Abstract for the annual Ecological Society Meeting for August 5-10, 2012 in Portland, OR
GWERD Task #23493, SHCR 3.3.1.10: Nitrogen management in large river floodplains.

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Title: Low elevation old channel features of the Willamette River floodplain support high subsurface denitrification rates.

Background/Question/Methods

Large river floodplains are poor nitrate pollution buffers when polluted groundwater moves beneath biogeochemically retentive zones prior to entering the main channel. However, in floodplain regions with extensive backwaters and organic carbon accumulation, surface waters may interact with groundwater to support enhanced denitrification in the subsurface and provide a sink for nitrate pollution. Here, we evaluate the spatial heterogeneity and patterns of nitrate and denitrification in the shallow groundwater of a large river floodplain to determine the controls and find predictable indicators of enhanced denitrification to better identify habitats for restoration and preservation that enhance pollution removal. Green Island, part of the Willamette River floodplain, near Coburg, Oregon is under active restoration, led by the McKenzie River Trust, to hydrologically re-connect the Willamette to its historic floodplain and re-establish native vegetation. We measured rates of denitrification using an *in-situ* push-pull technique with ^{15}N isotopic tracers injected into shallow groundwater ~0.5m below the water table across the floodplain from 0.5-4m below the sediment surface. These denitrification rates, combined with quarterly sampled nutrient concentration, ambient isotopes of N and O in nitrate, and evaluation of subsurface hydrology will help identify habitats that support enhanced denitrification and guide future restoration activities in the region.

Results/Conclusions

Subsurface denitrification rates at Green Island span three orders of magnitude across the floodplain (*Mean* 57.1±17.8 µMol $Kg^{-1}D^{-1}$ n=31) with the greatest rates beneath wet habitats (*Max* 307.7) and lowest in those areas with the greatest depth to groundwater (*Min* 3.65 to below detection). Denitrification rates in the subsurface are correlated negatively with elevation (**ρ**=-0.48 $p<0.01$) and positively with both dissolved organic carbon (0.45 $p<0.01$) and iron (0.44 $p<0.01$). These results suggest that obvious areas of groundwater and surface water interaction with reduced conditions, like backwater sloughs and wetlands, are indicators of subsurface denitrification and may govern subsurface processes. We found that several measures that typically indicate denitrification like enriched ^{15}N-NO_3 and N_2O concentration are not correlated with measured denitrification rates, owing to the integrative nature of those measures along diverse flow paths compared to the site specificity of push-pull measurements. Based on these preliminary results, lower elevation wet regions that contribute organic carbon to the subsurface possess greater potential to denitrify nitrate at Green Island and are an indicator of a potentially valuable nitrate sink in floodplain restoration.