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The Regulation of CH4 and N2O fluxes by Wetlands at Landscape Level

K. Soosaar (1), M. Maddison (1), J.O. Salm (1,2), J. Järveoja (1), R. Hansen (1), and Ü. Mander (1)

(1) Department of Geography, Institute of Egology and Earth Science, University of Tartu, 46 Vanemuise Str., 51014, Tartu, Estonia (ulo.mander@ut.ee), (2) Estonian Fund of Nature, 3 Magasini Str., 51005 Tartu, Estonia

The world's wetlands, despite being only about 5% of the terrestrial landscape, are currently significant net sinks of more than 1 Pg yr-1 of carbon (Mitsch et al 2012). At landscape level wetlands and riparian zones are important regulators of nutrient transport (Zedler 2003). However, they can be also significant hot spots of greenhouse gas (GHG) emissions (Teiter&Mander 2005). Swedish experience shows that the nationally planned wetland creation (12,000 ha) could make a significant contribution to the targeted reduction of N fluxes (up to 27% of the Swedish environmental objective), at an environmental risk equalling 0.04% of the national anthropogenic GHG emission (Thiere et al 2011). Only few studies consider the potential GHG emission throughout both natural and created wetlands. The main objective of this study was to clarify the potential of various wetland ecosystem and riparian zones of northern rural landscapes in regulation of GHG emissions.

Monthly-based measurements of GHG emissions using closed chamber method were performed from October 2007 to October 2011 in 47 study sites in Estonia. The study sites cover various wetlands and riparian forests as well as reference areas on automorphic soils.

In general, wetlands' drainage was the most significant disturbance factor influencing GHG fluxes, causing significant increase of N2O emission as well as decreasing CH4 emission. However, we also observed significantly high CH4 flux from drained peatlands. In most of the soils with ground/soil water levels deeper than 30 cm from the surface, a significant decrease of CH4 fluxes were detected. The highest CH4 emissions (up to 5060 kg CH4-C ha-1 yr-1) were detected from drained fen grasslands. In the case of N2O, no clear differences were found between colder and warmer periods. Relatively higher N2O fluxes were measured from the drained fen grassland, the fertilized arable land, the riparian forest on automorphic soil, and the drained transition fen forest: median values 4.2, 1.4, 1.1, and 0.9 kg N2O-N ha-1 y-1, respectively. In peatlands, median values of CH4-C were 85.2, 23.7, 0.07 and 0.12 kg ha-1 yr-1, and N2O-N -0.05, -0.01, 0.18 and 0.19 kg ha-1 yr-1, respectively. There were significantly higher emissions of N2O from abandoned and active peat mining areas, whereas CH4 emissions were significantly higher in natural and drained areas. We also found that the buffering capacity of long-term loaded riparian alder forests in agricultural landscapes will decrease over time, which calls for the careful management of these riparian forests.

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