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Nature's Kidneys: A review of 35 Years of USDA Wetland Restoration

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It's been forty years since the Food Security Act of 1985 introduced conservation compliance to discourage wetland conversion to cropland (*farmdoc daily*, October 9, 2025 and October 23, 2025*)* and 35 years since the 1990 Farm Bill allocated funds for restoration of wetlands under the Wetland Reserve Program. Today, we will review a recent analysis of the impact of three decades of government-supported wetland restoration (Karwowski and Skidmore, 2025). The paper is the first large-scale empirical analysis of how the program has benefited local water quality and economies.

Wetland restoration began under the Wetland Reserve Program (WRP) and was folded into the Agricultural Conservation Easement Program in 2014. Under a wetland easement contract, a landowner agrees to withdraw the eased land from all farming, ranching, and forestry practices while retaining ownership of the land. In exchange, the landowner receives a payment based on appraised value, regional rate cap, or voluntary offer—typically averaging $2,700/acre. The parcel must be a farmed or converted wetland or a riparian area linking protected wetlands to be eligible. The landowner must have owned the land for seven years, meet specified income eligibility thresholds, and comply with the highly erodible land and wetland conservation provisions. Program enrollment is limited to no more than 10% of a county's farmable acreage. USDA National Resources and Conservation Service staff restore the land to its natural wetland condition by planting native species, removing tiling, and building berms. The restoration process costs an average of $650/acre (Hansen et al., 2015).

Wetlands are likened to "nature's kidneys" because native wetland plants facilitate the nitrogen cycle and filter nitrogen from surface water, releasing it as atmospheric nitrogen. We estimate the effect of newly restored wetlands on nitrogen (measured in two forms: ammonia and total Kjeldahl nitrogen or TKN) and phosphorus loads in the Mississippi River Basin. We focus on surface water (i.e., rivers and streams). We accomplish this by combining over 30 years of water quality data with easement-level data on the WRP. We compare water quality before and after wetland restoration in subwatersheds that ever have a restoration, using subwatersheds that haven't yet had a restoration as comparison units. We control for numerous factors that influence surface water quality, including weather, seasonal variation, national policy, and the geology of the region. This approach allows us to isolate the impact of the restored wetland on water quality.

We find wetland easements have significantly reduced nitrogen concentration in surface water across the Mississippi River Basin. It takes on average three years after restoration for these water quality improvements to materialize, but our findings suggest that these benefits last for longer than a decade. The first wetland restoration in a subwatershed decreased ammonia concentration by 0.08 milligrams per liter (mg/L), or 62% of the sample mean ammonia concentration. TKN decreased by 0.20 mg/L (37% of the sample mean). For later restorations, we find that a 100% increase in restored wetland acres in a subwatershed decreased ammonia concentration by up to 0.015 mg/L (11% of the mean) and TKN by up to 0.060 mg/L (11%).

Reducing nutrient loads in surface waters is a goal in and of itself for many states in the Cornbelt (e.g., the Illinois Nutrient Loss Reduction Strategy). This goal has proven to be challenging for numerous reasons, including legacy nutrients, missed implementation goals, and inconsistent impacts of best management practices (IL NLRS biennial report, 2023; Liu et al., 2017). Our results demonstrate that relatively modest wetland restoration projects (the median project in our sample was only 100 acres) can contribute to nutrient loss reduction goals.

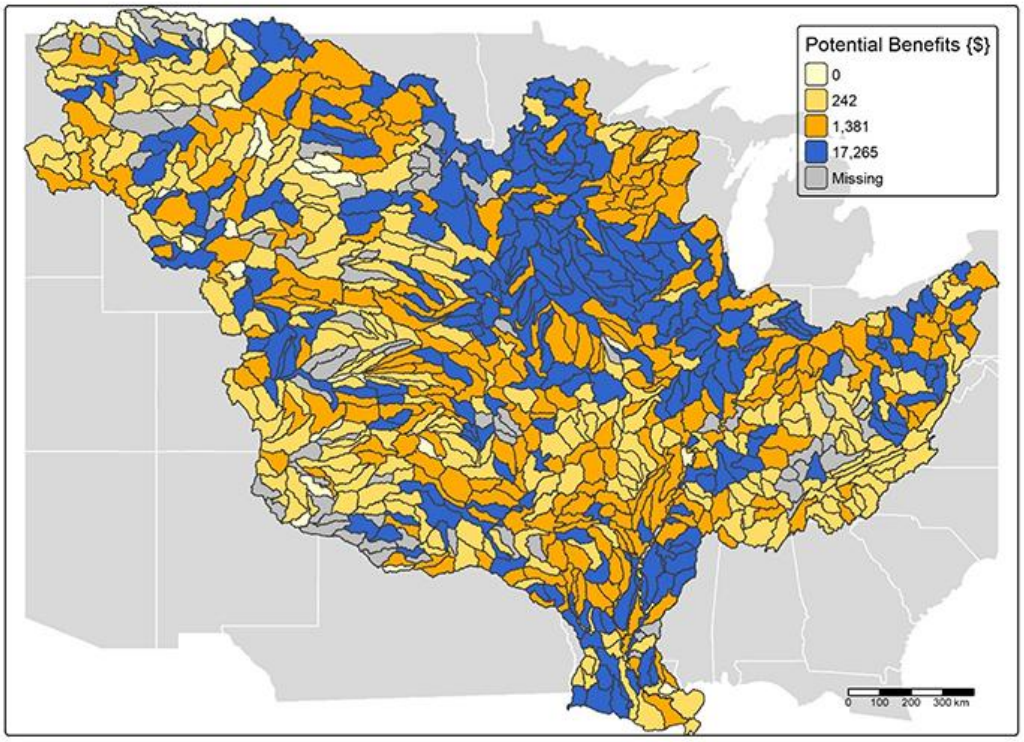
Reducing nitrogen concentration can be cost-effective at the local scale. Public water systems are required to maintain drinking water nitrate levels below thresholds prescribed by the Safe Drinking Water Act. This can be costly, particularly for communities with high nitrogen concentrations, as can be found in parts of the Cornbelt. We use existing estimates of the cost to public water systems to remove nitrogen from source surface water to estimate the cost savings of a 100-acre wetland restoration (Ribaudo and Shortle, 2017). In communities with high baseline nitrogen, the time to pay back the initial expenditure (the payment to the landowner and the cost of restoration) is only twenty years – well within a wetland's lifetime. Through this lens, the WRP is a cost-effective way to strengthen local economies in the Mississippi River Basin.

The surface water filtration we discuss is only one of the ways that wetlands have tangible benefits to the individual landowner and the local community. Wetlands are also likened to a sponge thanks to their ability to absorb high amounts of water Previous research shows wetland restoration benefits the landowner through this sponge capability by increasing yield and reducing risk (i.e., prevent plant claims) on surrounding fields (Karwowski, 2023a and 2023b). Wetlands also reduce the flood insurance claims in downstream communities (Taylor and Druckenmiller, 2023). Anecdotally, landowners that participate in the program have shared with the author that they enrolled in the program thinking of the legacy they could share with their children and grandchildren. Today, their families enjoy fishing and hunting on the land together, and someday they will pass on a healthy and productive farm.

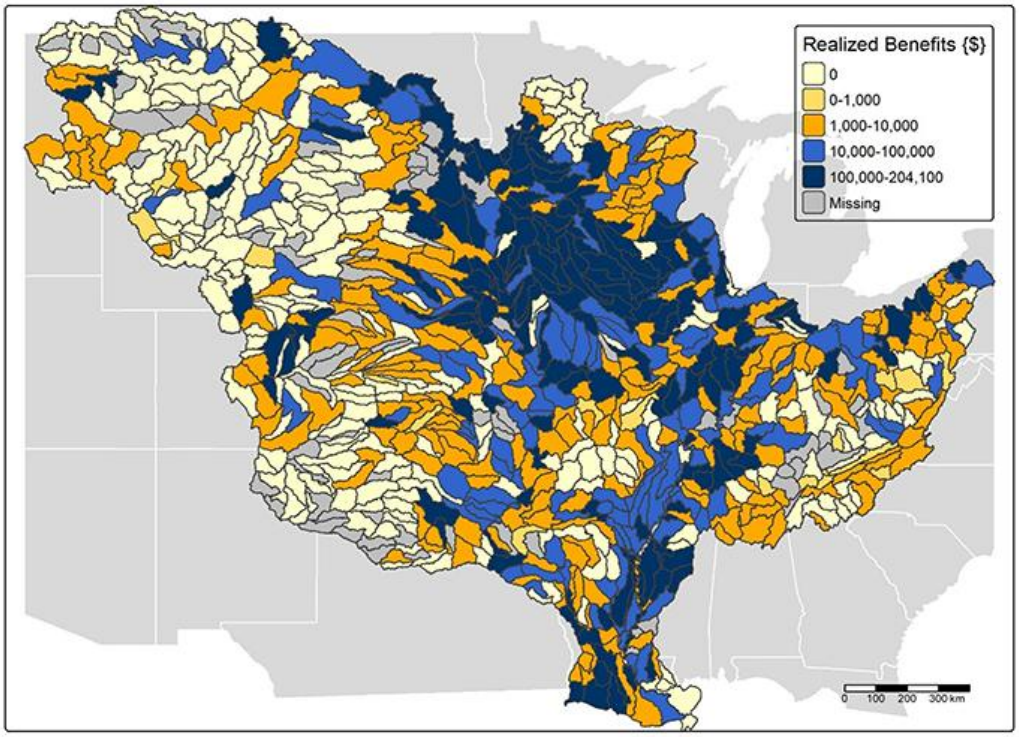
Evaluating the effectiveness of government programs – both in terms of their stated goals and their cost-effectiveness – is an important part of the public policy discussion over the use of public funds. Our review of USDA-funded wetland restoration shows that the WRP (now ACEP) has met that standard, particularly in Cornbelt communities that are investing local funds in solutions for nutrient loss. Federal support for wetland restoration is a cost-effective way to support communities through cleaner water and stronger local economies.

Figure 1. Estimated Annual Treatment Cost Savings from Wetland Restorations by Nitrogen Concentration in the Watershed

a) Potential benefits from a 100-acre wetland restoration based on nutrient concentration in the watershed



b) Realized benefits from total wetland restoration in 2018 based on nutrient concentration in the watershed



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References

Hansen, Le Roy, Daniel Hellerstein, Marc Ribaudo, James Williamson, David Nulph, Charles Loesch, and William Crumpton. 2015. *Targeting Investment to Cost Effectively Restore and Protect Wetland Ecosystems: Some Economic Insights*. Technical report. Economic Research Service. https://ers.usda.gov/sites/default/files/_laserfiche/publications/45347/51895_err183.pdf

Hockenberry, A., J. Coppess and B. Endres. 2025. "Swampbuster Stands, Part 1: Reviewing the Iowa Lawsuit Challenging Conservation Compliance." *farmdoc daily* (15):186, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 9, 2025.

Hockenberry, A., J. Coppess and B. Endres. 2025. "Swampbuster Stands, Part 2: The Constitutionality of Conservation Compliance." *farmdoc daily* (15):196, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, October 23, 2025.

Illinois Environmental Protection Agency and Illinois Department of Agriculture. 2023. *Illinois Nutrient Loss Reduction Strategy Biennial Report 2021–22*. Springfield, IL. University of Illinois Extension, Urbana-Champaign, IL. https://epa.illinois.gov/topics/water-quality/watershed-management/excess-nutrients/nutrient-loss-reduction-strategy.html

Karwowski, Nicole. 2023a. “Estimating the Effect of Easements on Agricultural Production.” In *American Agriculture, Water Resources, and Climate Change*, edited by Gary D. Libecap and Ariel Dinar, 53–105. Chicago: University of Chicago Press. https://www.nber.org/books-and-chapters/american-agriculture-water-resources-and-climate-change/estimating-effect-easements-agricultural-production

Karwowski, Nicole. 2023b. *The Direct and Indirect Effects of Wetland Easements: Evidence from Field-Level Yield Data in Wisconsin*. Working paper. Available at AgEcon Search.

Karwowski, Nicole, and Marin Skidmore. 2025. “Nature’s Kidneys: The Role of Wetland Reserve Easements in Restoring Water Quality.” Accepted manuscript, forthcoming in *Journal of the Association of Environmental and Resource Economists (JAERE)*. https://doi.org/10.1086/739287

Liu, Yaoze, Bernard A. Engel, Dennis C. Flanagan, Margaret W. Gitau, Sara K. McMillan, and Indrajeet Chaubey. 2017. “A Review on Effectiveness of Best Management Practices in Improving Hydrology and Water Quality: Needs and Opportunities.” *Science of The Total Environment* 601–602: 580–593. https://doi.org/10.1016/j.scitotenv.2017.05.212

Ribaudo, Marc, and James Shortle. 2017. “Nitrogen in Agricultural Systems: Implications for Conservation Policy.” *Land Economics* 93 (1): 12–39. https://doi.org/10.3368/le.93.1.12

Taylor, Charles A., and Hannah Druckenmiller. 2022. “Wetlands, Flooding, and the Clean Water Act.” *American Economic Review* 112 (4): 1334–63. https://doi.org/10.1257/aer.20210497