

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

*Sharing information and making connections from the headwaters to the gulf*

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January 10, 2023

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## **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](mailto:noaa.centralregion@noaa.gov).

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## **Spotlight: NASA Earth Information System**

[The Earth Information System \(EIS\)](#) is a platform for understanding and answering critical questions about Earth's complex systems. Using NASA's 20+ years of Earth observation data and novel modeling capabilities, it aims to support near-term and long-range analysis and decision making in support of preparation, mitigation, and resilience in the face of climate change. The EIS is organized around topical Scientific Collaboration Environments (SCEs), which group fragmented data, models, and tools to comprehensively address a specific topic (i.e. freshwater, sea level change, fire). SCEs speak to the needs of both the scientific and non-scientific communities.

The EIS builds upon NASA's Earth Observing System Data Information System (EOSDIS), and leverages NASA's Earth Science Data System's (ESDS) Data System Evolution (DSE) and the cloud-based computational resources of the High-End Computing (HEC) programs. Combining models with data from multiple missions and focus areas, NASA scientists develop science products ranging from reanalysis to real-time integrated products to skillful predictions. For example, fire risk is dependent on fuels which are studied in several focus areas (precipitation, soil moisture, vegetation health and structure); in turn, active fires generate atmospheric conditions that travel the globe and impact air quality. The EIS answers questions related to the global interaction of multiple focus areas and does so in a way that is comprehensible and relevant on a local level.

Three pilot studies have so far been initiated - freshwater, fire, and sea-level change - to confirm the potential of the EIS. The objectives of these pilots were to:

1. Determine the feasibility and value of a potential Earth Information System (EIS)
2. Overcome the challenges inherent in combining data and models from different focus areas
3. Determine the capabilities & limitations of new open source and commercial tools (such as Jupyterhub & ESRI's ArcGIS StoryMaps)
4. Demonstrate a new, more open approach to sharing scientific results to ensure that they are both accessible and actionable
5. Meet high priority needs by working closely with user communities

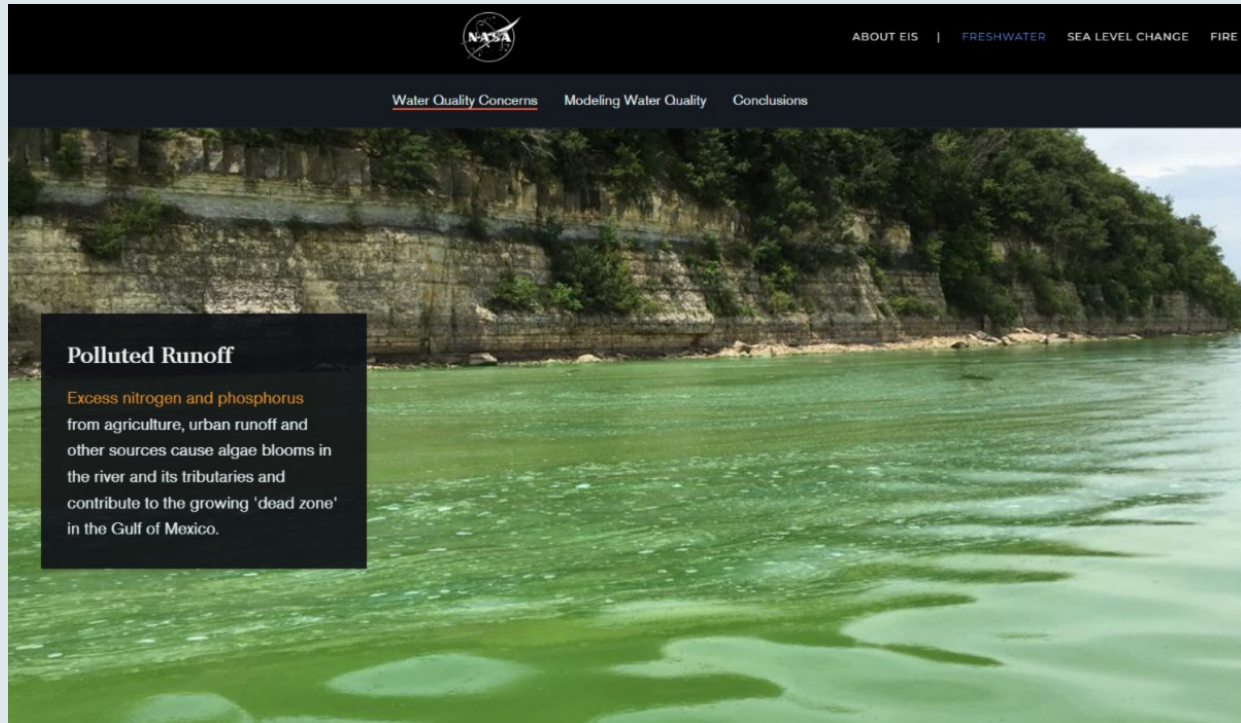
## **Actionable Freshwater Information**

[EIS Freshwater](#) enables decision-support science related to understanding freshwater variability, extreme events, and the impact of human management on the hydrosphere. NASA's Earth observations are incorporated within the Land Information System framework to model different water cycle components and impacts on water quality. To explore some of the ways that NASA tools and datasets can help measure and explain trends within the Freshwater pilot study, EIS includes the following interactive case studies:

- [The Human Footprint on the Ogallala Aquifer](#)
- [Flooding in 2019 - Tale of a Terrible Year](#)
- [2017 Drought - Havoc from the Heat](#)
- [Human Impacts on the Mississippi River Delta](#)
- [Landslides in Kentucky](#)

- [Water Quality in the Mississippi](#)

EIS has great potential to bring together disparate data and tools from multiple focus areas in order to better understand complex systems. Going forward, EIS will provide benefit to a broad range of users by helping to better understanding and answering critical questions about the Earth.



A NASA Earth Information System case study, "Water Quality in the Mississippi" describes water quality trends in the Upper Mississippi River Basin discovered using NASA's land surface models. (NASA)

## Nutrient Runoff News

### [Warming Winters Increasing Nutrient Runoff](#)

Concern is growing about a [significant new threat to U.S. water quality](#) as winters warm due to climate change, they are unleashing large amounts of nutrient pollution into lakes, rivers, and streams. [A first-of-its-kind national study](#), conducted by a team of scientists from the University of Vermont, University of Colorado, University of Kansas, and University of Michigan, finds that previously frozen winter nutrient pollution—unlocked by rising winter temperatures and rainfall—is putting water quality at risk in 40% of the contiguous U.S., including over 40 states. Nutrient runoff into rivers and lakes—from phosphorus and nitrogen in fertilizers, manure, animal feed, and more—has affected water quality for decades. However, most research on nutrient runoff in snowy climates has focused on the growing season. Historically, cold temperatures and a continuous snowpack froze nutrients like nitrogen and phosphorous in place until the spring thaw, when plants could help absorb excess nutrients. But winters are the fastest warming U.S. season, and the seasonal snowpack in much of the U.S. has become less stable. Increased rain-on-snow, snowmelt, and rainfall events now carry nutrients and soil into streams and rivers during winter when dormant vegetation cannot absorb them. As a result, winter runoff impacts on nutrient pollution has quickly progressed from rare or nonexistent to far worse than during other times of the year.



*As winters warm, chemicals frozen on farms and fields are thawing early, when no plants are absorbing them. That's unleashing winter runoff pollution into groundwater, streams and lakes. (Benjamin Lehman/Pexels)*

Of particular concern are so-called “rain-on-snow” events, researchers say, which can cause large, economically and environmentally devastating floods. The team used geospatial datasets to explore the impacts of rain-on-snow in U.S. regions with large pools of nitrogen and phosphorous, and found that rain-on-snow affects 53% of the contiguous U.S. and puts 50% of U.S. nitrogen and phosphorus pools at risk of export to groundwater and surface water. Where these factors converge, more than 40% of the contiguous U.S. is at risk of nutrient export and soil loss from rain-on-snow events.

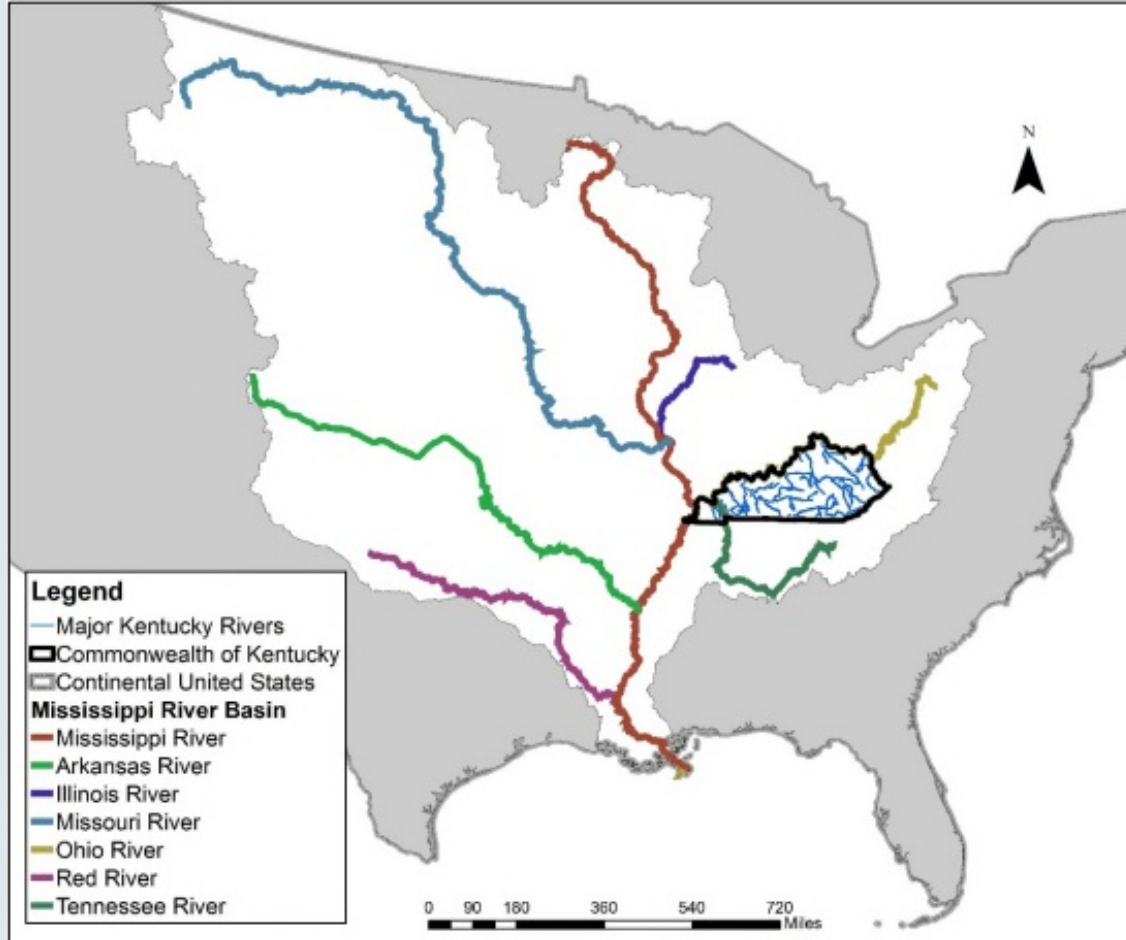
Analyzing the Mississippi River floods of 2019, researchers found rain-on-snow events delivered a large pulse of nutrients and sediment into the river and Gulf of Mexico—at much greater levels than a similar growing season rainfall event would—contributing to the Gulf of Mexico’s eighth largest dead zone on record. Dead zones occur when excess nutrients lead to algal blooms; as the algae die off, bacterial decomposition rapidly decreases oxygen in the water, causing massive die-offs of fish or other aquatic animals.

“We hope this study is a wake-up call for government agencies and researchers, because it reveals that 40% of the U.S. is producing winter pollution—but no one is tracking exactly how much, where it’s going, or the impacts on water quality and ecosystems,” said Carol Adair, a researcher at UVM’s Gund Institute for Environment, the Rubenstein School of Environment and Natural Resources, and the Vermont Established Program to Stimulate Competitive Research. “That’s a big problem that urgently needs addressing.”

### [Kentucky's Nutrient Reduction Strategy](#)

Kentucky's Division of Water has released an [update to its Nutrient Reduction Strategy](#) in order to address nutrient runoff negatively impacting the state and contributing to downstream issues like the Gulf of Mexico hypoxic zone.

The updated plan, which also includes an interactive [story map](#), provides a framework that is tailored to Kentucky’s unique geological, agricultural, and hydrologic landscape, and improves on progress made since 2014. The strategy includes point and non-point source water improvement efforts, education and outreach, monitoring and assessment, local engagement, reporting practices and more.



Map of Kentucky highlighting its drainage area within the Mississippi River Watershed. Nutrient loading to the whole Mississippi River Watershed is the leading contributor to the hypoxic zone in the Gulf of Mexico. Along with 11 other states and 5 federal agencies, Kentucky committed to develop a state specific strategy to address nutrients through the Mississippi River/Gulf of Mexico Watershed Hypoxia Task Force. (Kentucky Division of Water)

### [Increasing Rainfall in the Midwest Impacting Farmers, Downstream Ecosystems](#)



Climate change is leading to increased precipitation in the Midwest, [forcing many farmers to change the way they do business](#). The warmer atmosphere is causing rain to fall in heavier bursts, delaying planting and leading farmers to install drainage tiles in order to move water off farm fields more quickly. This runoff contributes sediment and nutrients to the Mississippi River, ultimately enhancing the hypoxic zone in the Gulf of Mexico. Rivers in the Midwest have seen increased stream flow over the last several decades from the

increases in precipitation and partially due to the faster draining water in agricultural areas.

All that water has to go somewhere. With a changing climate, the farms of the future will look different, experts say. How communities adapt will determine what kind of farming they can do. Some solutions which are gradually being implemented throughout the Midwest include cover crops, buffer strips, reduced tilling, and even reducing the subsidies in more flood-prone areas. With growing awareness of the issue, more steps are being taken to address it. Soon, money from the Inflation Reduction Act will be available to help farmers pay for implementing practices like growing cover crops or building wetlands. (Photo: NRCS)

### [Solar Farm Construction in 3 States Violated Clean Water Act](#)

Four companies have [agreed to pay fines](#) totaling \$1.3 million for violating construction permits and the Clean Water Act during construction of solar farms in Alabama, Idaho, and Illinois. Each large-scale solar project, which shared a common contractor, violated construction permits and mismanaged storm water controls, causing harmful runoff of sediment into waterways. Since solar panels are easier and cheaper to install on leveled ground, companies often clear trees and vegetation, which can lead to erosion and sediment runoff if not managed correctly. When this excess sediment runs into waterways, it can severely harm ecosystems by

blocking sunlight and introducing excess nutrients to rivers and lakes. Luckily, preparing sites for these solar projects is often very similar to more typical road construction projects; when companies follow tried-and-true methods for mitigating runoff, these types of runoff events can be minimized or avoided altogether. And because retired farmland is a prime candidate for large-scale solar, these types of projects can actually reduce the nutrient runoff which can occur with routine farming - that is, if the construction process is managed correctly.

### [Mississippi River Floodplain Could Help Reduce Gulf Hypoxia](#)

A University of Mississippi biologist is [working to understand](#) how the Mississippi River's floodplain lakes and wetlands, or "backwaters," might help remove nutrients that contribute to Gulf of Mexico hypoxia. With funding from U.S. Army Corps of Engineers, biology professor Cliff Ochs and his research team are evaluating the role that backwater lakes and wetlands in the Mississippi River floodplain play in removal of nutrients and production of algae. They will create a computer model that helps determine the controlling factors for these processes. This will build off of previous work done by Dr. Ochs and his colleagues to develop a more limited model evaluating the role of these floodplain features on nutrient sequestration. This simple simulation predicted nutrient removal from the main river channel based on the river height and interaction with a certain floodplain lake or wetland. Improving the understanding of these dynamics should allow for better management - the prioritization of which areas should be protected or restored will help ensure funds are spent wisely and ecological goals are met.



*When nutrient-enriched Mississippi River water gets into lakes and wetlands off the main channel, these backwater sites can help eliminate the nutrients from the system. (USGS Mississippi Cooperative Research Unit)*

### [Study Reveals Economic Benefit from No-Till and Cover Crops](#)

It is well-known that cover crops and no-till farming can reduce the amount of sediment loss and nutrient runoff while improving soil health. However, the economic benefits from these agricultural best management practices can be more difficult to calculate. [Recent analyses](#) done by the National Association of Conservation Districts and Datu Research suggest that adopting one or both of these practices can yield up to \$100 per acre. This is excellent news for farmers and conservationists alike, and may help convince those not already implementing these practices to start.

## [USDA Aims to Help Farmers Better Manage Nutrients](#)

The U.S. Department of Agriculture (USDA) is [advertising resources](#) to help farmers strengthen their nutrient management practices. The Inflation Reduction Act will deliver \$19.5 billion in new conservation funding to support climate-smart agriculture, including for USDA to improve opportunities for nutrient management. As part of USDA's broader effort to address future fertilizer availability and cost challenges for farmers, the Natural Resources Conservation Service (NRCS) will target funding, increase program flexibilities, launch a new outreach campaign to promote nutrient management's economic benefits, and expand partnerships to develop nutrient management plans. They estimate that by implementing the right nutrient management plan with the NRCS, farmers can save up to \$30 per acre on land currently receiving excess nutrients. A farmer's local office can help identify potential opportunities to apply for funding based on the production and conservation goals.

## [Students Help Unravel Secrets of Algal Bloom Toxicity](#)

University of Missouri Assistant Professor Rebecca North has long been interested in what causes harmful algal blooms and why they are increasing in time and place. Questions remain on what conditions are responsible for the increasing occurrence and why toxicity varies from bloom to bloom. To help get to the bottom of these questions, North and her collaborators are [working with students](#) in order to gather water quality data from their local lakes and reservoirs. The Reservoir Observer Student Scientists (ROSS) program, run by North, engages high school students in water quality monitoring while also teaching about the impacts of water quality on their community. Involved classes participate in a limnology curriculum, learn first-hand how to conduct water sampling, and then conduct monitoring on a local water body year-round. Students in Columbia, MO and Waterville, MN are currently involved in the program. Ultimately, the samples these students collect will help researchers understand the factors associated with bloom and toxin occurrence.

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## Funding Opportunities

[Mississippi-Alabama Sea Grant 2024-2025 Research Funding Opportunity](#) - Pre-proposals due February 17, 2023

[Texas Sea Grant 2024-2026 Request for Proposals](#) - Pre-proposals due February 3, 2023

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## Jobs, Fellowships, and Graduate Assistantships

[2024 Sea Grant Knauss Fellowship](#) - Application deadline February 16, 2023

[Mississippi State University Paid Summer Internships \(Apprenticeships\)](#) - Application deadline February 14, 2023

[PhD Assistantship in Coastal Water Quality \(Clemson, SC\)](#) - Application deadline April 15, 2023

[NOAA Harmful Algal Bloom Laboratory and Field Support Research Fellowship](#)- Application deadline February 28, 2023

[Environmental Scientist IV \(Kentucky Department for Environmental Protection, Division of Water\)](#)- Application deadline January 27, 2023

[Water Quality Technician \(Albany, NY\)](#) - Application deadline January 27, 2023

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## Upcoming Meetings and Events

[Ocean Visions Biennial Summit](#) - April 4-6, 2023, in Atlanta, GA

[Soil Health Nexus Webinar - Prairies and Landscape Change: Notes from the Underground](#)- This Digital Café will feature Iowa State University Associate Professor Dr. Marshall McDaniel, who will address how prairie strips (contour plantings of native prairie species embedded in row crop fields) might affect surrounding soil

## Nutrient Runoff Quiz!

Are you an expert on nutrient runoff and its effects?  
Test your knowledge with our trivia quiz!

[CLICK HERE : Nutrient Runoff Quiz - January 2023](#)



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