhouse gases CO_2, CH_4 and N_2O

Christina Steffens (1), Lars Vesterdal (2), and Eva-Maria Pfeiffer (1)

(1) Institute of Soil Science, CEN, University of Hamburg, Hamburg, Germany, (2) Department of Geosciences and Natural Resource Management, University of Copenhagen, Frederiksberg, Denmark

In the temperate zone, forests are the greatest terrestrial sink for atmospheric CO_2, and tree species affect soil C stocks and soil CO_2 emissions. When considering the total greenhouse gas (GHG) balance of the forest soil, the relevant GHGs CH_4 and N_2O should also be considered as they have a higher global warming potential than CO_2. The presented data are first results from a field study in a common garden site in Denmark where tree species with ectomycorrhizal colonization (beech - *Fagus sylvatica*, oak - *Quercus robur*) and with arbuscular mycorrhizal colonization (maple - *Acer pseudoplatanus*, ash - *Fraxinus excelsior*) have been planted in monocultures in adjacent blocks of about 0.25 ha in the year 1973 on former arable land. The soil-atmosphere fluxes of all three gases were measured every second week since August 2015. The hypothesis is that the total GHG efflux from forest soil would differ between species, and that these differences could be related to the type of mycorrhizal association and leaf litter quality. Preliminary results (August to December 2015) indicate that tree species influence the fluxes (converted to CO_2-*eq)* of the three GHGs. Total soil CO_2 efflux was in the low end of the range reported for temperate broadleaved forests but similar to the measurements at the same site approximately ten years ago. It was highest under oak (9.6$\pm$2.4 g CO_2 m^{-2} d^{-1}) and lowest under maple (5.2$\pm$1.6 g CO_2 m^{-2} d^{-1}). In contrast, soil under oak was a small but significant sink for CH_4(-0.005$\pm$0.003 g CO_2-*eq* m^{-2} d^{-1}), while there were almost no detectable CH_4 fluxes in maple. Emissions of N_2O were highest under beech (0.6$\pm$0.6 g CO_2-*eq* m^{-2} d^{-1}) and oak (0.2$\pm$0.09 g CO_2-*eq* m^{-2} d^{-1}) and lowest under ash (0.03$\pm$0.04 g CO_2-*eq* m^{-2} d^{-1}). In the total GHG balance, soil CH_4 uptake was negligible ($\leq$0.1% of total emissions). Emissions of N_2O (converted to CO_2-*eq*) contributed $<$1% (ash) to 8% (beech) to total GHG emissions. Summing up all GHG emissions, the tree species were divided in two groups as hypothesized: Beech and oak, both colonized by ectomycorrhiza and producing leaf litter with a high lignin:N ratio, had higher total GHG emissions (8.9$\pm$3.5 and 10.3$\pm$2.9 g CO_2-*eq* m^{-2} d^{-1}) than maple and ash (6.2$\pm$1.4 and 6.2$\pm$0.9 g CO_2-*eq* m^{-2} d^{-1}) that are colonized by arbuscular mycorrhiza and produce leaf litter with a lower lignin:N ratio.