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

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

September 21, 2022

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: Legacy Phosphorus

Masking the Effects of Nutrient Reduction Efforts

Legacy phosphorus accumulated in soil from historical sources can contribute to nutrient runoff - potentially masking the positive effects from conservation efforts targeting contemporary applications. In some areas, efforts to reduce the runoff of excess agricultural phosphorus have been in place for decades with little obvious effect on water quality. To investigate the potential role of legacy phosphorus in masking the effects of current conservation efforts, scientists with the U.S. Geological Survey (USGS) **conducted a study** looking at 143 watersheds across the country. Out of these 143 sites, they discovered that 49 were contributing legacy phosphorus to the river; based on the agricultural balances at those sites, this was probably due to manure and fertilizer inputs from the 1980s. This study shows that while agricultural management efforts to reduce phosphorus runoff have been successful in some locations, reductions in inputs alone may not be enough to reduce phosphorus. The most effective management actions will be system-specific and account for both the long-term effects of total historical phosphorus storage as well as reductions in contemporary runoff.

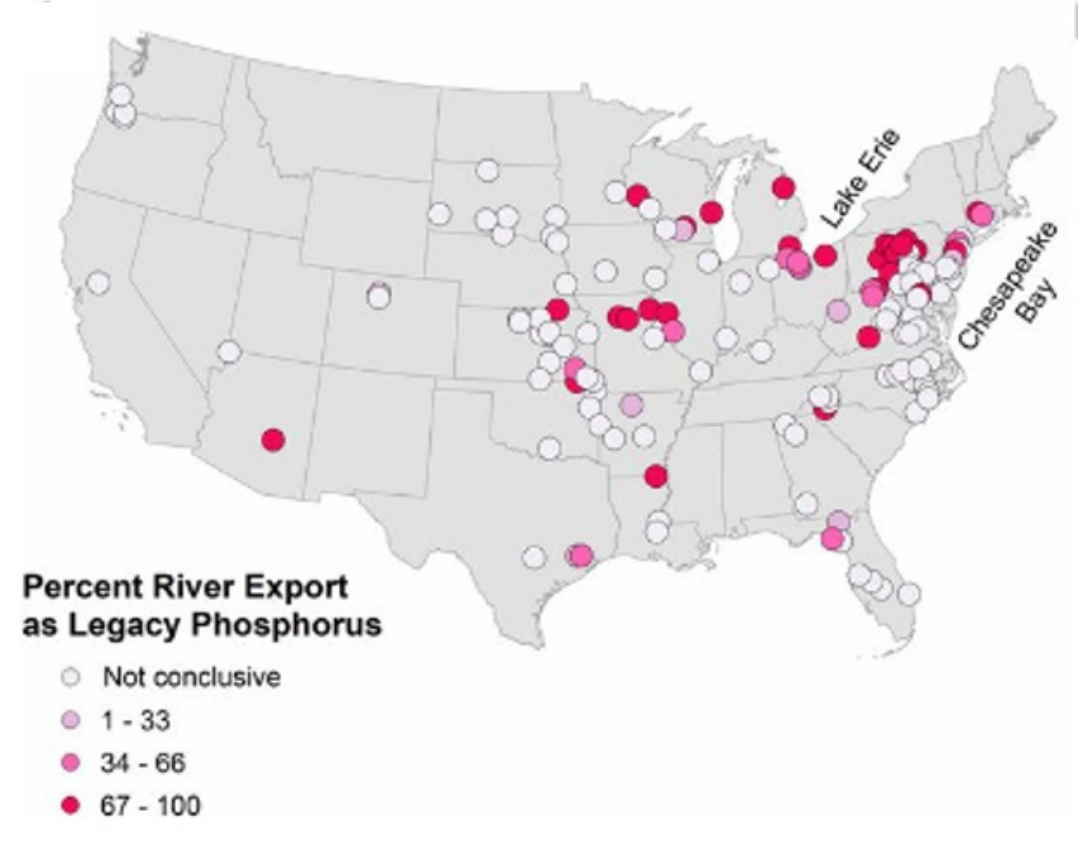


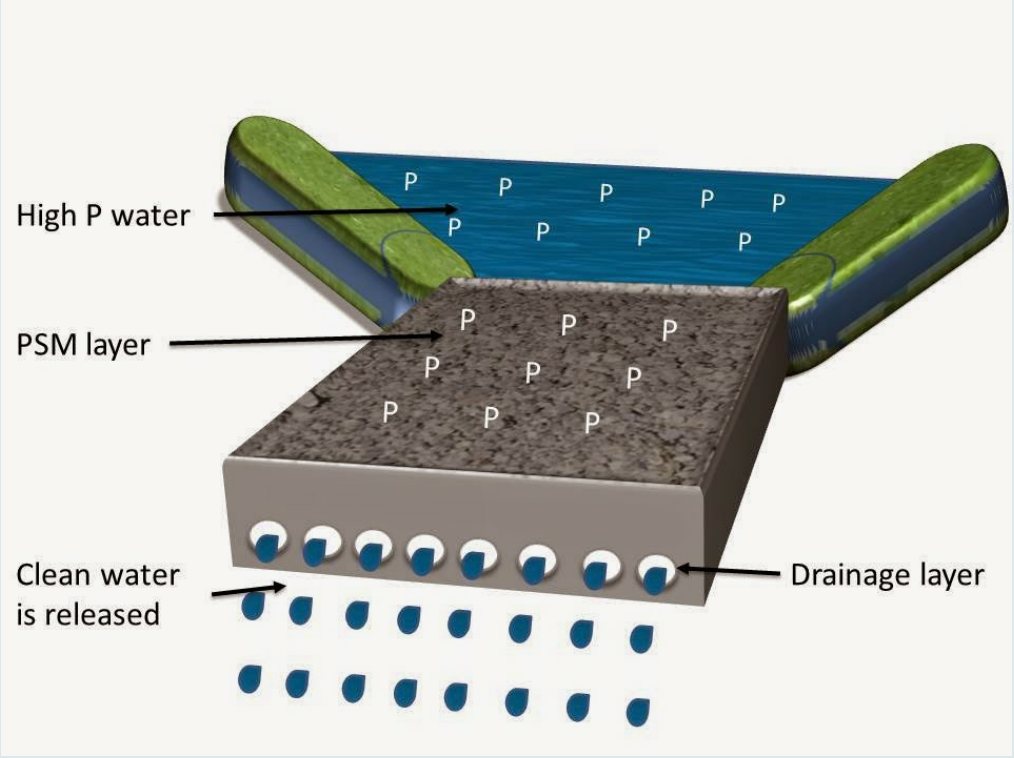
*Figure from **Stackpoole et al., 2019** showing the percentage of river phosphorus (P) export from legacy P sources. The 94 watersheds had contemporary mean agricultural P balances that exceeded mean river P export (white circles), so the proxy estimates of legacy contributions to river export were inconclusive at these locations. (USGS)*

USDA Legacy Phosphorus Assessment Project

The U.S. Department of Agriculture (USDA) **Legacy Phosphorus Assessment Project** leverages the watershed research of USDA's National Resources Conservation Service and Agricultural Research Service ARS to advance the science, innovation, and forecasting of legacy phosphorus mitigation strategies. Focusing on areas within the Snake River, Mississippi River, Lake Erie, Chesapeake Bay and Lake Champlain watersheds, participants in the project coordinate their research to systematically characterize legacy phosphorus in diverse settings across the country. Data from edge-of-field and stream monitoring sites give insight on the nature of phosphorus export through time. The USDA and its partners use this information to carry out watershed modeling in order to extrapolate findings from field research and to assess cost-effective strategies for mitigating legacy phosphorus.

Removing Legacy Phosphorus

Removing legacy phosphorus is key in order to meet water quality goals in many locations. The process can be a challenge, but has been proven effective through the use of **phosphorus removal structures**. Each of these structures contain a type of solid media with high affinity for phosphorus (P), commonly known as a “P sorption material”, which is contained and placed in a hydrologically active area with high dissolved P concentrations. Water containing high concentrations of dissolved P flows through the contained P sorption material at a sufficient rate for P removal. The material then must be removed and replaced once it is no longer effective.

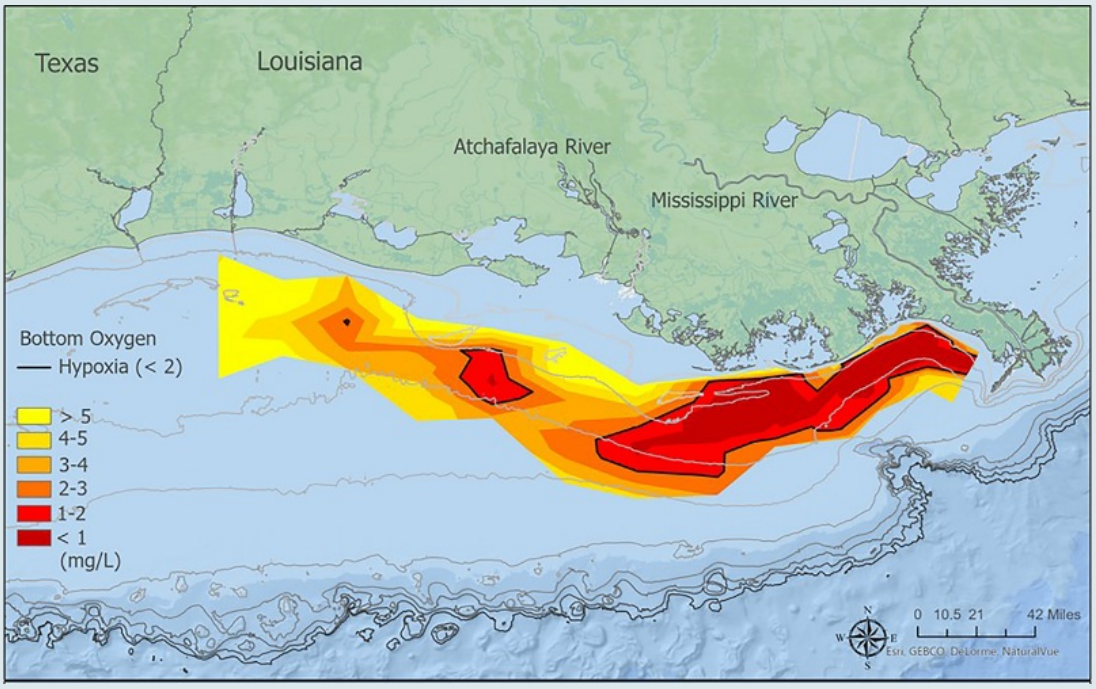


Example of a phosphorus removal structure for surface water. (Chad Penn)

Dr. Chad Penn from the USDA's Agricultural Research Service has done a lot of work designing and testing different types of P removal structures for legacy P soils, and describes the nature of the problem and exactly how these structures work to address it in this **recorded presentation**. Additionally, you can watch the actual installation of a P removal structure and learn more about a easy-to-use tool for non-engineers to design their own site-specific structure in this **6-minute video**.

Nutrient Runoff News

Below-average Gulf of Mexico 'Dead Zone' Measured



Map of measured Gulf hypoxia zone, July 25- August 1, 2022. Red area denotes 2 mg/L of oxygen or lower, the level which is considered hypoxic, at the bottom of the seafloor. (LUMCON/LSU/NOAA)

On August 3rd, NOAA-supported scientists announced that this year's Gulf of Mexico "dead zone"— an area of low to no oxygen that can kill fish and marine life — **is approximately 3,275 square miles**. That's more than 2 million acres of habitat potentially unavailable to fish and bottom species — larger than the land area of Rhode Island and Delaware combined. The five-year average dead zone size (also known as the hypoxic zone) is now 4,280 square miles, which is over two times larger than management targets of 1,900 square miles. Since records began in 1985, the largest hypoxic zone measured was 8,776 square miles in 2017. This year's measurement was made during the annual survey cruise, led by a team of scientists from Louisiana State University and the Louisiana Universities Marine Consortium (LUMCON) aboard the R/V Pelican during the last week of July. The information gathered is a key metric used by the Mississippi River/Gulf of Mexico Watershed Hypoxia Task Force to measure progress toward achieving their five-year average target of 1,900 square miles or smaller by 2035. The cruise provides a one-time snapshot of the dead zone; the five-year average captures the dynamic and changing nature of the zone over time.

In June, NOAA forecasted an average-sized hypoxic zone of 5,364 square miles, based primarily on Mississippi River discharge and nutrient runoff data from the U.S. Geological Survey. The measured size fell within the uncertainty range for the models which factors in some of the inherent environmental variability of the system such as the below average river discharge over the summer. This demonstrates the overall accuracy of the models and their ability to be applied as tools for nutrient reduction strategies.

Is It Time to Rethink How We Regulate Farm Pollution?

That is the question posed by research scientists Donald Boesch and Donald Scavia,scientists who each have spent almost 50 years figuring out what causes dead zones and what it will take to resuscitate them and reduce risks of harmful algal blooms. Focusing on Lake Erie, Chesapeake Bay, and the Gulf of Mexico, Boesch and Scavia describe the history of regulatory attempts: The U.S., Canada, and cities around the Lake Erie started working to reduce pollution in 1972, the federal government and states around Chesapeake Bay agreed in 1987 to cut pollution by 40% by 2000, and in 2001 the federal government and 12 Mississippi River basin states agreed to action aimed at reducing the dead zone in the Gulf of Mexico by two-thirds by 2015. In all of these cases, progress has been slow and goals have not been met. In the authors' point of view, these efforts have fallen short primarily because controls on nutrient pollution from agriculture are not strong enough and therefore ineffective. Studies cited by the authors show that agriculture contributes 85% of Lake Erie's Maumee River phosphorus load, 65% of the Chesapeake Bay's nitrogen load and 73.2% of the nitrogen load and 56% of the phosphorus load to the Gulf of Mexico.

A 2020 harmful algal bloom in Lake Erie turns the water green. (Great Lakes Now)

Given the slow pace of improvement and failure to meet water quality goals, the authors' state that the largely voluntary approaches, with technical assistance and substantial public financing, are not working. Economists have called for a fundamental shift in policies controlling agricultural pollution. Instead of offering polluters

subsidies to clean up their operations, these experts argue, the strategy should be to pay farmers for performance, based on environmental outcomes that can be measured or predicted at appropriate scales and specific places. Under this approach, government would set limits on the amount of nutrients that can be lost to the environment, and farmers would choose how to meet them, based on what kinds of action work best for their specific soils and climate.

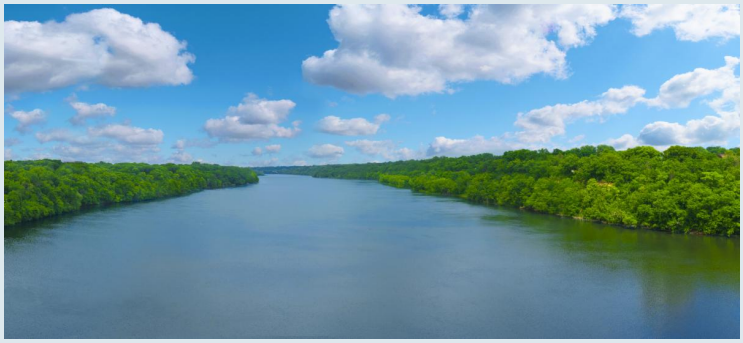
In June 2022, the Government Accountability Office concluded that federal agencies charged with preventing and controlling harmful algal blooms and dead zones under a 1998 law have failed to establish a national program to address these issues. Fifty years after the federal Clean Water Act was enacted, the authors' posit such a program is long overdue.

Phosphorus Reductions Alone May Increase Harmful Algal Bloom Toxicity

Researchers conducting a new modeling study on Lake Erie Harmful Algal Blooms (HABs) found that reducing phosphorus alone, while keeping nitrogen levels the same, **may increase bloom toxicity**. Cyanobacteria, also known as blue-green algae, can undergo intense growth leading to toxin production and depleting lakes of oxygen when they die. Phosphorus is an critical nutrient for these algae, and efforts are underway worldwide to reduce phosphorus levels and inhibit the growth of cyanobacteria. However, as the reduction in phosphorus leads to a reduction in the total number of cyanobacteria, the remaining cyanobacteria have more nitrogen available to them. And higher concentrations of nitrogen help certain strains of cyanobacteria produce a toxin that protects them against damage resulting from oxidation.

“This study supports the idea that phosphorus reduction will successfully reduce the overall abundance of cyanobacteria, consistent with the goals of current policies,” said study co-author Gregory Dick, a professor in the Department of Earth and Environmental Sciences at the University of Michigan and director of the Cooperative Institute for Great Lakes Research in the School for Environment and Sustainability. “However, it also suggests that reducing phosphorus will cause an increase in abundance of the subset of cyanobacteria that are able to produce toxin, resulting in more toxin overall." There has been much debate and ongoing research in the scientific community on the conditions driving toxin production in freshwater lakes, and this publication provides new insight for improving nutrient reduction strategies.

The Inflation Reduction Act in the Mississippi River Basin



On August 16, 2022, the Inflation Reduction Act was signed into law. This legislation provides nearly $370 billion in new spending on climate change and energy security programs over the next 10 years. Added together, these policy and funding initiatives could put the U.S. on track to reduce greenhouse gas emissions by 40% from 2005 levels by 2030. Certain incentives funded by this bill will provide direct and indirect benefits to the Mississippi River Basin, as described in a **recent article from Friends of the Mississippi River (FMR)**.

According to FMR, unmitigated climate change is expected tosupercharge runoff pollution in Minnesota by an additional 24% this century — given that this is just a small part of the full drainage basin for the Mississippi River, the impacts from nutrient runoff from the entire basin could be significant without any action. Fortunately, the bill includes over $21 billion for climate-friendly agriculture, United States Department of Agriculture conservation programs, and conservation technical assistance. Specifics of the bill include $11.7 billion for climate-friendly farmland conservation, $6.75 billion for the Regional Conservation Partnership Program, $1.4 billion for the Agricultural Conservation Easement Program, and $1 billion for Conservation Technical Assistance. These measures will not only help address greenhouse gas emissions from the farm sector but will do so in a way that helps improve water quality, soil health and habitat in the Mississippi River Basin.

Pennsylvania Passes Laws Targeting Nutrient Runoff

Recent legislation in Pennsylvania**provides new tools to farmers** in order to control nutrient runoff. On July, 8th, Governor Tom Wolf signed the state budget, which creates a

$220 million Clean Streams Fund, of which, $154 million will go toward supporting the new Agricultural Conservation and Assistance Program. As a follow-up Gov. Wolf signed another bill tightening rules for nonagricultural users applying fertilizer. This bill lowers the limit for nitrogen to the same level set by Maryland and Virginia. As well, the program will give Pennsylvania a grant funding source for the support of riparian buffers, stream fencing, and other nutrient runoff controls.

The journey for both bills was long and convoluted, with the fertilizer bill having been around for at least 12 years and passing multiple senate votes before finally becoming law. One of the reasons cited for the bills ultimate passage was that the funds will be available to the entire state and not just the parts in the Chesapeake Bay watershed - this means that the Mississippi River Basin will more funding for conservations efforts addressing nutrient runoff.

Funding Opportunities

NOAA Funding - Actionable Science- Application due November 15, 2022

Jobs, Fellowships, and Graduate Assistantships

EPA Water Quality Criteria Implementation Support Fellowship - Application deadline November 7, 2022

EPA Water Quality Restoration and Safe Drinking Water Program Research Opportunity- Application deadline October 18, 2022

Graduate Assistantship – Water Quality/Aquatic Microbiology: Syracuse, NY - Application deadline October 21, 2022

EPA Postdoctoral Fellowship for Developing Isotopic Indicators to Assess Wetlands as Nitrogen Processing Hotspots - Application deadline November 14, 2022

Upcoming Meetings and Events

Gulf of Mexico Climate and Resilience Community of Practice Annual Meeting- October 4-6, 2022, in Sarasota, FL

Webinar - Remote Sensing and Strategic Management of CyanoHABs Across the Nation- October 5, 2022, 11:00 AM CDT

11th U.S. Symposium on Harmful Algae - October 23-28, 2022, in Albany, NY

The Watershed Game Local Leader Training- November 7th and 8th from 12-4 PM CST, Virtual

2022 Coastal and Estuarine Summit - December 4-8, 2022, in New Orleans, LA

Bays and Bayous Symposium - January 23-25, 2023, in Mobile, AL

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 - September 2022

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