Mississippi River Basin / Gulf of Mexico Nutrient Runoff Network Info Bulletin

Sharing information and making connections from the headwaters to the gulf

April 10, 2023

Welcome!

This bulletin is designed as a way to share information with those interested in nutrient runoff issues and impacts. ***We hope you find this a valuable resource and encourage you to be a part of the exchange!*** You can share resources or information for inclusion in future bulletins, or join the distribution list, by sending an email to noaa.centralregion@noaa.gov.

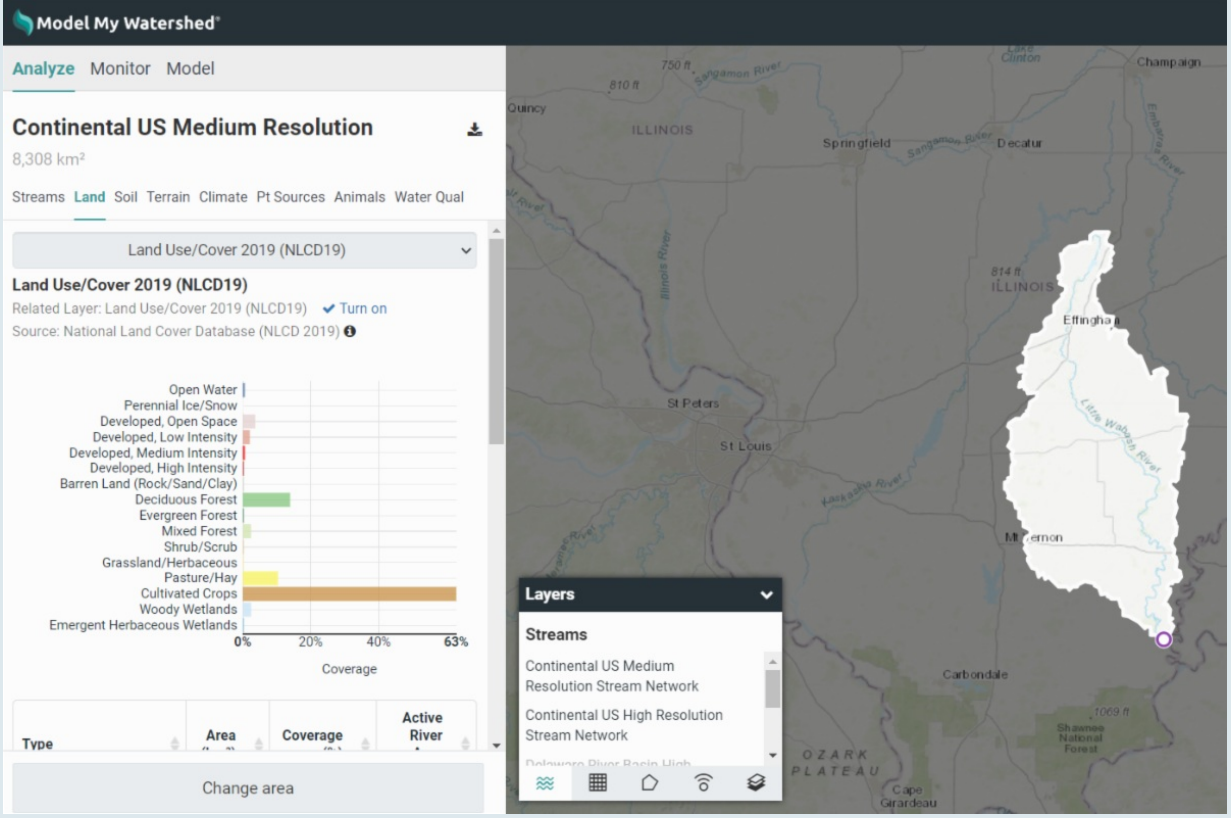
Spotlight: WikiWatershed

An Initiative of the Stroud Water Research Center

WikiWatershed is a web toolkit with the goal of supporting decision-makers, researchers, educators, and students in collaboratively advancing knowledge and stewardship of freshwater. This set of tools, built using open-source software, is an initiative of The Stroud Center, an organization focused on research and outreach for freshwater issues in 1967. WikiWatershed web tools offer rapid visualization of watershed data, advanced geospatial analysis capabilities, and science-based predictions of human impacts on stormwater runoff and water quality in order to facilitate the sharing of watershed-model scenarios, watershed-monitoring data, and watershed-management stories as part of an open, collaborative community.

Model my Watershed

One of the tools in the WikiWatershed toolkit is **Model My Watershed**, which allows users to analyze mapped watershed data, visualize monitoring data, and run model simulations of human impacts on water quality. Users can select an area of interest, and Model My Watershed automatically performs geospatial analyses on mapped data layers within the area. Summary statistics are provided in graphs and tables for each of these data layers that impact stormwater runoff and/or water quality. **Curricula** using Model My Watershed are available for teachers; these curricula were designed for middle school students to learn systems thinking and geospatial analysis skills in the context of place-based problem-solving for watershed science.



Using the Delineate Watershed feature of the Model My Watershed tool, a user can select any point on the map and easily explore mapped layers of factors impacting water quality for that drainage area. Shown above is the Land Use/Cover 2019 for the Little Wabash River at a point just upstream of its confluence with the Ohio River, in Illinois. (Stroud Water Research Center)

High School Students Learn about Land-Use Impacts to Water Quality

In 2021, students at a rural Illinois high school taking an Earth and Space science class **completed an ambitious project** to learn about land use effects on water quality and to propose and implement a project aimed at addressing nutrient runoff in a local watershed. Funded by a NOAA Planet Stewards grant, students addressed the question, “How do our land use choices affect the Little Wabash River and all of the bodies of water it empties into, including its estuary, the Gulf of Mexico, and how can we better manage our land in central Illinois to positively impact water quality?” After learning about watersheds in general, the class shifted focus to their local watershed for the Little Wabash River and learned about its current land uses and impairments. They used Wikiwatershed Model My Watershed tools to calculate runoff, infiltration, and nutrient loss from a site ~10 miles away from the school, where a landowner had requested the planting of a riparian forest. Results from the students' analysis indicated that a transition from agriculture to forest land use would significantly reduce nutrient runoff. The work done by these high school students is a great example of how tools like Model My Watershed can allow for hands-on learning and bring larger concepts like nutrient runoff to a more understandable, backyard level *(Photo: Students and volunteers measure and plant tree seedlings. Amy Brown)*

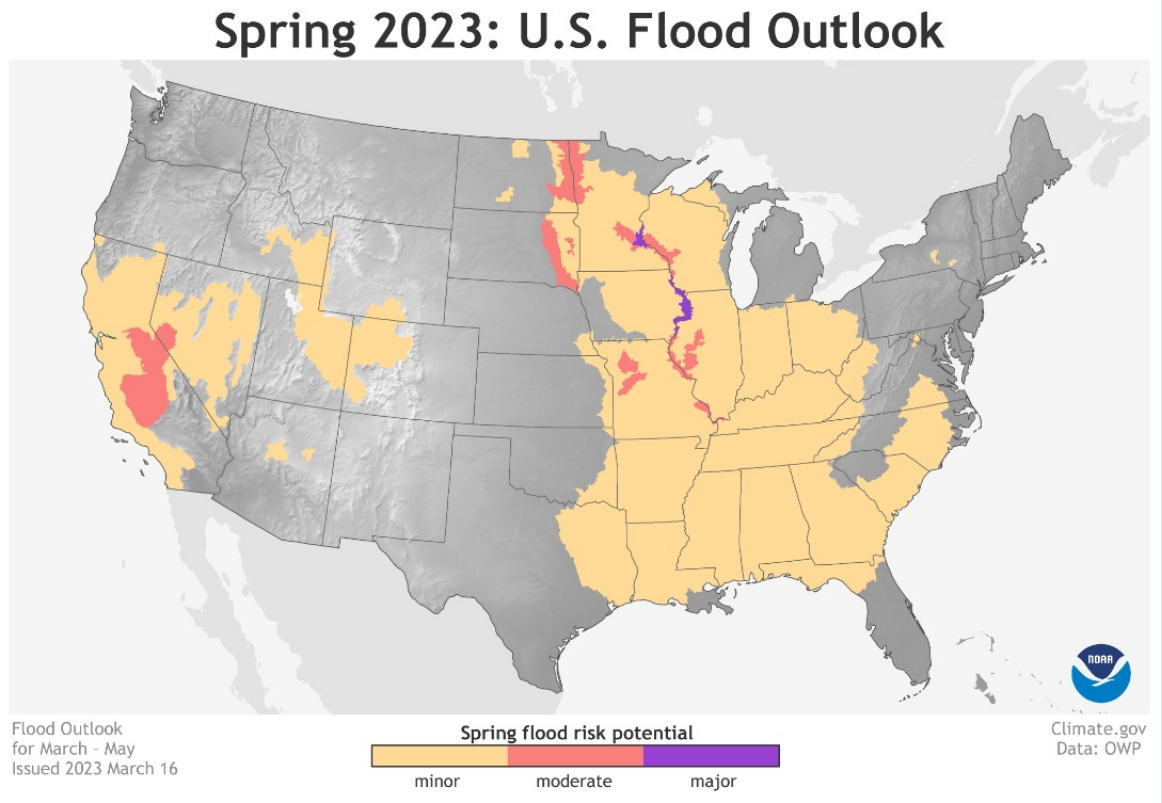
Nutrient Runoff News

NOAA Releases Spring Outlook

On March 16th, the National Oceanic and Atmospheric Administration (NOAA) released its annual**Spring**

Outlook for temperature, precipitation, drought, and flooding. The recent wet weather that brought flooding and other challenges to California has reduced and even ended drought across much of the western U.S; moderate to exceptional drought coverage is at its lowest point since 2020, and most of what remains is in the central and southern plains.

After two years, La Nina has finally ended, and we are currently ENSO-neutral (the transition period between La Nina and El Nino) and are projected to stay that way through early summer before a likely shift to El Nino. For April through June, above-average precipitation is likely for the Great Lakes and Ohio Valley. This has implications for Mississippi River water levels, as most of the Mississippi Basin is at risk of flooding (>50% chance of at least minor flooding).



Areas where there is a greater than 50% chance of minor to major flooding during March through May, 2023. Most of the Mississippi River Basin falls into these categories. (NOAA)

Study Finds Soil Eroding 10 to 1,000 Times Faster Than It Forms

Findings from a study conducted by UMass Amherst Researchers suggest current soil erosion rates in the Midwestern US are 10 to 1,000 times greater than pre-agricultural erosion rates. The study's authors used beryllium-10, a rare element left behind when a star's explosion sends high-energy particles colliding into Earth, to precisely determine average erosion rates over the span of thousands to millions of years. Using deep soil cores from remnant native prairies in Iowa, Minnesota, South Dakota, Nebraska, and Kansas, the scientists were able to calculate a precise erosion rate stretching back to the last ice age (~12,000 years ago). What they learned is not encouraging: The median pre-agricultural rate of erosion across all 14 study sites was 0.04 mm per year. The US Department of Agriculture's current erosion limit of 1 mm per year is 25 times greater than this median pre-agricultural rate. This implies that current guidelines may still allow for unsustainable erosion. Furthermore, some sites experience much higher erosion that this current limit. Results from this study may have implications for food security, environmental degradation, and even climate mitigation plans. (*Photo: Caroline Quarrier (r) and Brendon Quirk preparing to extract a soil sample from Stinson Prairie, Iowa. University of Massachusettes Amherst)*

Missouri Develops Plan to Address Gulf of Mexico Hypoxia

Missouri is part of a group of 12 states bordering the Mississippi River working together in order to fight the seasonal dead zones in the Gulf of Mexico. These areas of hypoxia, or low dissolved oxygen, can harm fish and marine life in the Gulf, and are primarily driven by excess nutrient runoff coming down the Mississippi River. Working with its first year of federal funding totaling nearly $1 million, the Missouri Department of Natural Resources **will implement five projects** under its Gulf Hypoxia Program. These projects include enhanced stream nutrient monitoring, pilot testing for ways of reducing nutrient loading, improved modeling to better understand the ways in which nutrients are transported, and outreach components such as a public nutrient reduction progress dashboard and a Gulf Hypoxia educational exhibit at the St. Louis Science Center. Occurring in tandem with that of other Mississippi River states, this work not only aims to improve water quality and ecosystems in local and state communities, but also addresses a much larger downstream problem that can benefit from this type of widespread and integrated approach.

Value of Runoff Risk Advisory Forecast Highlighted by Minnesota Fish Kill

The National Weather Service North Central River Forecast Center leads efforts to incorporate forecast precipitation, temperature, snowmelt and soil conditions up to ten days into the future. The resulting information is used by state groups to help farmers know when it's appropriate to apply fertilizer. State working groups then create maps with this important information, and develop **websites** for farmers and other land managers in their states. When these maps are used by farmers, they can help ensure nutrients stay where they are intended, and not run off into creeks and rivers where they can lead to big problems.

In late July 2022, **a fish kill left 2,500 trout dead** in a southeast Minnesota creek. An angler discovered and reported the fish kill in Rush Creek, one of the top trout streams in Winona County, after witnessing dead trout floating in the stream. Investigators from the Minnesota Pollution Control Agency (MPCA) could not determine a single specific cause for the kill. However, the official report pointed to a runoff event triggered from a major rainstorm occurring on July 23rd. Numerous manure and fertilizer applications took place across many upstream farms during that time period, and a statement from MPCA officials read, “Investigators did not find evidence of a direct discharge of pollutants to Rush Creek. They concluded that recent upstream applications of manure and pesticides combined with low-flow conditions in the creek prior to rainfall on July 23 may have led to the fish kill.” MPCA Southeast Watershed Unit Supervisor Justin Watkins is encouraging farmers to watch the weather carefully when applying fertilizer, manure, or pesticides, and use Minnesota's **Runoff Risk Advisory Forecast**. In the days leading up to this July 2022 event, this tool showed users that it was not an appropriate time to spread nutrients on farm fields in the area. In light of this event and the results of its investigation, MPCA has plans for an education campaign to share information about best management practices and how farmers can use the Runoff Risk Advisory Forecast to keep nutrients on their fields and out of nearby waterways. *(Photo: At least 2,500 fish were killed in the event, including this trophy-sized 27-inch brown trout. Minnesota Trout Unlimited via Outdoor Life)*

Massive Seaweed Bloom Linked to Nutrient Runoff

Sargassum is a genus of large brown seaweed (algae) that floats, rootless, in the Atlantic Ocean and Gulf of Mexico (GoM). This pelagic brown algae provides a diverse and important habitat for fish and other aquatic organisms at the ocean's surface. About a decade ago, scientists started noticing what had previously been disparate mats of sargassum had **started becoming massive blooms**, capable of being seen from space. Since 2011, these seasonal blooms have been getting larger and larger. According to Brian Barnes, a research scientist at the University of South Florida, "What we thought was just a massive bloom has gotten bigger, and bigger, and bigger each year." Today, the sargassum circulates from near West Africa into the GoM and back out into the Atlantic Ocean - a 10 million-ton belt of seaweed stretching 5,500 miles.

The past decade's large blooms have caused tremendous problems for beach-side communities and

ecosystems; the sargassum mats can smother coral reefs, alter the water's pH balance, and affect local economies by shutting down beaches and limiting access to marinas and making life difficult for fishermen and all who make their living on the water. This summer is shaping up to be perhaps one of the worst when it comes to these negative effects - blooms are already washing up on beaches in the Yucatán Peninsula and the Florida Keys, and more areas may be affected as this mass of seaweed continues moving west. While the exact cause of these recent massive blooms are still uncertain, Brian Lapointe, a professor at Florida Atlantic University, who's studied sargassum for four decades, thinks that it is likely due to human alterations of the nitrogen cycle. As nutrient runoff has increased, we're sending more nitrogen and phosphorus down major rivers like the Mississippi. "What we've found in studying these plants over the last four decades is that the ratio [of nitrogen to phosphorus] is going up, and that's exactly what's happening to all these major river systems," Lapointe said. "It's almost like sargassum is a barometer for how global nitrogen levels are changing." (*Photo: People remove Sargassum in Playa del Carmen, Mexico, in April, 2022. Researchers expect this year will bring another massive bloom, choking local ecosystems and tourism economies. Elizabeth Ruiz/AFP via NPR)*

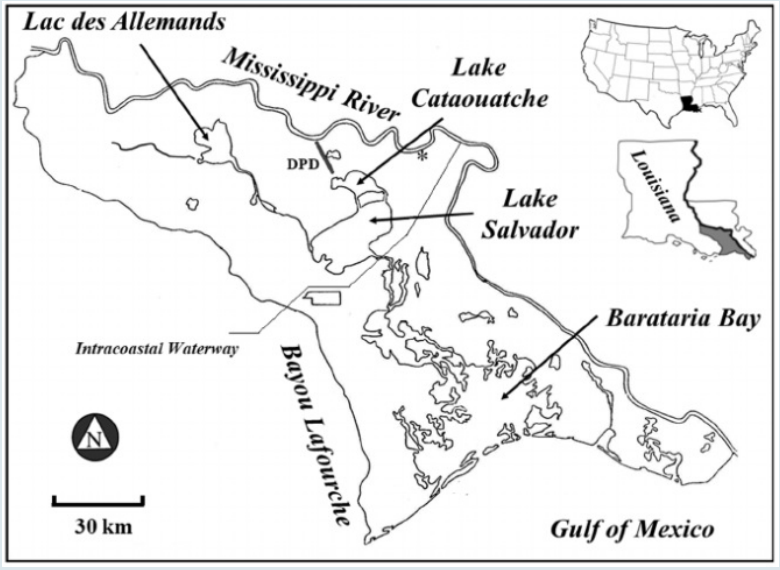
Could Inflation Reduction Act Funding Increase Nutrient Runoff?

When the Inflation Reduction Act (IRA) was signed into law in August, 2022, it was celebrated for its climate funding. The $369bn IRA includes funding for many projects designed to address environmental issues, but some are concerned that provisions in the Act could actually **increase nutrient runoff from farmland**. Researchers and activists point to the promotion of corn-fed ethanol refineries and manure-based energy production as potential problems for water quality. The incentivization for more corn production could increase nitrogen runoff, a particular concern for the Gulf of Mexico hypoxic zone. Corn is the most heavily fertilized row crop in the US, already accounting for 11bn lb of commercial nitrogen fertilizer applied each year, and much of what is applied runs off into nearby waterways and eventually into the Gulf of Mexico. Similarly, the IRA's promotion of new biodigesters for renewable energy production could lead more more nitrogen and phosphorus runoff if the funding incentivizes increased herd sizes at industrialized livestock operations, which limited evidence suggests could be the case.

This is not to say that water quality went ignored by legislators writing the IRA; the US Department of Agriculture's $19.5bn climate smart program is partially devoted to managing nutrients. Likewise, there are other components of the Act focused on addressing water quality and nutrient runoff, but it's the unintended consequences of some of the main provisions that activists worry about.

Funding Approved for Mississippi River Sediment Diversion

The agencies in charge of restoring Louisiana's natural resources following the 2010 Deepwater Horizon oil spill have **formally approved $2.26bn** for the Mid-Barataria Sediment Diversion project. This restoration project, managed by the Coastal Protection and Restoration Authority, will use sediment-laden water from the Mississippi River to create and maintain between 10K and 30K acres of wetlands over 50 years by reconnecting the river to areas where it once flowed. Recognizing that the scale of the project will increase water levels near the diversion and impact natural resources reliant on higher-salinity waters, this funding decision includes $378M for mitigation and stewardship efforts to minimize impacts where possible.



The Mid-Barataria Sediment Diversion Project aims to withdraw water from the Mississippi River to build

*wetlands in Barataria Bay, in southern Louisiana. (Figure from **Ren et. al., 2020**)*

Following the great floods of 1937, efforts to contain the Mississippi River have been successful at limiting flood damages in riverside communities, but separating the river from its historic floodplain has exacerbated Louisiana land-loss, and contributed to environmental issues. **The reintroduction of nutrient-rich freshwater and sediment** from the river into Barataria Basin should slow down land loss, create wetland habitat vital for countless species, and help protect the state from hurricanes.

Private Wells in Minnesota at Risk of Nitrate Contamination

Private wells are how many rural Minnesotans obtain drinking water, and**a recent article from Investigate Midwest** highlights the growing danger of nitrate contamination. When nitrogen mixes with aerated water, it forms nitrate which can be harmful to humans at high concentrations (above 10 ppm). Farmers rely on nitrogen fertilizers for their crops; unfortunately, nitrogen is easily transported by water and can readily reach the groundwater relied upon by over 1 million people in Minnesota. A common fix for drinking water with unsafe levels of nitrate is the installation of a reverse osmosis filter. However, these filters can be cost-prohibitive, and community water systems most affected by nitrate pollution are more likely to be low-income. Efforts are being made by nonprofits and state organizations to communicate the risks and encourage well owners to have their water tested, but advocates are pushing for more public policy addressing the pollution's root causes.

Funding Opportunities

NOAA Planet Stewards project funding for educators ($5,000)- Application deadline June 4, 2023

Jobs, Fellowships, and Graduate Assistantships

PhD Assistantship in Coastal Water Quality - Clemson, SC; application deadline April 15, 2023

Multiple job opportunities at Soil and Water Outcomes Fund

Postdoctoral Fellowship at the University of Minnesota's Institute on the Environment- Minneapolis, MN; application deadline May 1, 2023

NOAA Postdoctoral Harmful Algal Bloom Numerical Modeler Fellowship- Beaufort, NC or Silver Spring, MD; application deadline April 28, 2023

EPA Groundwater Nitrate Soil Health Practices Fellowship - Corvallis, OR; application deadline July 21, 2023

Upcoming Meetings and Events

Gulf of Mexico Alliance all-hands meeting- June 26-29, 2023 in Austin, TX

Nutrient Runoff Quiz!

Are you an expert on Mississippi River Basin nutrient runoff and Gulf of Mexico hypoxia?
Test your knowledge with our trivia quiz!

CLICK HERE : Nutrient Runoff Quiz - April 2023

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