Geophysical Research Abstracts
Vol. 16, EGU2014-887, 2014
EGU General Assembly 2014

Greenhouse gas emissions of drained fen peatlands in Belarus are controlled by water table, land use, and annual weather conditions

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Drainage of peatlands causes strong emission of the greenhouse gases (GHG) CO_2 and N_2O, sometimes combined with a weak CH_4 uptake. In Belarus drained peatlands occupy about 1505000 ha or more than 7.2 % of the country area. Joosten (2009) estimates CO_2 emission from degraded peatlands in Belarus as 41.3 Mt yr^{-1} what equals to 47 % of total anthropogenic greenhouse gases (GHGs) emission of country in 2011. However, it could not be checked if these numbers are correct since there are no GHG measurements on these sites up to now.

Therefore we studied the GHG emissions with the closed chamber approach in four peatlands situated in central and southern Belarus over a period from August 2010 to August 2012. The measurements comprised eight site types representing different water level conditions, and ranging from grassland and arable land over abandoned fields and peat cuts to near-natural sedge fens. Fluxes of CH_4 and N_2O were determined using the close-chamber approach every second week in snow free periods and every fourth week during winter time. The annual emissions were calculated based on linear interpolation. Carbon dioxide exchange was measured with transparent and opaque chambers every 3-4 weeks and the annual net ecosystem exchange (NEE) was modeled according to Drösler (2005).

Most of the drained sites were sources of CO_2 in both years. NEE increased with lower mean annual water table level. The highest NEE value (1263.5 g CO_2-C $m^{-1}yr^{-1}$) was observed at the driest site of the study; an abandoned fen formerly used for agriculture. In contrast, a former peat extraction site with moist peat and small *Pinus sylvestris* tress were sinks of CO_2 with uptake to 389.6 g CO_2-C $m^{-1}yr^{-1}$. The highest N_2O emissions were recorded at a drained agricultural fen with mean annual rates of up to 2347 mg N_2O-N m^{-2} yr^{-1}. Significant fluxes of CH_4 (15 g CH_4C m^{-2} h^{-1}) were observed only at the near-natural site in the first year of investigation when precipitation and the mean water level were high. At the drained sites fluxes of CH_4 were mainly close to null and sometimes a weak uptake of CH_4 (-0.06 mg CH_4-C m^{-2} h^{-1}) was observed. In general the results show an increase of global warming potential of site with decreasing mean annual water level from 5.5 t CO_2 equivalents $ha^{-1}yr^{-1}$ at near-natural site with annual mean water level -8 cm to 51 t CO_2 equivalents $ha^{-1}yr^{-1}$ at abandoned fen formerly used for agriculture with mean annual water level near -90 cm.

This study was conducted in the framework of the BMU financed project "Restoring Peatlands and applying Concepts for Sustainable Management in Belarus – Climate Change Mitigation with Economic and Biodiversity Benefits".

Joosten H. The Global Peatland CO_2 Picture: peatland status and drainage related emissions in all countries of the world – 2009.