Kate Ballantine
Cornell University, Ithaca, New York

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Long-term development of restored New York wetlands

Overview

Wetland restoration is increasingly used as a strategy both to address historic wetland losses and to mitigate new wetland impacts. Wetland soils, plants, and decomposition rates were examined in 35 wetlands, both natural and ranging from 3-55 years old. The results of this study indicate that, unlike the rapid re-establishment of hydrophytic vegetation, some soil properties critical for water quality functions take decades or longer to reach natural reference levels.

Overall Project Goal

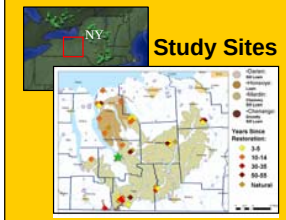
Investigate soil properties and development processes of restored wetlands that influence water quality ecosystem services.

Research Design

Compared 35 wetlands of four different age classes spanning five decades, e.g. ~3, 10, 30 and 50 years since restoration with natural reference wetlands.

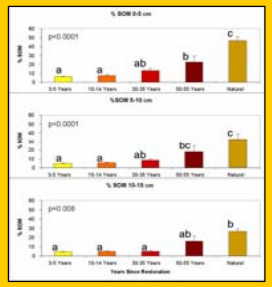
1. Inventoried and compared soil properties
• SOM, Bulk Density, Field Color and Texture, Texture Analysis, Chemical Properties (e.g. P, K, Mg, Ca, Fe, Al, Mn, Zn, Cu, pH, H.EXA, OM, NO3, CEC)
2. Examined contributing factors
•Standing biomass, Litter biomass, Species composition, Roots, Insects
3. Experimentally evaluated how rapidly litter decomposes

Key Questions and Results



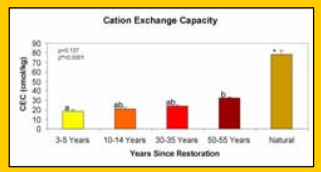
Study Sites

Question 1: Does percent soil organic matter (SOM), a key indicator of overall wetland function, increase with time?



Result 1: Soil organic matter increases over time at every depth level, but percent SOM has not increased to half of natural levels 55 years after restoration.

Question 2: Does cation exchange capacity (CEC), a measure of the soil's ability to hold nutrients and bind certain contaminants, increase with time?



Result 2: CEC is not at 50% natural levels 55 years after restoration.

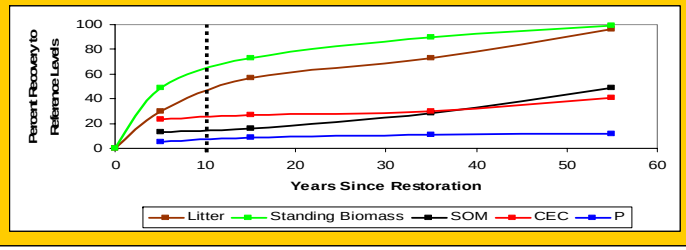
Is this a successful wetland restoration project?

Soil Core 4 Years After Restoration

Soil Core 55 Years After Restoration

Question 3: How fast do wetland properties critical to water quality functions develop?

Result 3: Rates of change differ between wetland properties, with commonly monitored variables increasing at faster rate.



Implications

•These findings contribute to our ecological understanding of wetland development.
•These findings have policy implications for how we restore and conserve wetlands.
•Restored wetlands may not be achieving goals of functional replacement as fast as is assumed.
•Water quality functions may take centuries or longer to develop to levels of natural wetlands.

Next Steps

•Can we accelerate water quality functioning in restored wetlands by improving initial restoration conditions?
•Do initial amendments of organic matter, soil plugs, charcoal, and/or planting of wetlands accelerate processes of pollutant and nutrient removal?
•How does the species, quality, and amount of organic matter affect the soil's filtering capacity in restored and in natural wetlands?

Acknowledgements

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