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NO and N2O emissions from different forests throughout Europe - Final results of the NOFRETETE project

K. Pilegaard and The NOFRETETE Team

Biosystems Department, Risø National Laboratory, Denmark (kim.pilegaard@risoe.dk)

The contribution reports the final results of a part of the EU-funded NOFRETETE project where soil emissions of NO and N_2O were measured continuously at high frequency for more than one year at 15 European forest sites. The locations represent different forest types (coniferous/deciduous) and different nitrogen loads. Geographically they range from Finland in the north to Italy in the south and from Hungary in the east to Scotland in the west.

The largest NO emissions were observed from coniferous forests, whereas the smallest NO emissions were observed from deciduous forests. The NO emission from coniferous forests were highly correlated with N-deposition. Very small ($\approx$0) NO emissions were observed from a pine forest in Finland where the N-deposition was smaller than 1 g N m^{-2} y^{-1}. The site with the largest average annual emission (82 μg NO-N m^{-2} h^{-1}) was a spruce forest in Höglwald (Germany) receiving an annual N-deposition of 2.9 g m^{-2}. No systematic differences in N_2O emission were observed between deciduous and coniferous forests, and the correlation between N_2O emission and N-deposition was weaker than for NO. The largest average annual N_2O emission (25 μg N_2O-N m^{-2} h^{-1}) was found in a spruce forest in Nyirjes (Hungary) receiving an annual N-deposition 1.4 g m^{-2}.

The difference in N-oxide emissions between coniferous and deciduous forests may partly be explained by differences in N deposition rates and partly by difference in characteristics of the litter layer and soil. NO is mainly derived from nitrification whereas N_2O is mainly derived from denitrification. Soil moisture is lower at coniferous sites (at least during spring time) and the litter layer of coniferous forests is thick and well aerated favouring nitrification and thus release of NO. Conversely, the higher

rates of denitrification in deciduous forests due to a compact and moist litter layer lead to N_2O production and NO consumption in the soil.

The results show that some key parameters like N-deposition and soil moisture clearly affects nitrogen oxides emission on a local scale, but on a European scale some of these determining factors do not show clear relationships with the emission. The lack of correlation on a European scale is most likely due to the differences in the characteristics of the forest ecosystems that are compared. The models used for upscaling therefore need to include more determining factors.