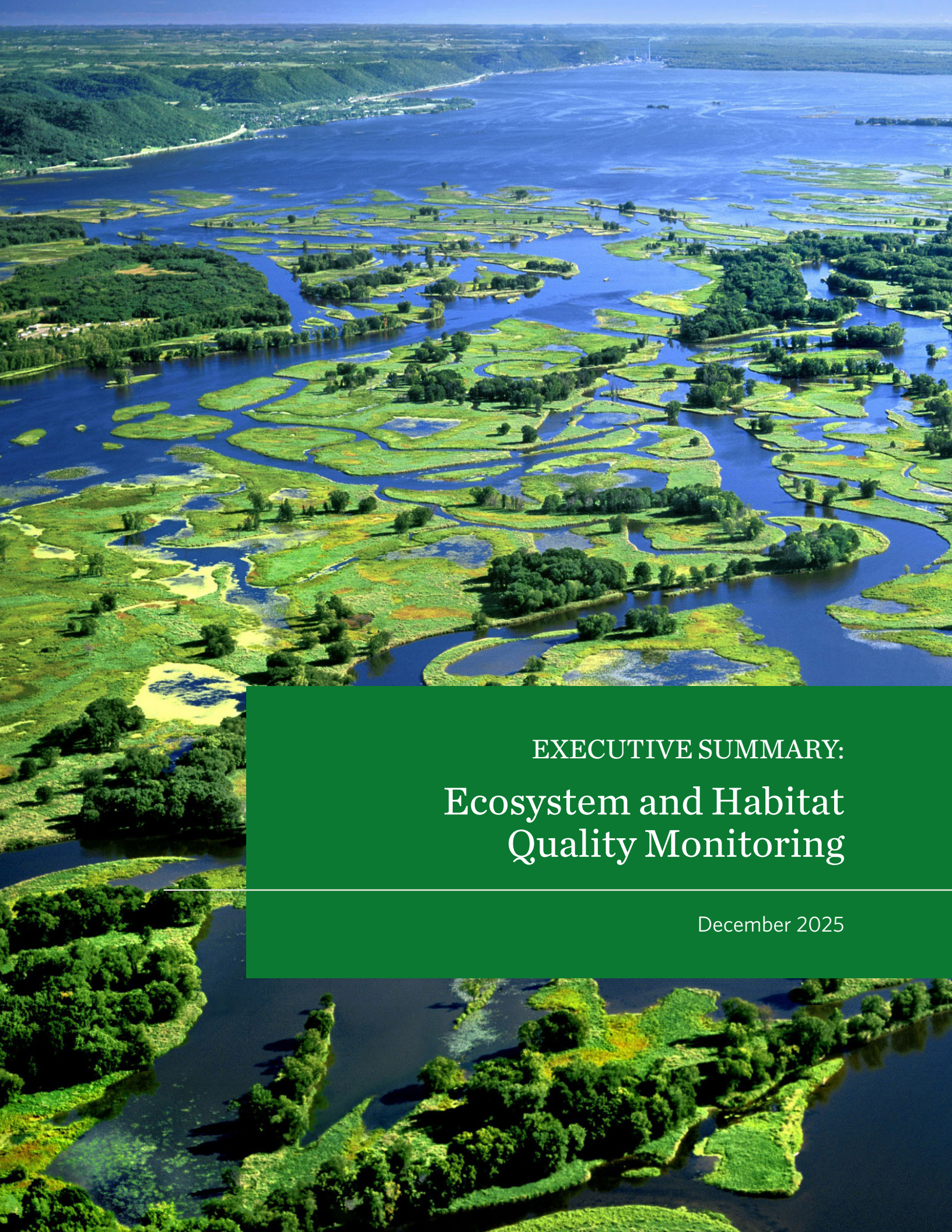

EXECUTIVE SUMMARY:

Ecosystem and Habitat Quality Monitoring

December 2025

Context

Building on the work completed and published in 2023, The Nature Conservancy sponsored a second team of scientists and technical experts to identify criteria for monitoring ecosystem and habitat quality along the Mississippi River and its tributaries, spanning an even greater geographic area within the watershed.

Additional Challenges

Seasonal periods of high and low flow are normal and are good for ecosystems, yet increased frequency and intensity of extreme flooding and drought events in the upper and lower Mississippi River basins are negatively impacting the health and resilience of ecosystems, leading to reductions in biodiversity and ecosystem services. Damage to ecosystems leads to other risks such as fragmented habitats and pollution.

Human activities such as constructing levees, navigation channels, locks and dams, and diversions alter natural floodplain function. Historical clearcutting of mature forest stands for agriculture, an expanding human footprint and changes in land use fragment natural habitat and degrade the natural ability of historic floodplains to mitigate the effects of extreme flooding and drought, clean the water and provide habitat for fish and wildlife.

Federal, regional and state monitoring agencies conduct varying degrees of ecosystem and habitat monitoring. While monitoring is being done, the system is piecemeal, with substantial investment and robust systems in some areas (e.g., the Long-Term Resource Monitoring System element of the Upper Mississippi River Restoration Program and the Environmental Protection Agency's National Aquatic Resource Surveys) and substandard investment and systems in other areas (e.g., lower Mississippi River). There is no cooperative management body that sets and uses a common set of indicators for monitoring fisheries.

Without equal investment and systemwide integration and expansion to consider new threats, critical information will not be available to protect communities, clean the water and restore critical habitats.

System Design for Monitoring Ecosystem and Habitat Health

The sheer scope and scale of monitoring ecosystems and habitat across the watershed will likely require significant investments in monitoring technology, coordination and capacity over time. To provide consistent and comprehensive data that federal, regional and state monitoring agencies, communities and government decision-makers can use requires an integrated systems-wide approach. Toward that end, the Technical Design Group identified a set of primary interests, priority stressors and indicators to guide the design of monitoring ecosystem and habitat health at scale.

Primary Interests:

1. Habitat connectivity: How and to what degree distinct areas of habitat are connected, which can influence the distribution, genetic diversity and health of aquatic, terrestrial and avian plant and animal species.
2. In-stream flows: The amount of water needed in a stream or river to adequately provide for aquatic habitat, riparian vegetation, water quality and healthy wetlands, in addition to human uses such as navigation, recreation and hydropower.
3. Diversity, abundance and distribution of habitat types: A measure of the array of different habitats in a particular ecosystem, with multiple habitats having distinctive physical attributes, functions and species. The number of habitat types, and their condition, within an ecosystem.
4. Species abundance and distribution: The number and distribution of species within a habitat, including species of special conservation concern.

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Priority Stressors & Indicators

Priority Stressors	Indicators
Longitudinal & lateral connectivity	• Linear distance of streams protected by riparian vegetation · Presence of floodplain habitat · Obstructions to flow within floodplain (e.g., Hatchie-Loosahatchie feasibility study)
Altered hydrograph & water quantity	• Decreased base flow to streams · Flashiness of flow · Increased discharge · Changes in frequency, direction, timing, magnitude of inundation of floodplain
Altered sediment regime & sedimentation	• Changes in frequency, direction, timing, magnitude of inundation of floodplain · Changes in bathymetry · Extreme changes (loss and accumulation) in sedimentation in stream and river channels
Water pollution & contaminants	• Nutrient (N and P) concentration and loading • Number and type of agriculture conservation practices · Dissolved oxygen concentration
Groundwater recharge	• Change in key hydrologic metrics · Groundwater reduction · Change in base flow
Invasive species (animals)	• Distribution and abundance of invasive animal species
Abundance of wetlands/floodplains/riparian vegetation	• Distribution and abundance of each (wetlands, floodplains, and riparian vegetation)

Given it is not feasible with existing capacity to monitor all of the indicators for each of these seven priority stressors, the Technical Design Team suggests anchoring habitat and ecosystem monitoring on two: longitudinal and lateral connectivity and abundance of wetlands/floodplains/riparian vegetation. Additionally, the Technical Design Team recommends monitoring a set of indicators with remote-sensing methodologies so that data collection can commence quickly across the entire watershed.

While we have made great progress in defining an ecosystem and habitat monitoring approach, further research and testing are needed to definitively determine what capacity and gaps exist in monitoring across the watershed and to propose the best methodologies for comprehensive ecosystem and habitat monitoring.

Recommendations

1. Champion and fund congressional and America's Watershed Initiative efforts to create shared management goals for the watershed.
2. Build and implement greater, shared monitoring capacity across the watershed. Ensure continued funding of federal and regional monitoring programs and launch regional monitoring programs in the Lower Mississippi River Basin.
3. Fund and complete an assessment of existing monitoring programs throughout the watershed.
4. Fund work to identify a consistent set of monitoring parameters for the watershed.
5. Better define habitat types and associated species in the Mississippi River watershed.
6. Test remote sensing at two sites in different habitat types.
7. Implement a collective data management system and expand user access through a unified interface.

Technical Experts

Partner Organizations

- The Nature Conservancy
- America's Watershed Initiative
- Upper Mississippi River Basin Association
- Upper Mississippi River Conservation Committee
- Lower Mississippi River Conservation Committee
- Environmental Defense Fund
- Mississippi Interstate Cooperative Resource Association
- Ohio River Basin Alliance
- Ohio River Valley Water Sanitation Commission
- Tulane University

Technical Experts

- U.S. Environmental Protection Agency
- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- U.S. Army Engineer Research and Development Center
- Louisiana Department of Wildlife and Fisheries

The Nature Conservancy

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