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Dissimilatory Nitrate Reduction to Ammonium (DNRA) potential in the re-connected floodplain of the River Cole (Oxfordshire, UK).

F. Sgouridis (1), C.M. Heppell (1), M. Trimmer (2), and G. Wharton (1)

(1) Department of Geography, Queen Mary University of London, London, E1 4NS, email: f.sgouridis@qmul.ac.uk, (2) School of Biological and Chemical Sciences, Queen Mary University of London, London, E1 4NS

Floodplains are recognised as an important interface for nitrate removal at the landscape scale, but there is a lack of available information on the nitrate attenuation capacity of reconnected floodplains following river restoration. Whilst numerous studies have documented the dominant role of heterotrophic denitrification for nitrate loss in these environments, DNRA, a microbial pathway that conserves N in the ecosystem, has previously been considered unimportant in aerobic floodplain soils due mainly to its anoxic nature (Tiedje, 1988). However, recent research has shown DNRA to be of importance in N-limited, redox fluctuating tropical soils (Silver *et al.,* 2001, Huygens *et al.,* 2007). This could potentially be important in the context of temperate intermittently saturated reconnected river floodplains designed to tackle diffuse nitrate pollution. Therefore the objectives of this research were to quantify (i) the magnitude of and; (ii) factors controlling DNRA and denitrification potential in four different land use zones (grazing grassland, buffer zone, pasture and fritillary meadow), and with depth (0 – 120 cm) in a re-connected rural floodplain of the River Cole, UK. Denitrification and DNRA potential rates were measured with a combination of $^{15}NO_3$- isotope tracer addition and combined microdiffusion - hypobromite oxidation methods.

DNRA potential rates were approximately 40times less than denitrification potential rates, in all samples, ranging from 0.02 – 2.64 mg N and 7 – 24 mg N Kg^{-1} of dry soil day^{-1} respectively. Denitrification potential rates were found to be significantly different (P <0.01) across the different land uses and the main controlling factors identified were the availability of labile organic carbon and soil nitrate concentration (significant at the 0.05 level). On the contrary, DNRA potential rates were not affected by the type of land use and were primarily controlled by redox conditions and by soil nitrate concentration. However, DNRA was more variable within each land use zone reflecting the variability in redox conditions caused by the flooding regime at each location. Although the two processes are significantly correlated, indicating their coexistence, the difference in magnitude could potentially be explained by the opposing effect of soil nitrate availability to the two processes. The research paper also examines the variability of denitrification and DNRA potential with depth within two of the reconnected land use zones.

References

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