Identifying factors influencing denitrification and greenhouse gas production in riparian wetland soils

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Ecology and the Environment, MSc Thesis 2012

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Introduction:

The removal capacity of nitrate in wetlands through denitrification and the production of greenhouse gas (GHG) are influenced by several biogeochemical variables.

The purpose was to identify which parameters are the most important regulators on nitrate removal capacity and GHG production, in riparian wetlands soils regarding water and soil characteristics. This could help to achieve a better understanding of wetland restoration.

Conclusion:

- Higher nitrate concentration would not increase the denitrification rate.
- Nitrate removal capacity and GHG production was found to be limited by the amount and the quality of organic matter.
- Dissimilatory nitrate reduction to ammonium (DNRA) was occurring beside denitrification.

Method:

Intact soil cores were collected from four different riparian wetlands.

GHG production and nitrate removal capacity were simultaneously studied in an experimental setup under controlled conditions regarding temperature and hydrology. Anoxic $^{15}N\text{-}NO_3^-$ enriched groundwater was pumped through the cores. Water samples were collected at seven depths in the core during 15 days.

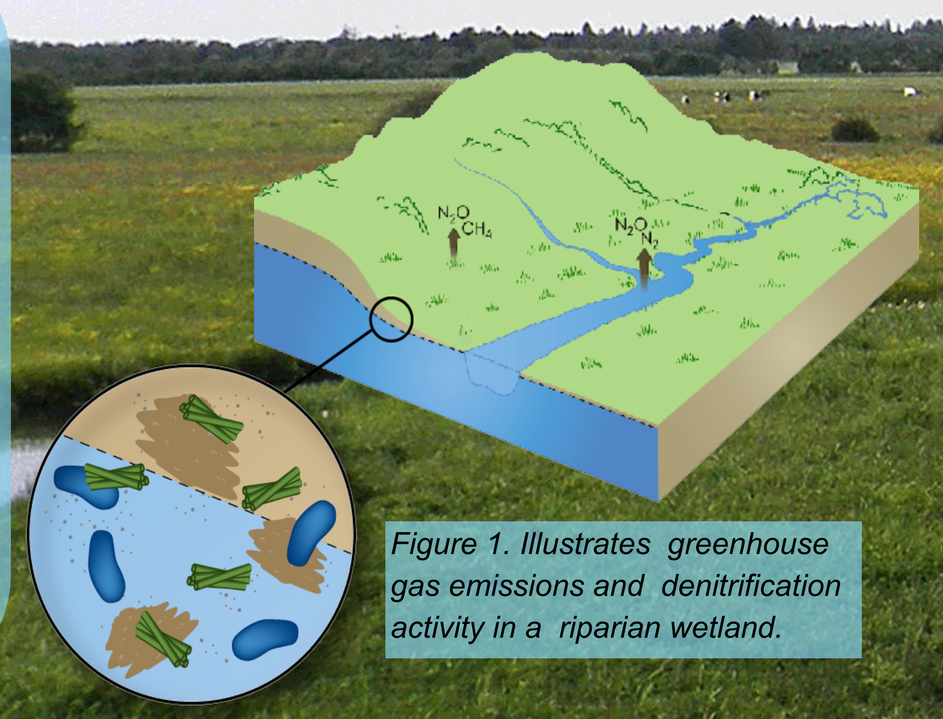

Figure 1. Illustrates greenhouse gas emissions and denitrification activity in a riparian wetland.

Results:

The nitrate removal rate ranged from 38 ± 4 to 71 ± 7 mmol NO_3^--N m^{-2} d^{-1}, the highest rate at the sites with higher organic matter content.

N_2O was used by denitrifying bacteria when nitrate was depleted from the groundwater.

CH_4 was produced when NO_3^- and sulfate electron acceptor was reduced.

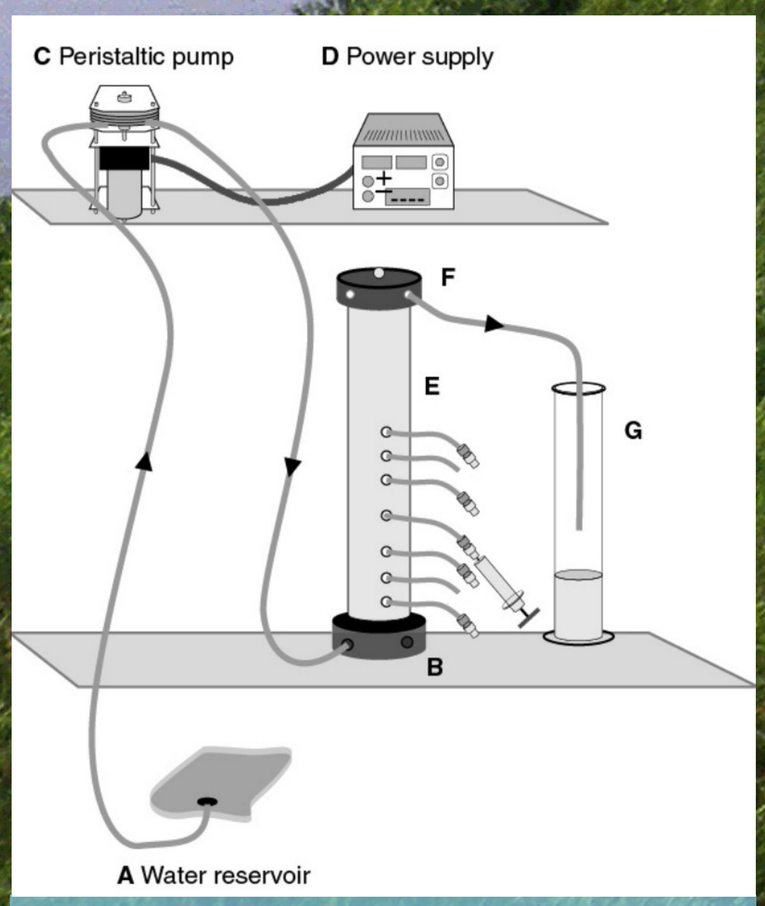

Figure 2. Experimental setup for the soil cores, continues water flow follows the arrows (A to G) driven by a pump (C) with power supply (D), components: A; water reservoir, E; soil core from B to F, G measuring glass.

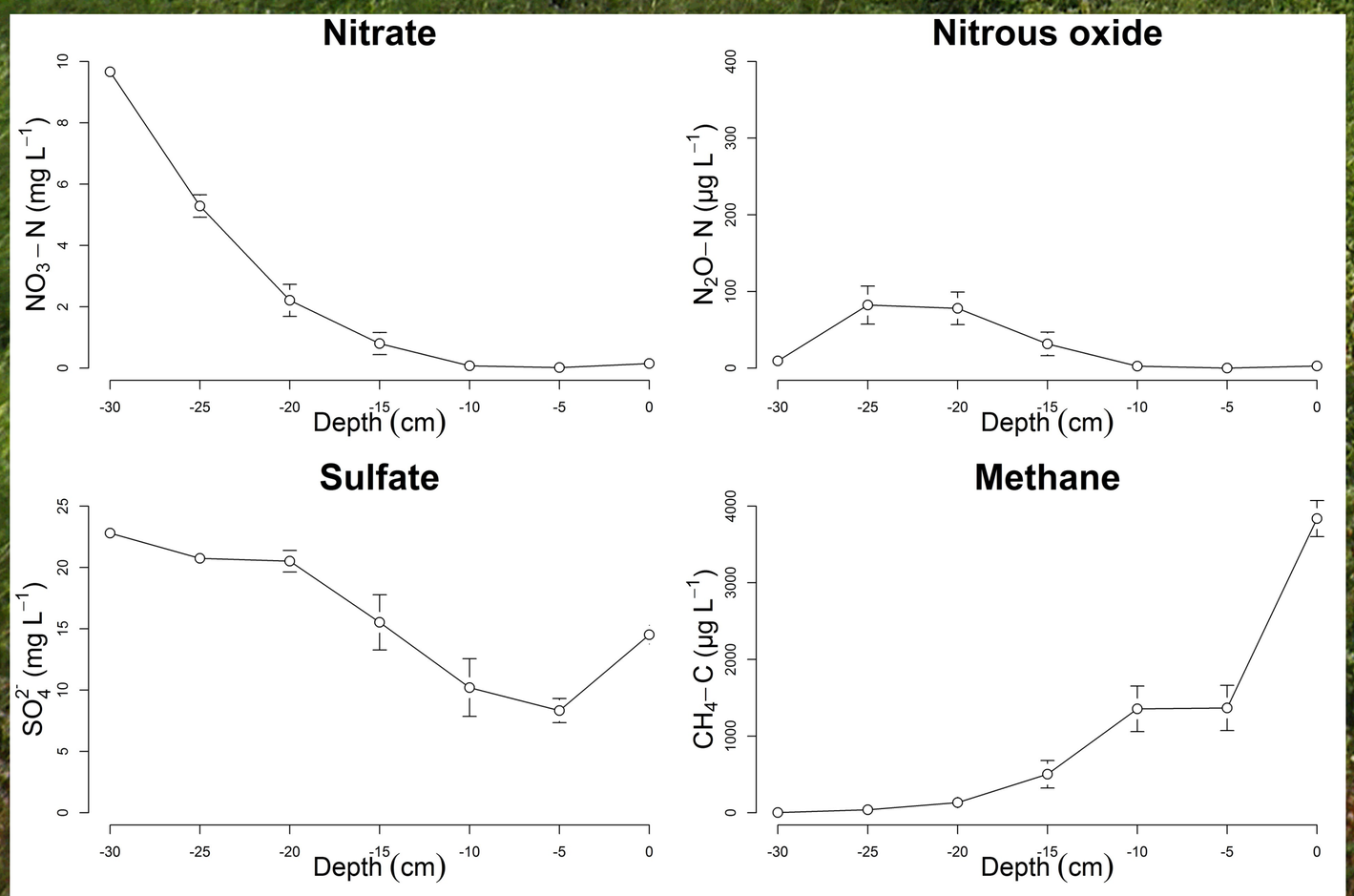

Figure 3. Symbols are representing mean values ± standard errors for the concentration of nitrate, nitrous oxide, sulfate and methane at the measuring points below soil surface, (7 values from -30 (inlet) to 0 (outlet)), at site Simested.

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