Phosphorus Retention in Riparian Wetlands Restored on Formerly Farmed Land: Key Drivers and Lessons for Future Restoration

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Poor and declining water quality in Lake Champlain and increasing frequency of extreme flood events in the Lake Champlain Basin pose threats to both residents and aquatic ecosystems. Riparian wetlands and floodplains can help address these threats by slowing floodwater, trapping sediment, and serving as nutrient sinks. The Wetlands Reserve and Agricultural Conservation Easement Programs have invested millions of dollars to protect and restore wetlands in the basin. This presentation will focus on the Vermont CEAP Wetlands research project, the primary objective of which is to quantify the water quality benefits that accrue from restoration of riparian wetlands in terms of phosphorus (P) load reductions. While wetlands are generally known to be P sinks, data are relatively scarce for restored riparian wetlands on formerly farmed land, where legacy P can potentially be released in dissolved form during inundation. We have monitored water quality during numerous flood events on five such wetlands in Vermont since 2022, including a historic flood in July 2023. Using a combination of field monitoring, soils analysis, laboratory incubations, and modeling, we estimate net P retention for various scenarios at each site that represent a range of plausible hydrologic and biogeochemical conditions. Results to date suggest positive net P retention at all monitoring sites, with site hydrology, soil P storage capacity, and influent river water quality being key factors in determining the balance between P capture and release. Our findings will inform ongoing efforts to reduce watershed P loads, estimate the water quality benefits of wetland and floodplain restoration, and refine the design of restoration plans to achieve intended water quality benefits.