Restoring Mississippi River Basin Health with Floodplains

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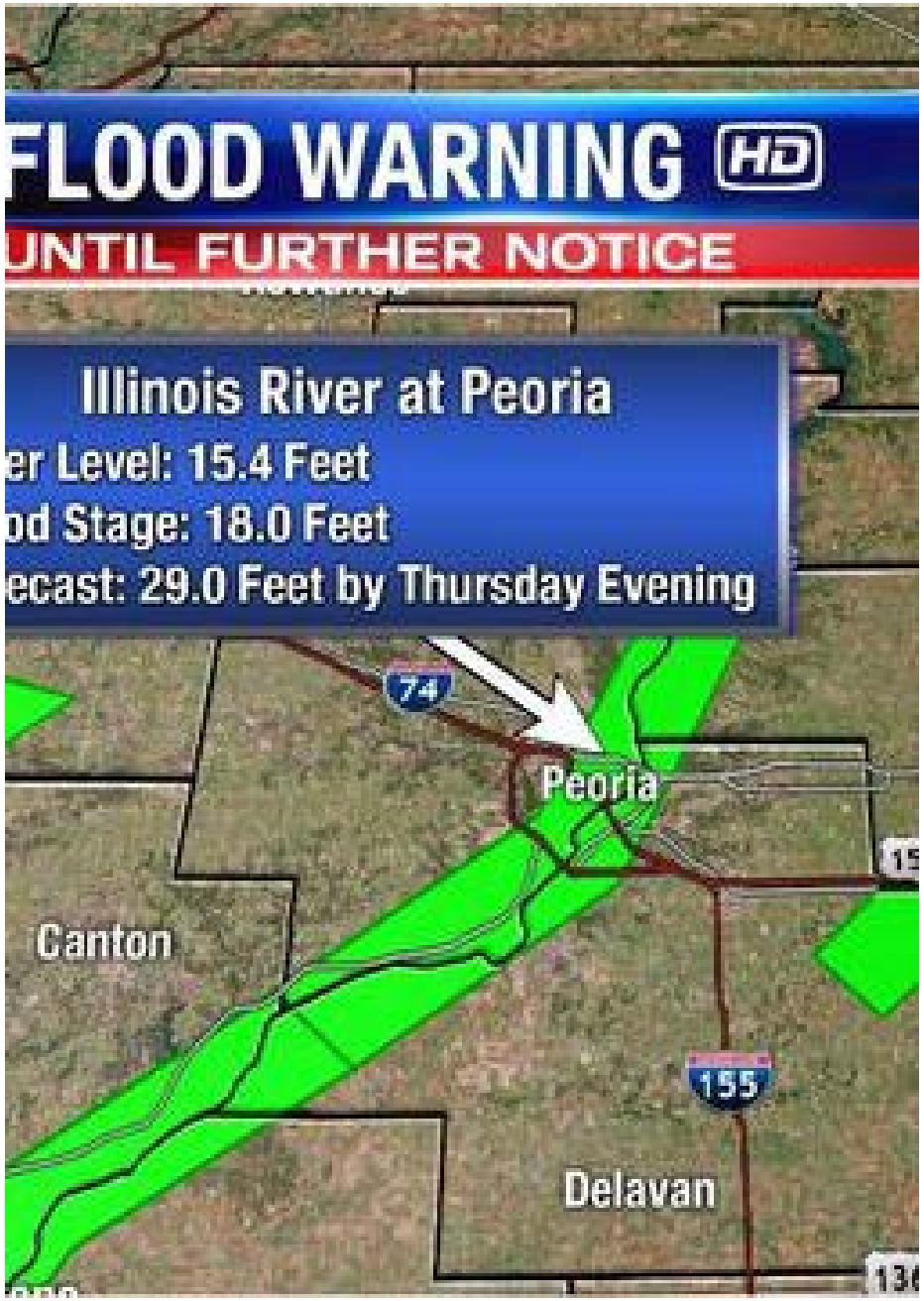
Ouachita River, LA

Floodplains


SCHOOL BUS
SCHOOL BUS


FLOOD WARNING HD
UNTIL FURTHER NOTICE
Illinois River at Peoria
er Level: 15.4 Feet
od Stage: 18.0 Feet
ecast: 29.0 Feet by Thursday Evening
74
Peoria
Canton
155
Delavan

The Des Moines Register

WEDNESDAY, MARCH 11, 2015 | THE NEWS IOWA DEPENDS UPON | DESMOINESREGISTER.COM | METRO EDITION A GANNETT COMPANY

SCHOOL START DATE DEBATE

Year-round schools fear loss of programs

Alternative scheduling proponents say stricter state rules jeopardize their functioning timetables

By Mackenzie Ryan
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When Susan and Nick Bruck moved to Indianola, they chose to enroll their children in Irving Elementary, which operates on a year-round calendar, instead of their neighborhood school.

Private tutors told the Brucks that Irving, with its shorter summer breaks, would provide a better education for their daughter Devon, who is dyslexic.

"She needs the constant learning experience," Susan Bruck said. "When she's off in the summertime, she's that much further behind than when they started back up."

Only a handful of Iowa schools operate on a year-round calendar. Although they have a similar number of class days as schools on traditional calendars, they have shorter summer vacations and more frequent breaks during the school year. And typically, classes start

See SCHOOL, Page 11A

IOWA SENATE OKS LOCAL CONTROL FOR SCHOOL CALENDARS

The bill goes to the Iowa House, which is sticking with Aug. 23 as a compromise school starting date.
Page 11A

FEDERAL LAWSUIT

WATER WORKS VOTES TO SUE 3 COUNTIES

FARM RUNOFF FOULING IOWA RIVERS, UTILITY SAYS

By Timothy Meinch
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Des Moines Water Works will file a federal suit against three rural counties in northwest Iowa, an action that could trigger far-reaching effects on how states approach water quality regulation.

The action follows a 60-day warning that sparked little promise for solving water quality concerns at Water Works, according to utility trustees. The board voted unanimously during a special meeting Tuesday to file a lawsuit against drainage districts in Buena Vista, Calhoun and Sac counties.

Graham Gillette

Graham Gillette, chairman of the board of trustees, said since January the public utility hit a wall with local and state leaders, including Gov. Terry Branstad and Secretary of Agriculture Bill Northey.

"Not one responded in any substantive way to the claims we have made in the intent to sue," Gillette said. "Frankly, they did not acknowledge the significant threats faced by those we serve."

Water Works officials

TILES ON TRIAL

Des Moines Water Works claims drainage tiles in farm fields from northwest Iowa are contributing to high nitrate levels in central Iowa. The utility claims that water, nitrogen and other nutrients that enter intakes like this are eventually carried underground by drainage lines to streams and rivers that feed the Des Moines and Raccoon rivers, the source of water for 500,000 central Iowa customers.

RODNEY WHITE/REGISTER PHOTOS
A tile collects water from a field at Dwight Dial's Calhoun County farm near Lake City, Ia. Calhoun is one of three counties that Des Moines Water Works will sue.

Farmers: We feel unfairly targeted

Some frustrated producers threaten to boycott Des Moines

By Donnelle Eller
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LAKE CITY, Ia. — With decades of conservation farming under his belt, Dwight Dial has a hard time understanding why Des Moines Water Works is so intent on suing three northwest Iowa counties for contributing to high nitrates in the Raccoon River, a source of drinking water for roughly 500,000 residents in central Iowa.

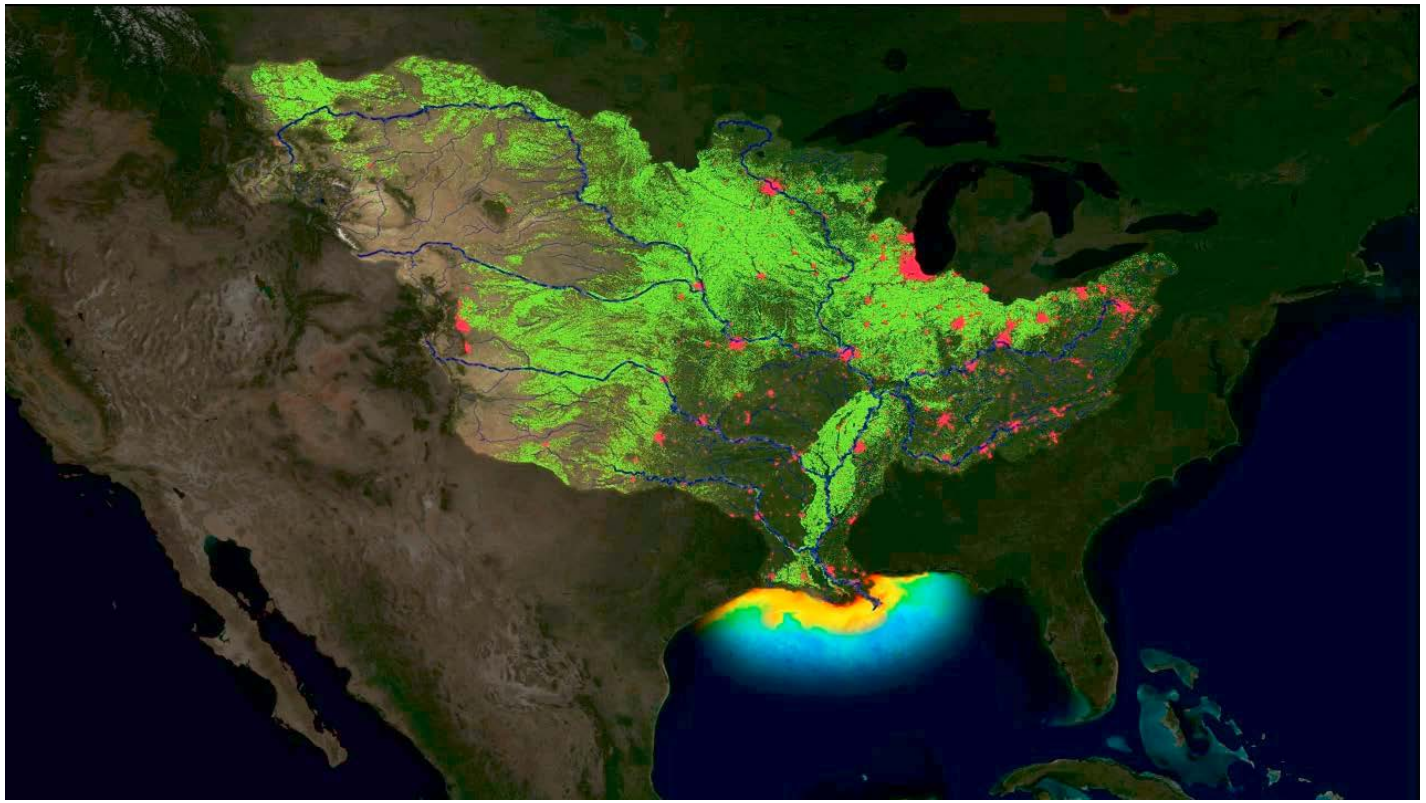
"We're not deliberately dumping our nitrogen into the Raccoon or Des Moines river systems," said Dial, who raises corn, soybeans and pigs near Lake City in Calhoun County, a target of the Des Moines lawsuit along with Sac and Buena Vista counties.

"We're doing everything we can to retain nutrients in the field for our plants. ... But we can't control Mother Nature."

Officials with the Des Moines utility say Water Works has fought too long with high nitrate levels and can no longer afford to wait for farmers to ramp up conservation efforts to help improve water quality.

The utility's board agreed Tuesday to pursue a suit against drainage districts in Calhoun, Sac and Buena Vista counties.

Dial, like other farmers and rural Iowans, is frus-



Benefits of Floodplains and other Wetlands

- **Nutrient Removal**
  - **40% N and P reduction** on average (range 10% - 90%)
  - Up to **5X** land-based nitrate mitigation BMPs
- **Flood risk mitigation**
- **Biodiversity hotspots**

nature geoscience

ARTICLES

https://doi.org/10.1038/s41561-017-0056-6

Contribution of wetlands to nitrate removal at the watershed scale

Amy T. Hansen[1,2*], Christine L. Dolph[2], Efi Foufoula-Georgiou[1,3] and Jacques C. Finlay[1,2]

Intensively managed row crop agriculture has fundamentally changed Earth surface processes within the Mississippi River basin through large-scale alterations of land cover, hydrology and reactive nitrogen availability. These changes have created leaky landscapes where excess agriculturally derived nitrate degrades riverine water quality at local, regional and continental scales. Individually, wetlands are known to remove nitrate but the conditions under which multiple wetlands meaningfully reduce riverine nitrate concentration have not been established. Only one region of the Mississippi River basin—the 44,000 km² Minnesota River basin—still contains enough wetland cover within its intensively agriculturally managed watersheds to empirically address this question. Here we combine high-resolution land cover data for the Minnesota River basin with spatially extensive repeat water sampling data. By clearly isolating the effect of wetlands from crop cover, we show that, under moderate–high streamflow, wetlands are five times more efficient per unit area at reducing riverine nitrate concentration than the most effective land-based nitrogen mitigation strategies, which include cover crops and land retirement. Our results suggest that wetland restorations that account for the effects of spatial position in stream networks could provide a much greater benefit to water quality then previously assumed.

Large-scale changes in land use and land cover and human amplification of the availability of fixed nitrogen have fundamentally changed nitrogen processing within the agriculturally dominated Mississippi River basin[1]. High fertilizer use on corn crops and in soybean production have increased nitrate inputs while hydraulic modifications to the landscape, such as subsurface drainage systems and the reduction of wetland cover, have reduced the nitrate removal capacity of the landscape. Both of these changes have been dramatic—nitrogen fertilizer inputs tripled between 1950 and 2000 and 60–90% of historic wetlands in the region have been drained since European settlement[2,3]. Elevated levels of nitrate in streams and rivers have serious human and environmental consequences, including degraded regional drinking water, harmful algal blooms and the formation of hypoxic zones[4,5]. In response to annually occurring hypoxia in the northern Gulf of Mexico, multiple states in the Mississippi River Basin have committed to reducing their nitrate exports by 40% or more; however, a recent meta-analysis of field-based nitrogen management strategies concluded this is not possible without removing large areas of land from agricultural production[6,7].

Mass balance studies across individual wetlands consistently show that wetlands remove nitrate[8,9]. In contrast, empirical studies at the watershed scale have found little to no influence of wetland cover on riverine nitrate[10,11]. The lack of response at the watershed scale could be due to interactions between terrestrial land cover and the wetland complex that mask the effect of a single land-cover variable[12], the large variability in the capacity of individual wetlands to

comparative accounting of the water quality benefits and trade-offs of wetland protection and restoration relative to other management options in agricultural landscapes is not possible.

In this study, we investigated the interactive influences of multiple wetlands on riverine nitrate by isolating the effect of wetlands, crop cover and flow conditions. This was accomplished by land-use analysis and simultaneous observations of water chemistry for over 200 watersheds ranging in size from 1 to 6,000 km² and containing up to 2,000 wetlands. All observations occurred within a prototypical high-intensity agricultural basin, the Minnesota River Basin (MRB). The MRB is a 44,000 km² sub-basin of the Mississippi River Basin and, like much of the Midwestern USA, is heavily cultivated for corn and soybean production (Fig. 1a). Unlike the rest of the agricultural Midwest, however, the MRB retains a wide range in remnant wetland and shallow lake cover (Fig. 1b), providing an ideal natural laboratory for systematic and multidimensional examination of wetland effects on nitrate across a range of spatial scales. Riverine water samples were collected at an average of 53 locations per sample event (>200 sites in total) over 4 years and 7 sample events that spanned a wide range of seasonal and streamflow conditions (Fig. 1). For the drainage basin of each sampling site, we used 0.5-m-resolution land-use and wetland classification data to determine the extent of crop production, drainage area and wetland coverage, type and configuration as described more fully in the Methods. Wetland types included both permanent and ephemeral wetlands, isolated and flow-through wetlands, which could be vegetated marshes, lakes (primarily shallow) and riparian flood-

Mollicy Farms

Ouachita River, Louisiana

- **Purchased and restored 16,000 acres**
  - **3-million** trees planted
  - Ouachita River reconnected
  - Historic bayous restored
  - Final footprint **75,600 acres**

- **Flood risk mitigation**
  - Lowered record flood stage in Ouachita River by **1-foot**.

- **Nutrient Removal**
  - Removing **48.1 MT** of nitrogen from the MRB each year.

Mollicy Farms, Ouachita River

Atchafalaya River Basin

A critical wetland landscape with global significance

- Largest contiguous tract of forested wetlands in the US
- Habitat for more than 300 resident and migratory wildlife species and more than 100 species of fish.
- Flood protection for millions of US citizens.
- Supports the culture and livelihoods of Louisiana residents – e.g. largest wild crawfishery in US.
- Important nutrient bio-reactor

The Need for Restoration

- **Altered Hydrology** - The plumbing in the Basin is broken

- **Poor water quality** – "Dead Zones"
  - Reduced forest health
  - Repeated fish kills
  - Reduced crawfish populations

- **Reduced ability** to remove nutrients.

Atchafalaya River Basin Initiative

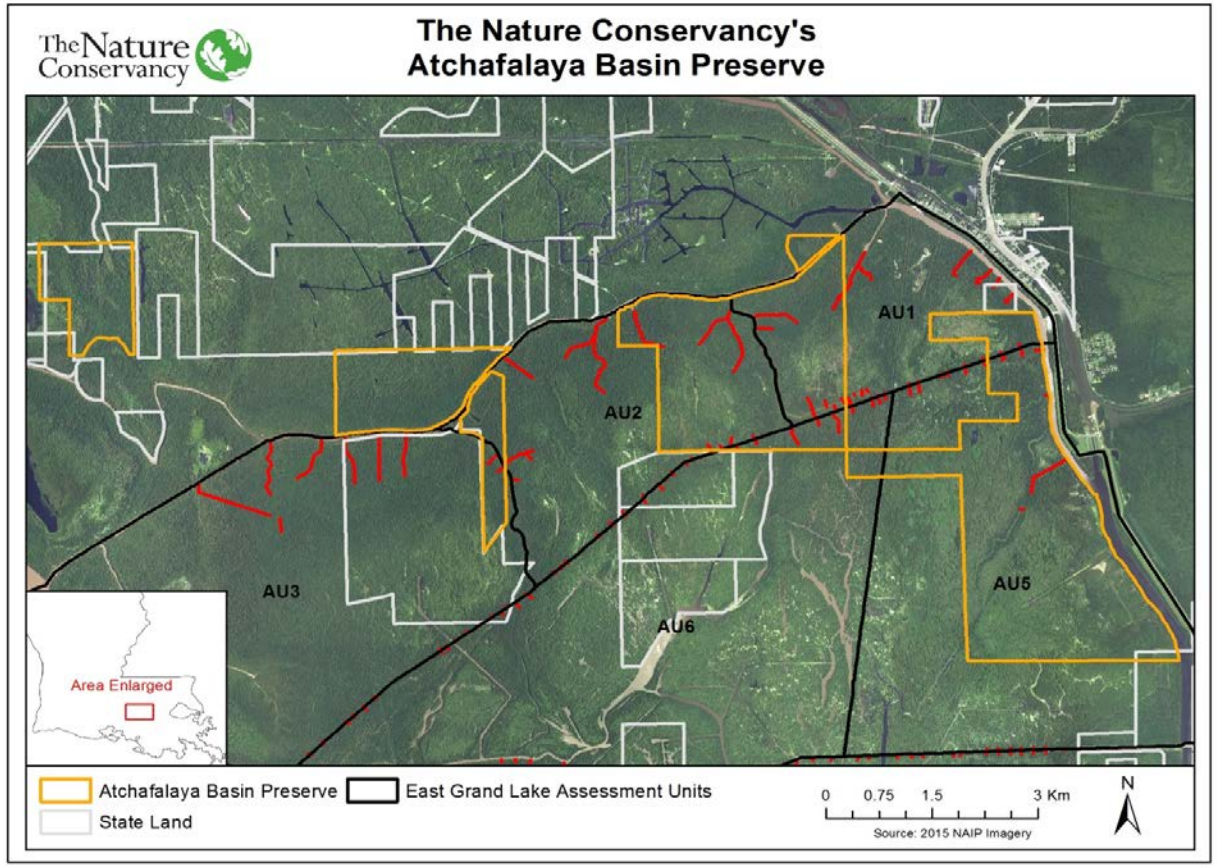
TNC's long-term vision to conserve and restore America's great swamp forest

1. Restoration
2. Science
3. Community

Atchafalaya Basin Preserve

The Foundation

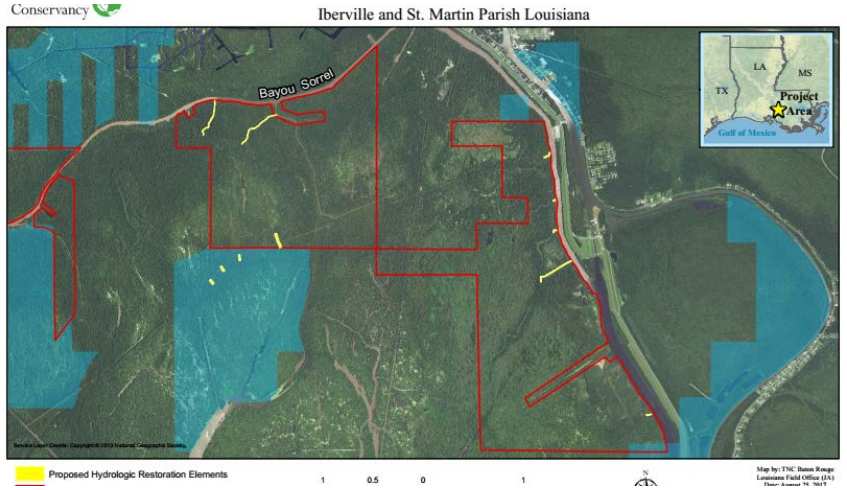
- Five tracts - 5,359 acres.
- Embedded within a matrix of state-owned lands.
- Key tracts that contains several state-approved restoration landmarks.



Restoration

Improved Connectivity

- Reinstitute north-south flow pattern through the swamp.
  - Create a more natural flood/drain cycle
  - Improve water quality
  - Improve forest health – cypress regeneration
  - Improve habitat for fish and wildlife
- First restoration project – 5,000 acres.



Science

Documenting ecosystem response with replicable protocols.

- **Monitoring**
  - TNC – hydrology and water quality

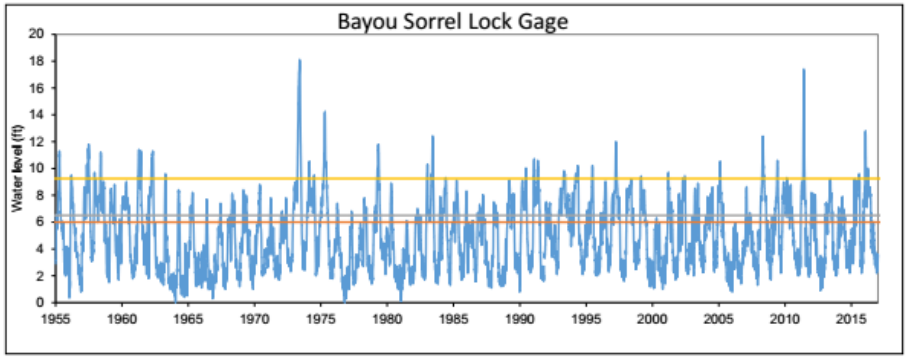
- **Applied Research** - TNC Conservation Fellows Program

  - Nutrient cycling and removal
  - Geomorphology
  - Forest health
  - Crawfish stocks

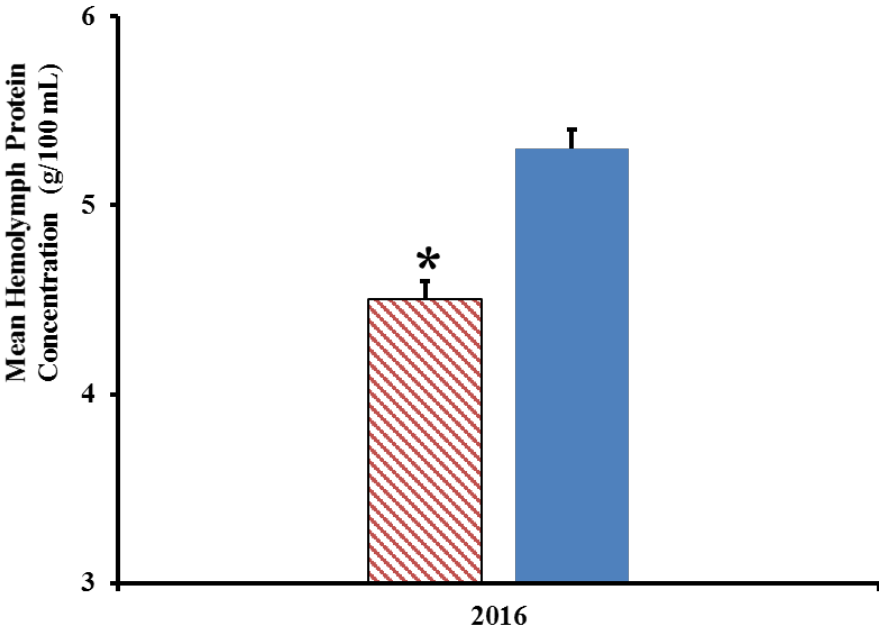
Science

Improved Connectivity

- **Increased floodplain connection.**
  - Pre-restoration ~20 days
  - Post-restoration ~100 days.
- **Improved water quality.**
  - When the floodplain is disconnected, the swamp is hypoxic over 99% of time.
- **Improved fisheries.**
  - Hypoxia reduces crawfish growth by half
- **Improved nutrient removal.**
  - ARB not living up to its true nitrogen removing potential.
    - Removing 14% total nitrogen



Crawfish growth rates in relation to dissolved oxygen



Science
Nitrate Reduction

- Floodplain areas connected to river are currently removing **58.6 mg N $m^{-2}d^{-1}$**
- We expect to remove **107 MT of N** for ~ 5,000 acres over 3-month flooding period
    - **52,655 bags** of fertilizer

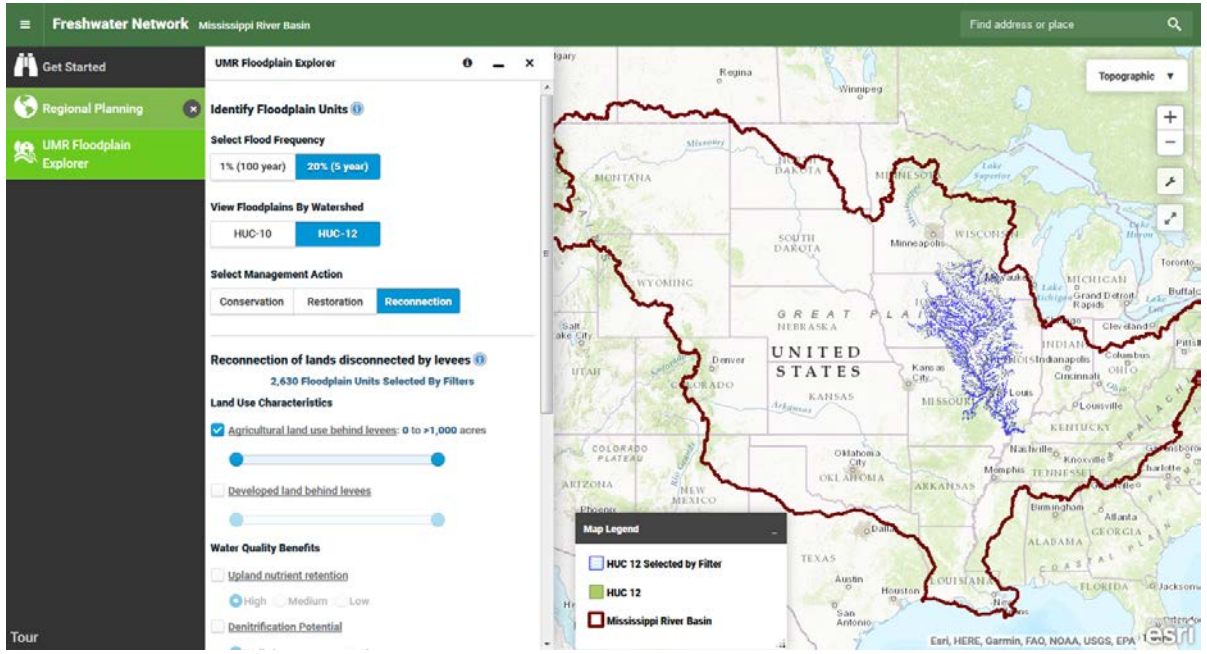
Community
Creating a Restoration Culture

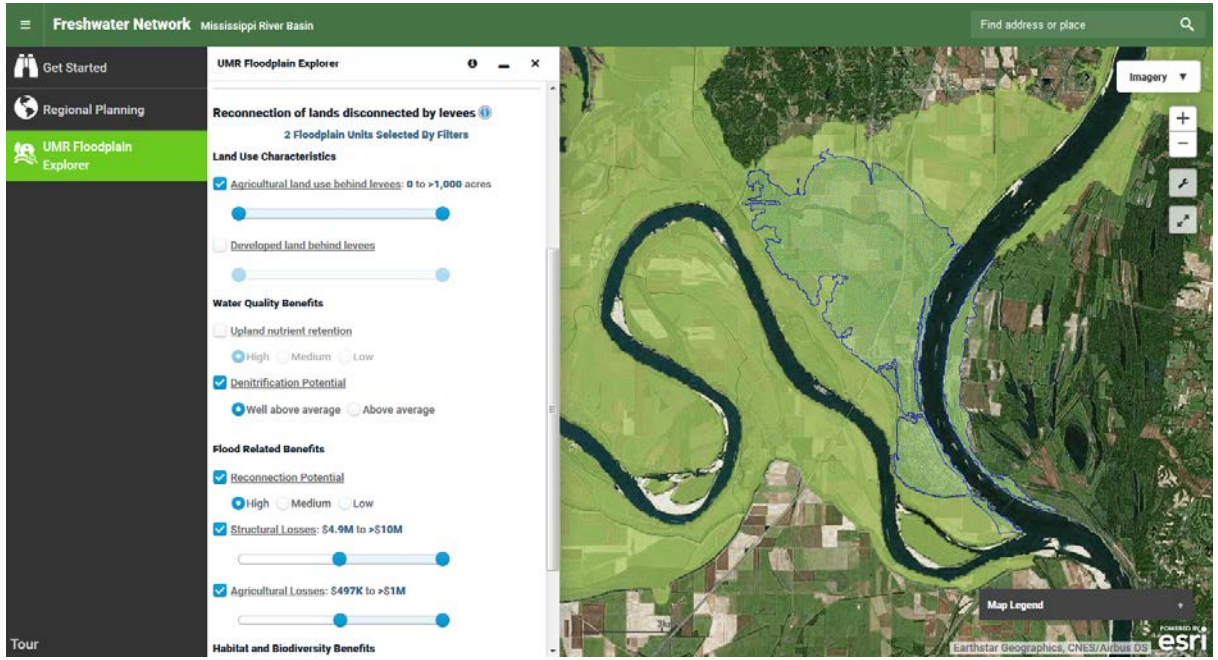
- **The Atchafalaya Conservation Center**
  - Nucleus for research and community and stakeholder engagement.
- **Water Quality Markets**
  - Potential incentive for private landowners.
- Our goal is to expand restoration to **more than 100,000 acres** of the Atchafalaya Basin.

Floodplain Conservation in the Mississippi River Basin

Scaling Up

- **Targeting and Prioritizing**
  - Where and how much?
- **Conservation Delivery**
  - Innovative public/private partnerships for conservation.
  - Protect floodplains at a scale that matters.
- **Monitoring**
  - Understanding and documenting return on investment.





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www.nature.org/Louisiana

The Nature Conservancy
Protecting nature. Preserving life.