Soil amendments promote denitrification in restored wetlands

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Wetlands perform important ecosystem functions, including improvement of water quality through the process of denitrification. To offset the negative environmental impact of replacing wetlands with agriculture and development, the United States has a policy requiring that losses in wetland area are compensated for through wetland restoration elsewhere. However, these restored wetlands may require decades to achieve functional equivalency to natural wetlands. We evaluated the efficacy of using carbon amendments during restoration to promote denitrification potential in four restored wetlands in central New York State, United States. The amendments were straw, topsoil, and biochar, chosen to range along a gradient of carbon lability. Soil samples collected 6 years after restoration were analyzed for denitrification potential and associated soil properties, including soil carbon and nitrogen, pH, microbial biomass carbon and nitrogen, carbon lability, and potential net nitrogen mineralization and nitrification. Compared to unamended control plots, denitrification potential was approximately 3 times higher in straw-amended plots, 8 times higher in topsoil-amended plots, and 11 times higher in biochar-amended plots. Denitrification potential positively correlated with both soil organic carbon and microbial biomass nitrogen, suggesting that the use of soil amendments in restorations can help stimulate the development of denitrification potential by facilitating the suite of carbon and nitrogen cycling processes that underlie this function. However, denitrification potential in a nearby natural reference wetland was at least 50 times higher than it was in the restored wetland plots, highlighting the limitations of using wetland restoration to compensate for the loss of natural wetlands.
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