

Woody debris: Denitrification Hotspots and N₂O Production in Fluvial Systems

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The maintenance and restoration of forested riparian cover is important for watershed nitrogen (N) cycling. Forested riparian zones provide woody debris to streams that may stimulate in-stream denitrification and nitrous oxide (N₂O) production. We examined the effects of woody and mineral substrates on N removal and denitrification at streams with and without forested riparian zones to determine if fresh inputs of woody debris support higher denitrification than other common stream substrates due to the difference in labile carbon (C). Three different substrates (fresh wood blocks, extant streambed wood and artificial stones) expected to vary in their C lability were incubated in two streams, a high N agricultural stream in Pennsylvania and a low N forested stream in Rhode Island and subjected to mesocosm conditions with ¹⁵N-nitrate. Denitrification rates did not significantly differ between extant wood and in-stream wood block substrates. Wood substrates at the forested site had significantly higher denitrification than all other substrates. Nitrate-N removal rates were markedly higher on woody substrates compared to artificial stones. Nitrate-N removal rates were significantly correlated to biofilm biomass. N₂ accounted for 99.9% of total denitrification. Restoration practices that generate woody debris in streams should be encouraged for N removal and do not appear to generate high risks of in-stream N₂O generation.