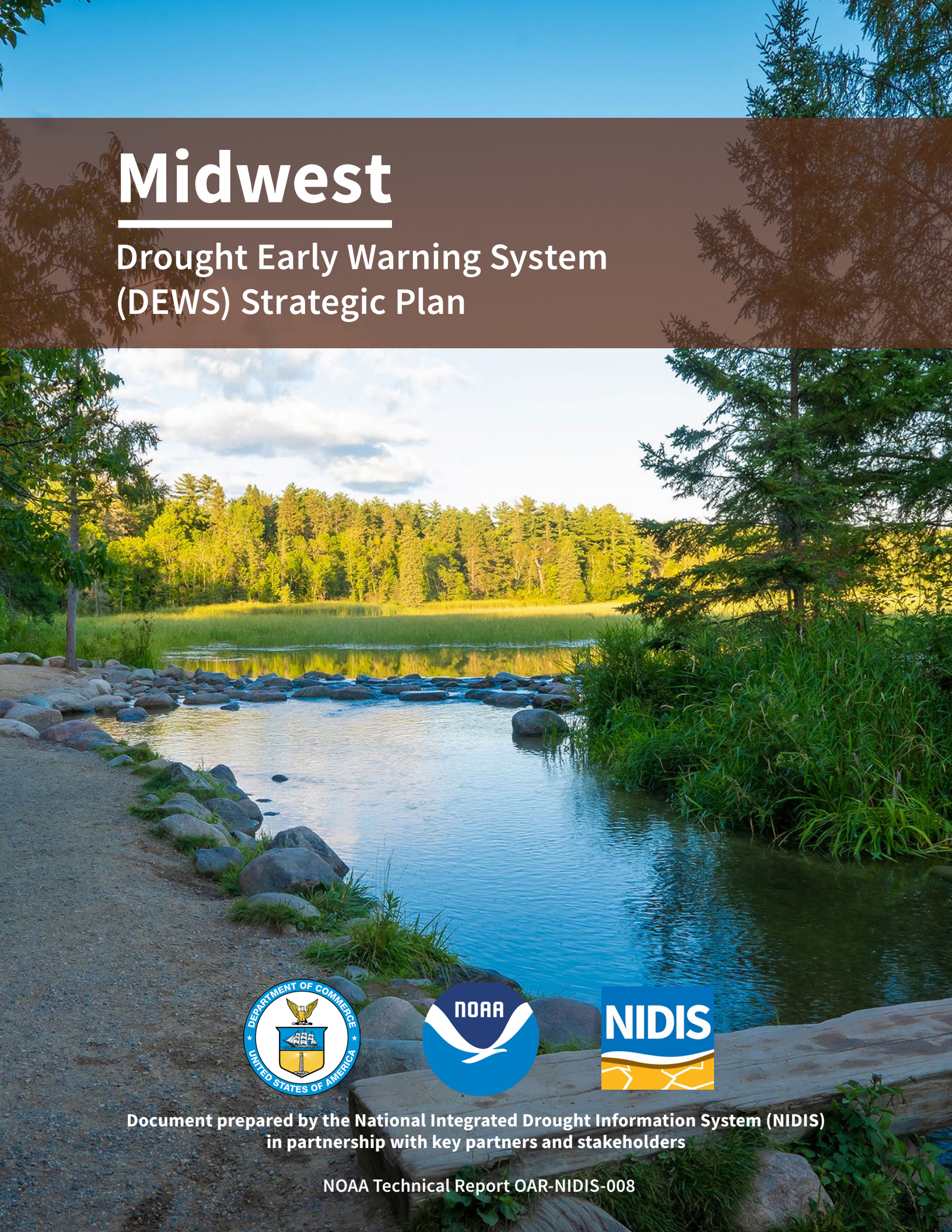
Midwest

Drought Early Warning System (DEWS) Strategic Plan



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NOAA Technical Report OAR-NIDIS-008

Midwest Drought Early Warning System (DEWS) Strategic Plan

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Cover and back photo: Gravel walkway along the Mississippi River at its source, where the water flows out of Lake Itasca in Minnesota. Photo credit: scandamerican/Adobe Stock.

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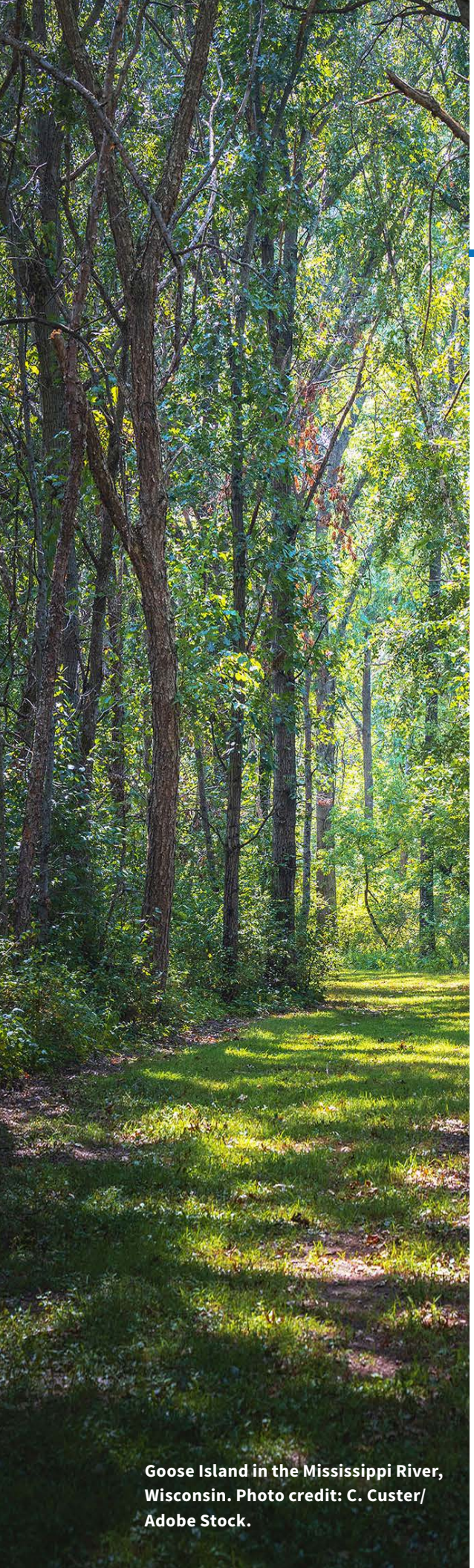

Goose Island in the Mississippi River, Wisconsin. Photo credit: C. Custer/ Adobe Stock.

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Viking Mississippi river boat docked on sand bank due to low water levels in the river at Vicksburg, MS. Photo credit: steheap/Adobe Stock.

Introduction

DROUGHT IN THE MIDWEST

Over the past 70 years, the Midwest has become wetter overall while facing greater swings between extremes. Although annual precipitation and median wetness have increased, "weather whiplash"—rapid shifts between flood and drought—are becoming more common, with the Lower Midwest experiencing faster and more frequent wet-to-dry transitions (Ford et al., 2021).

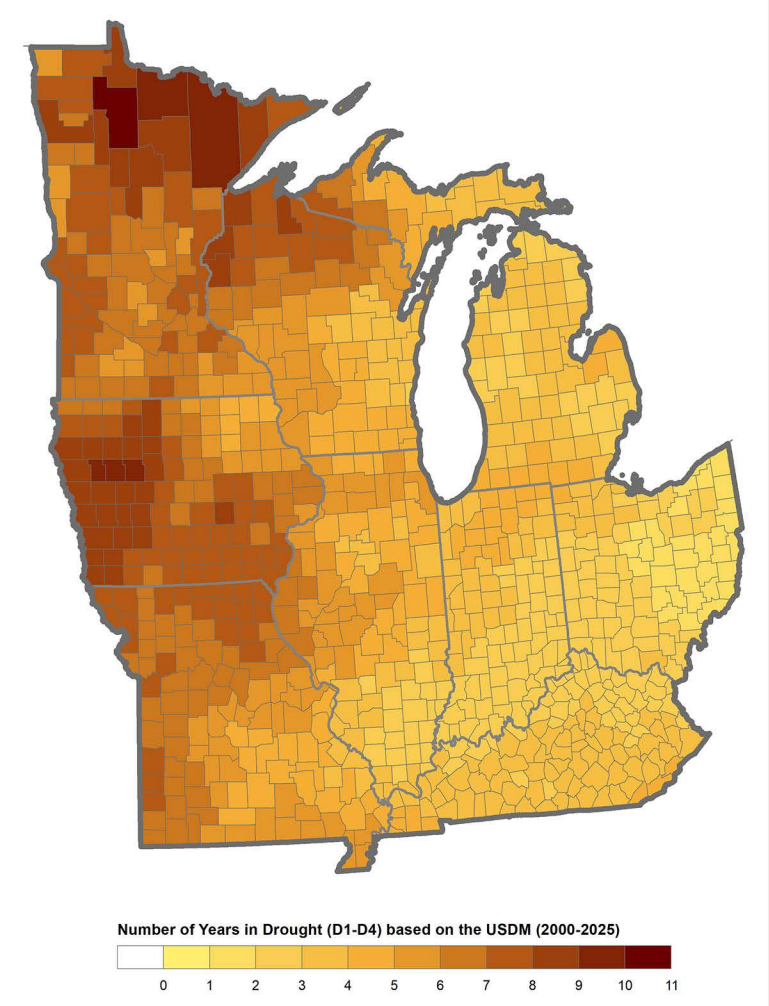
Drought characteristics vary across the region: the Northern and Central Great Plains (including western portions of Iowa, Missouri, and Minnesota) tend to experience persistent, long-term droughts (often 12+ months), while the Great Lakes and Ohio Valley see more frequent but shorter-lived events driven by seasonal variability. Flash drought—rapid onset or intensification of drought due to precipitation deficits and high temperatures that increase evaporative demand—has also become more common, leaving farmers or water managers little time to prepare (Hoell et al., 2021).

Since 2000, Midwest states have experienced four billion-dollar drought and heat wave events, including the 2012 Central U.S. drought—the most extensive drought since the 1930s—which caused $41.7 billion in damages[1] and an estimated 123 deaths (NOAA/NCEI, 2025). In 2023, Moderate to Exceptional Drought (D1–D4, based on the U.S. Drought Monitor) affected much of the region,

1 These estimates are primarily based on agricultural losses.

impacting agriculture, livestock, ecosystems, fire activity, and Mississippi River levels, with losses totaling $14.8 billion.

While widespread drought events often receive the most news coverage, the Midwest also experiences more frequent, smaller-scale drought events. The **2018 flash drought in Missouri** resulted in localized impacts to both agriculture and public water supplies (Missouri Department of Natural Resources, 2018). Minnesota's 2021 drought—its worst since 1988—caused major agricultural losses, low lake levels, and increased fire risk. In 2024, Ohio experienced its **most intense drought in 25 years**, reaching an unprecedented Exceptional Drought (D4) level on the U.S. Drought Monitor that impacted agriculture, livestock production, water resources, ecosystems, and local communities (State Climate Office of Ohio, 2025).



A county-level map of the Midwest DEWS region illustrating the number of years spent in Moderate to Exceptional Drought (D1-D4) from 2000 to 2025 based on the U.S. Drought Monitor.

The Midwest is a cornerstone of the U.S. economy—supporting agriculture, manufacturing, energy, and tourism—and droughts in the region have wide-ranging impacts on water quantity and quality, public health, the environment, infrastructure, and economic stability (Midwestern Governors Association, n.d.). The Mississippi River system, which depends on flows from almost all Midwest Drought Early Warning System (DEWS) states, carries about 48% of U.S. corn and soybean exports. Drought across the Mississippi River Basin can **lower river levels**, restricting tourism and navigation and reducing the movement of goods, which can have significant, global economic consequences.

Emerging Issues Leading to Monitoring and Management Challenges

In recent years, Midwest DEWS partners have discussed emerging drought-related issues that have led to monitoring and management challenges. In addition to the "weather whiplash" phenomenon and flash droughts, other emerging issues include:

The Hidden Deficit. Longer-term precipitation deficits have accumulated over the Midwest since 2020 or 2021, leading to persistent hydrological impacts such as low groundwater and streamflow, depleted subsoil moisture, and low reservoir levels. Entering each warm season with these moisture deficits increases vulnerability to rapid-onset drought. Limited rainfall and high temperatures can quickly deplete available surface moisture, forcing greater reliance on deeper soil moisture and groundwater reserves that may already be diminished. A key challenge for Midwest DEWS partners is assessing and communicating drought when short-term conditions differ from longer-term trends, and when conditions are rapidly deteriorating.

Recurring Seasonal Drought. Because of the "weather whiplash" phenomenon, many areas experience drought in the summer and fall months with some recovery in the winter and spring, but drought emerges again the following summer. For agricultural producers, back-to-back summer droughts—even with some recovery in between—can feel like a multi-year drought because water availability has not fully recovered (e.g., soil moisture and groundwater depletion).

Runoff vs. Recharge. The Midwest is seeing more intense rainfall events (Baule et al., 2022). High-intensity events (i.e., high rainfall totals within a short time window) increase runoff at the expense of recharge to soil or groundwater, thus reducing moisture available for ecosystems and stream baseflow. This increase in intensity limits how effectively precipitation relieves drought and heightens economic and environmental impacts. Drought monitoring and assessment in the U.S. currently lacks actionable measures of precipitation effectiveness, making it difficult to assess true drought relief.

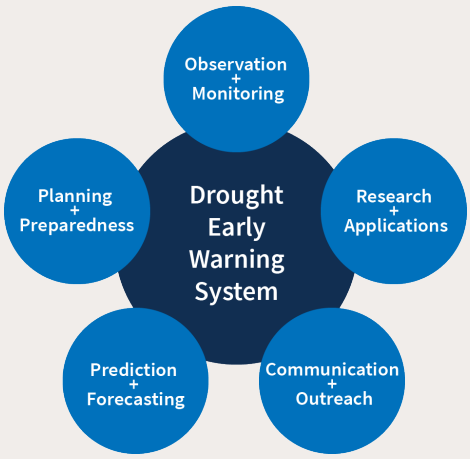
Water Demand. The Midwest is facing increasing strain on its water resources, particularly its vital groundwater aquifers, driven by competing high-volume demands. There is the influx of water-cooled data centers, residential and commercial developments, local demands from industrial municipal users, and traditional agricultural irrigation. Because groundwater is often treated as a shared, invisible pool, these overlapping sectors pump water out faster than nature can replenish it. This accelerating depletion threatens the long-term viability of water supply in the Midwest.

Flooding in a soybean field after a heavy rain. Photo credit: JJ Gouin/Adobe Stock.

WHAT IS A DROUGHT EARLY WARNING SYSTEM (DEWS)?

A **drought early warning system** (DEWS) improves the capacity of farmers, ranchers, water suppliers, wildfire managers, and other decision-makers to plan for, forecast, monitor, and cope with the impacts of drought. A DEWS is a network of partners that share information and coordinate actions—foundationally connecting communities who need drought information with those that are providing it. This network includes partners from Federal, Tribal, state, and local agencies, as well as academia, non-governmental organizations, and the private sector.

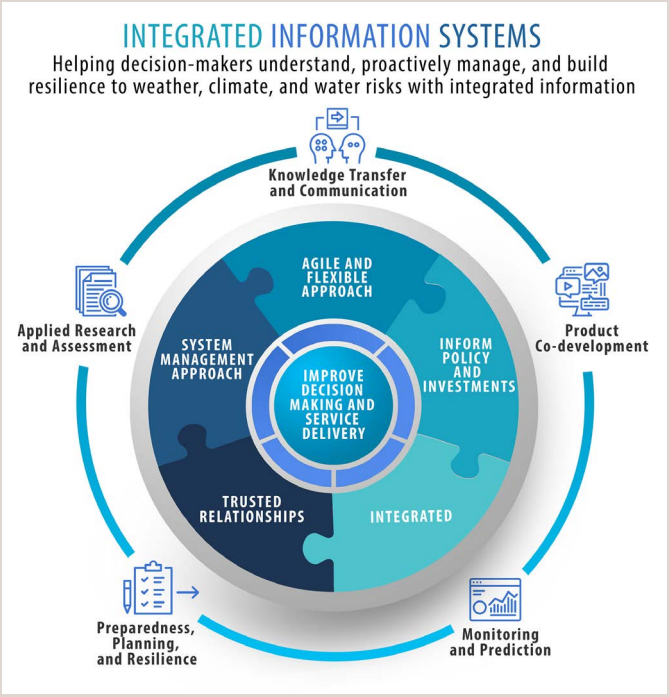
A DEWS is not simply the dissemination of a forecast. It is a key component of an integrated information system that pulls together, or improves on, any information that may mitigate the impacts, reduce the costs, and help communities plan for upcoming droughts.



Graphic depicting the components of a Drought Early Warning System.

WHAT IS THE NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM (NIDIS)?

NIDIS is a multi-agency partnership that coordinates drought monitoring, forecasting, planning, and information at national, state, and local levels across the country. The NIDIS program was authorized by Congress in 2006 (Public Law 109-430) and reauthorized in 2014 and 2019 with an interagency mandate to coordinate and integrate drought research, building upon existing partnerships in support of creating a national drought early warning information system. NIDIS is an interagency program housed within NOAA's Office of Oceanic and Atmospheric Research Climate Program Office.



A conceptual diagram illustrating an Integrated Information System with improving decision making and service delivery at its core.

NIDIS employs an **integrated information system (IIS) approach**, which is a proven, whole-of-government organizational approach that helps decision-makers understand, proactively manage, and build resilience to weather, climate, and water risks with integrated information. An IIS adds unique value through convening, integrating, and strengthening existing individual efforts—such as a specific data portal, a community of practice or learning network, federal research programs, early warning systems—in the context of a defined problem and hazard. In essence, an IIS serves as a "network of networks" that connects and amplifies existing work, while also addressing specific gaps identified by partners.

Midwest Drought Early Warning System (DEWS)

HISTORY OF THE MIDWEST DEWS

The rapid evolution and significant impacts of the 2012 drought emphasized the need for a regional early warning system that would improve drought monitoring, forecasting, and preparedness in the Midwest. In response, NIDIS and regional partners began developing a Midwest Drought Early Warning System (DEWS) in 2015, officially launching the Midwest DEWS in February 2016 at a meeting in St. Louis, Missouri. NIDIS held **four regional strategic planning workshops** across the Midwest in late 2016, which led to the development of the inaugural **2018-2019 Midwest DEWS Strategic Plan**.

Throughout the following years, the Midwest DEWS network convened around key topics, including drought communication and the impact of drought on public health. The **November 2019 Midwest DEWS Partners Meeting** was held in conjunction with the Midwest Drought and Health Regional Workshop, which was one of five regional workshops that informed the development of the **Drought and Public Health Roadmap** (co-authored by the University of Nebraska Medical Center and NIDIS).

In 2019, NIDIS launched a partnership with the University of Colorado-Boulder's Masters of the Environment Program to engage with the tribal nations of the Midwest and Great Lakes to assess drought information gaps and needs. This informed the development of the **NIDIS Tribal Drought Engagement Strategy for the Missouri River Basin and Midwest DEWS**, which was released in November 2020.

Poorly developed cornstalks show the effects of prolonged hot, dry weather on a farm in southern Wisconsin. Photo credit: wakr10/Adobe Stock.

Since 2022, the Midwest DEWS network convened in person two times. The DEWS also provided multiple virtual engagements around a variety of topics, including drought planning, annual spring season assessment meetings, and soil moisture data. To facilitate cross-DEWS learning opportunities, the **2022 DEWS Partners Meeting** was held jointly with the Missouri River Basin DEWS in Omaha, Nebraska. The **August 2024 Midwest DEWS Partners Meeting** in Indianapolis, Indiana explored key topics, including drought monitoring and communication, ecological drought, and drought in the Mississippi River Basin.

National Integrated Drought Information System
Midwest Drought Early Warning System (DEWS)

Map of the NIDIS Midwest Drought Early Warning System (DEWS)

Key Milestones for the Midwest DEWS

Meetings **Strategies**

FEB 2016
Kick-Off Meeting
(St. Louis, MO)

FALL 2016
Strategic Planning Workshops
(Rochester, MN; Cedar Rapids, IA; Champaign, IL; Cincinnati, OH)

2016 — 2016

FALL 2017
Full-Time DEWS Coordinator Hired

SPRING 2018
First Midwest DEWS Strategic Plan

MAY 2018
Communication Workshop
(Champaign, IL)

NOV 2019
Midwest DEWS Partners Meeting and Drought and Health Regional Workshop
(St. Paul, MN)

2020 — 2020

NOV 2020
NIDIS Tribal Engagement Strategy for the Missouri River Basin & Midwest DEWS

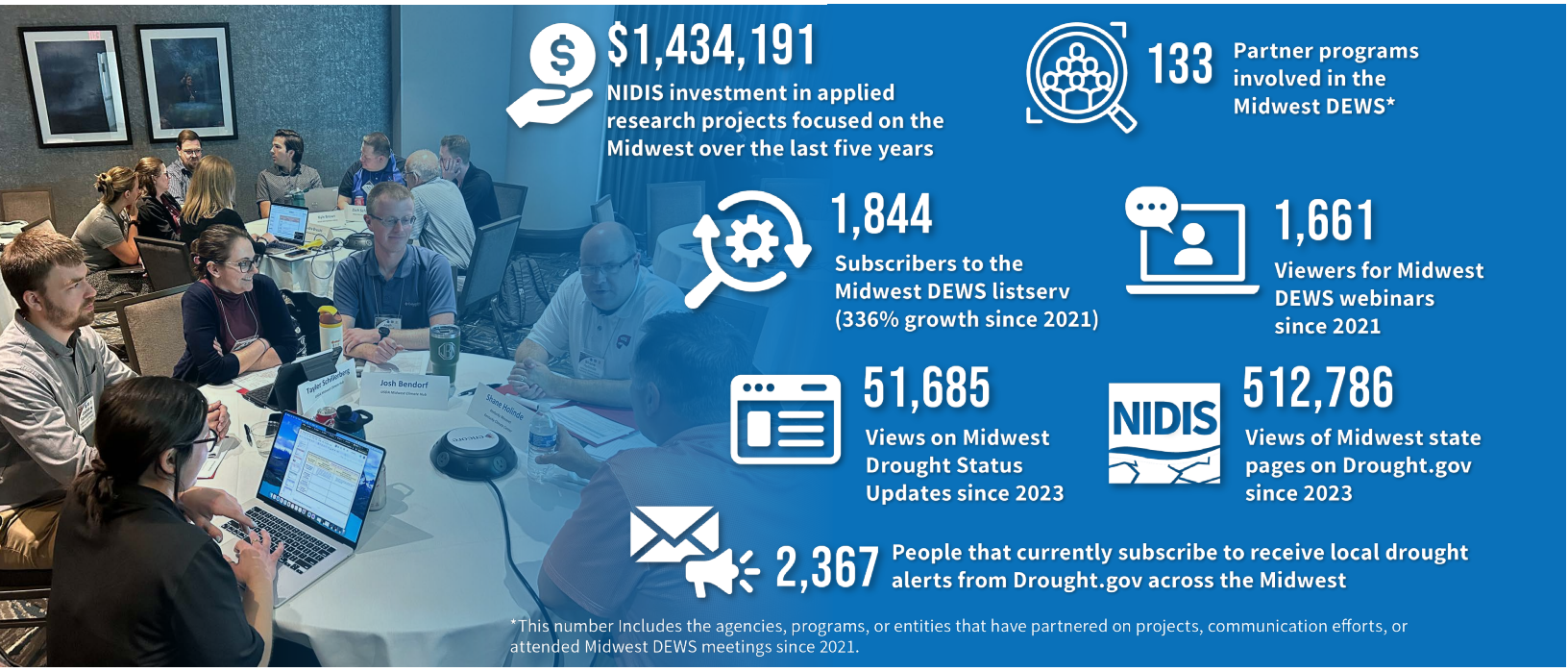
NOV 2021
2021-2024 Midwest DEWS Strategic Plan

OCT 2022
Midwest and Missouri River Basin DEWS Joint Meeting
(Omaha, NE)

SUMMER 2024
Michigan Officially Added to Midwest DEWS

AUG 2024
Midwest DEWS Partners Meeting
(Indianapolis, IN)

2025 — 2025



Small group discussions at the August 2024 Midwest DEWS Partners Meeting in Indianapolis, Indiana.

MIDWEST DEWS PRIORITIES IN ACTION

Since it began in 2016, the Midwest DEWS has made progress on several priorities identified by partners across the region. The 2021-2024 Midwest DEWS Strategic Action Plan focused on five priorities: (1) building a comprehensive understanding of drought indicators in the Midwest, (2) increasing the understanding of the characteristics, predictability, and risk of drought and rapid transitions between precipitation extremes in the Midwest, (3) identifying innovative solutions and proactive measures that can build drought resilience, (4) enhancing collaboration, coordination, and communication among partners in the region, and (5) integrating the Great Lakes watershed into the Midwest DEWS.

The following section highlights selected Midwest DEWS successes since 2021 across these priority areas. While not a comprehensive list, it illustrates key accomplishments and progress.

Early Warning in Action: 2024 Record Drought in Ohio

A key to effective drought early warning is having people and processes in place before drought occurs. In August 2024, parts of Ohio reached Exceptional Drought (D4) for the first time since the U.S. Drought Monitor began in 2000. Despite this historic event, Ohio was prepared.

As part of the Midwest DEWS, Ohio had already strengthened its drought monitoring and response. In 2023, NIDIS and researchers from the Ohio State University **completed a project** that identified the most relevant indicators and timescales for tracking agricultural, hydrological, and ecological drought, improving access to localized, timely information.

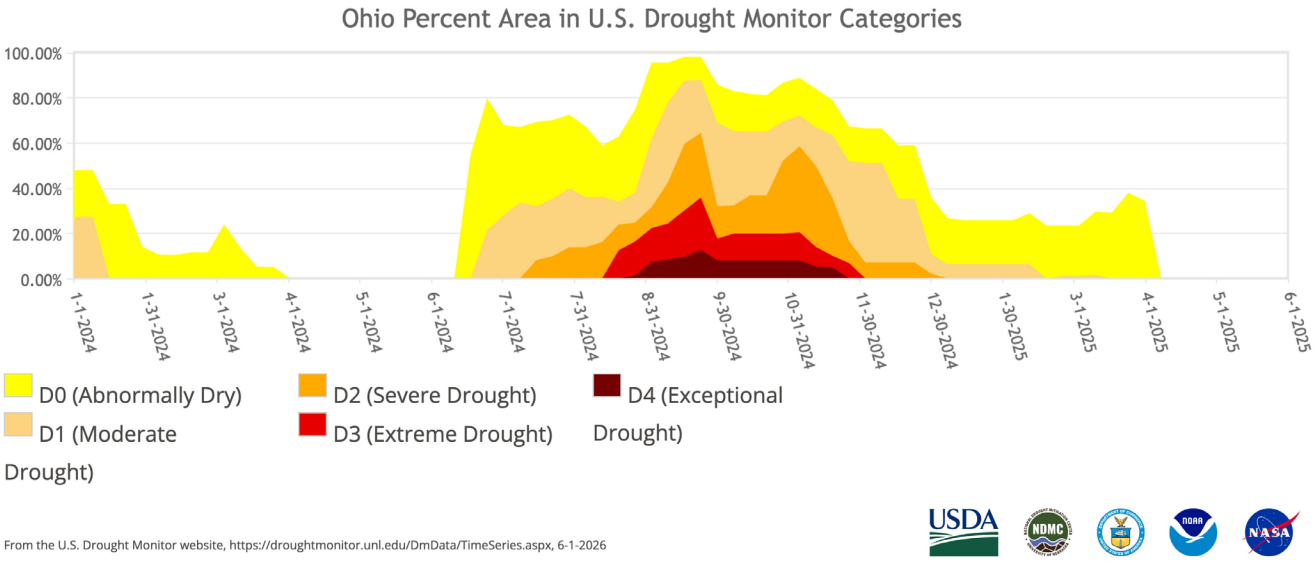
Early warning proved critical. An April 25, 2024 NIDIS **Drought Status Update** flagged emerging drought risk despite drought-free conditions, prompting the Ohio State Climatologist to activate the Ohio State University Extension's Drought Response Team. By late June, the team was sharing resources to help producers manage impacts, specifically around livestock and managing feed and forage shortages (e.g., **Addressing Feed & Forage Shortages**).

> "I think it's the people and the network, when the information is communicated effectively, that is the bread and butter of a Drought Early Warning System!"
>
> – Aaron Wilson,
> Ohio State Climatologist

Conditions worsened quickly. A **flash drought outlook** in June was followed by Exceptional Drought (D4) conditions in southeastern Ohio by late August, expanding to 13% of the state by September. NIDIS continued issuing updates (**July** and **September**) and co-hosted a **September webinar for West Virginia and Ohio** with regional partners, informing stakeholders—including state and federal officials—on conditions, impacts, and available assistance.

Experts indicated the drought had peaked, and drought slowly began to dissipate over the next few months. NIDIS issued two more Drought Status Updates in **fall** and **early winter** tracking ongoing impacts, as well as these improvements. By the end of 2024, the drought had largely dissipated.

Strong partnerships and coordinated communication among state agencies, NIDIS, and Midwest DEWS partners enabled effective early warning and response, even during Ohio's most severe drought in over 25 years.



A U.S. Drought Monitor time series chart for Ohio showing the percentage of land area affected by varying levels of drought between January 2024 through May 2025.

Improved Drought Coordination and Early Warning in Michigan

Michigan's humid continental climate typically produces a relatively wet environment, with about 33 inches of precipitation annually and few months without rainfall. While severe drought is infrequent, its impacts can be significant—affecting agriculture (including specialty crops), stressing forested ecosystems, increasing wildfire risk, and lowering water levels. Long-term drought can lower Great Lakes water levels, affecting navigation and water supplies and directly impacting communities across Michigan. Of growing concern is the rise in flash droughts, which have become more frequent in recent decades, as well as snow drought, which can disrupt tourism and recreation industries that depend on reliable snowfall.

State partners across Michigan expressed a strong interest in taking a more proactive approach to drought and joining the Midwest DEWS. With facilitation and technical support from NIDIS, partners[2] convened through a series of virtual meetings in fall 2024 to share current drought-related efforts and identify gaps in monitoring, coordination, and planning.

Fields of crops in Traverse City, Michigan. Photo credit: Reagan/Adobe Stock.

2 Partners included the Michigan State Climatologist's Office at Michigan State University, Michigan State Police, Michigan Department of Agriculture and Rural Development, and the National Weather Service local offices from across the state.

A key gap partners identified was the lack of a coordinated system for monitoring drought conditions and informing weekly input to the U.S. Drought Monitor. Partners emphasized that establishing a dedicated weekly monitoring group was critical to ensuring accurate representation of conditions across the state.

This effort led to the creation of a weekly drought monitoring coordination group, which has provided regular recommendations to the U.S. Drought Monitor authors since early 2025. The group has facilitated more consistent discussions of drought conditions across the state, ensuring that drought indices accurately reflect on-the-ground conditions.

This effort was initiated and continues to be driven by committed state partners who recognized the need for greater coordination to advance drought early warning. NIDIS supported the effort through facilitation, providing technical resources and examples and lessons learned from neighboring states to help Michigan partners determine the best path forward for their needs. Michigan officially became part of the Midwest DEWS in summer 2024—a key priority in the **2021–2024 Midwest DEWS Strategic Action Plan**.

Applied Research Improves Understanding of Drought in the Midwest

NIDIS supports drought research by advancing the scientific understanding of drought mechanisms and improving the coordination and delivery of drought information. The DEWS uses an approach to identify gaps, foster collaboration, and facilitate information flow and informed decision-making.

NIDIS, in collaboration with several Midwest DEWS partners, has supported several applied, interdisciplinary research projects to directly address outstanding, drought-related research questions facing the region. The scientific assessments resulting from this work, and coordinated efforts to make this research accessible and useful, are crucial for informing decision-makers across the Midwest on effective drought response and planning.

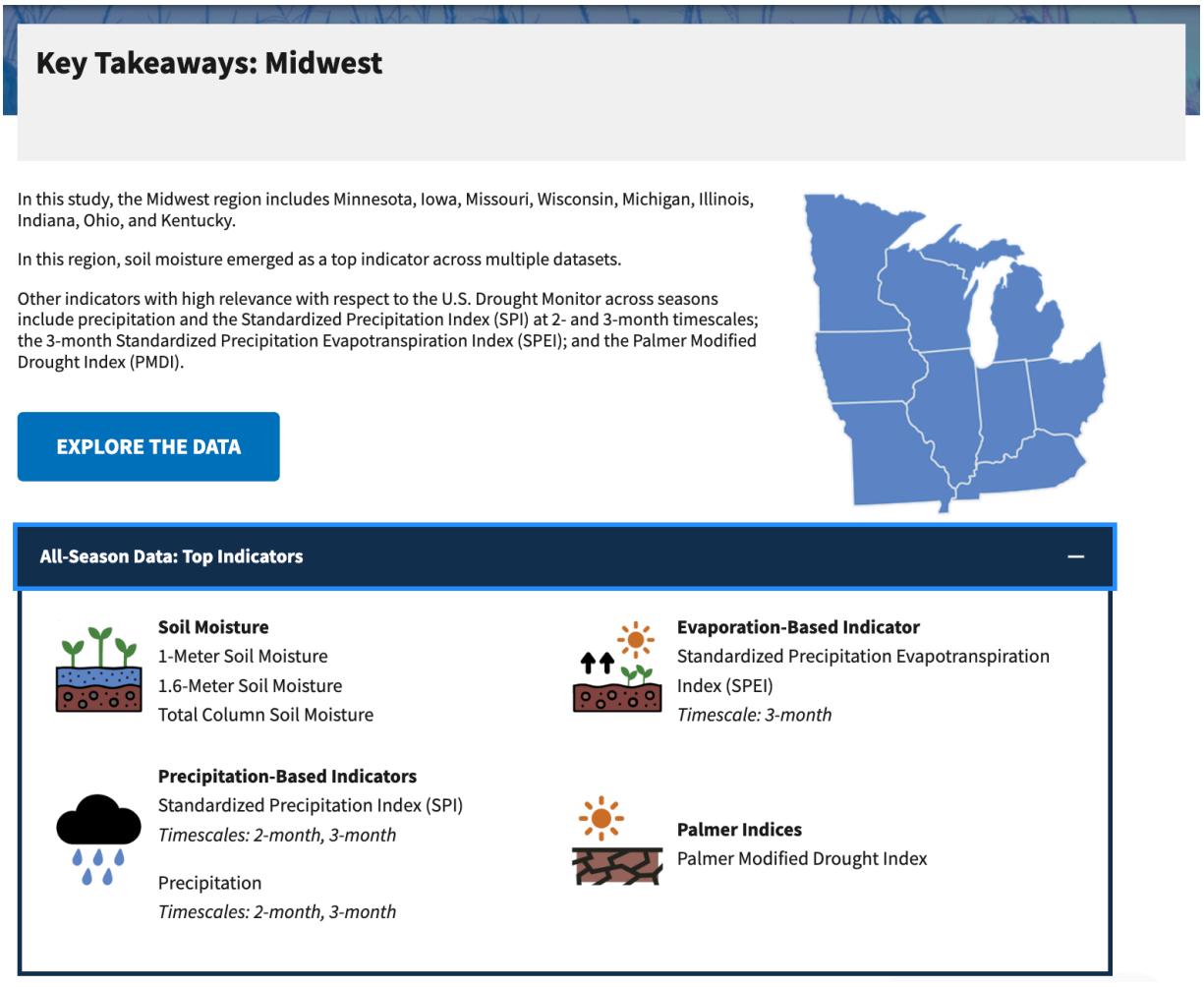
Two research projects focused squarely on two key priorities identified in the 2021-2024 Midwest DEWS Strategic Plan: (1) building a comprehensive understanding and application of drought indicators across the Midwest, and (2) increasing understanding of the characteristics, causes, and risks of rapid transitions between precipitation extremes (e.g., wet to dry) historically, today, and in the future.

A research team led by Trent Ford at the University of Illinois studied the variability, trends, causes of, and future risk for rapid transitions between precipitation extremes in the Midwest, and their findings were integrated into the **Fifth National Climate Assessment**. NIDIS and project researchers **collaborated on communication materials** and a webinar to share the results of this research.

Many DEWS partners across the country, including those in the Midwest, expressed the need to better understand which of the many drought indicators should be used at different times of the year for their location or region. In response, NIDIS partnered with NASA to offer a data-driven

approach to answer this question. The findings from this research show which drought indicators are most representative of the U.S. Drought Monitor's depiction of drought across six U.S. regions, by season. NIDIS and NOAA's National Centers for Environmental Information (NCEI) **developed an online resource** to make the findings from this research accessible, in consultation with partners and stakeholders from across the country.

Other Midwest-focused applied research projects in progress include **improving our understanding of rainfall variability and its impact on precipitation effectiveness**, as well as **developing tools for urban forest managers** in the Chicagoland area.



A snapshot of the Drought.gov online resource developed to display research results from the NASA study.

Aerial view of a wind farm beneath approaching storm clouds over Antwerp, Ohio. Photo credit: Grindstone Media/Adobe Stock.

Strategic Goals, Outcomes and Objectives

PURPOSE AND DEVELOPMENT OF THE STRATEGIC PLAN

This Strategic Plan outlines strategic goals, outcomes, and objectives for the Midwest DEWS, developed in consultation with federal, Tribal, state, and local partners across multiple sectors in the region. Its overarching aim is to strengthen drought early warning and preparedness across the region. The Plan will guide Midwest DEWS efforts and programmatic investments over the next five years and, in consultation with regional partners, is intended to be an adaptable living document to address emerging challenges.

Authors developed the first draft of this Plan through engagement with regional partners over several years, building on the 2021–2024 Plan and key insights from the **August 2024 Midwest DEWS Partners Meeting**. Partners across the region (listed in the Acknowledgements) reviewed and provided feedback during virtual engagements in spring 2025. Authors finalized the plan after collecting this feedback.

STRATEGIC GOALS, OUTCOMES, AND OBJECTIVES

Based on recent and emerging drought issues and identified challenges, gaps, and regional experiences in the Midwest, authors identified the following **Strategic Goals**[3] as priorities to strengthen drought resilience in the Midwest. **Outcomes** for each Goal will describe the expected long-term change the Midwest DEWS plans to achieve in accomplishing the Strategic Goals. These outcomes will be the basis for evaluation. **Objectives** for each Goal define measurable actions to achieve the Goals and to ensure resulting outcomes over the next 5 years. Each goal also lists **Performance Metrics** NIDIS will track to measure the outcome of these actions on drought early warning and preparedness across the Midwest.

STRATEGIC GOALS guide regional activities over the next 5 years in collaboration with regional partners and in alignment with the NIDIS Public Law.

OUTCOMES for each Goal describe the expected long-term change the Midwest DEWS plans to achieve in accomplishing the Strategic Goals. These outcomes will be used as the basis for evaluation.

OBJECTIVES for each Goal defines measurable actions to accomplish to achieve the Goals and to ensure resulting outcomes over the next 5 years.

PERFORMANCE METRICS for each Goal will measure the outcome of these actions on drought early warning and preparedness.

Confluence of the Mississippi and Ohio Rivers below Cairo, IL with Fort Defiance State Park. Photo credit: MarekPhotoDesign/Adobe Stock.

3 The Strategic Goals are not listed in ranked order of importance.

Table 1. Overview of the Midwest DEWS Strategic Goals

OVERVIEW OF THE MIDWEST DEWS STRATEGIC GOALS

GOAL 1

COORDINATION

Strengthen coordination, collaboration, and communication among federal, tribal, state, and local agencies, academic institutions, and other entities responding to drought and mitigating its impacts across the Midwest.

GOAL 2

INFORMATION DELIVERY

Enhance delivery of timely, relevant, and actionable drought information to communities and decision-makers across the Midwest.

GOAL 3

CASCADING IMPACTS

Advance understanding of the cascading impacts of drought across the Midwest and enhance drought impact monitoring to enable earlier warning and more proactive planning.

GOAL 4

DATA AND INDICATORS

Strengthen the availability, comprehension, and effective application of critical data and indicators to support drought monitoring and preparedness across the Midwest.

GOAL 5

RESEARCH

Advance and integrate interdisciplinary research to address emerging issues and challenges related to monitoring, predicting, and managing drought in the Midwest.

1 STRATEGIC GOAL 1: COORDINATION

Strengthen coordination, collaboration, and communication among federal, tribal, state, and local agencies, academic institutions, and other entities responding to drought and mitigating its impacts across the Midwest.

Outcomes

Strengthened drought early warning and preparedness across the Midwest through collective action within the regional DEWS network.

Expanded partnerships within the Midwest DEWS include critical sectors across the region and targeted focus areas, such as ecological drought, strengthening cross-sector collaboration and regional drought response capacity.

Objectives

1. Provide forums to engage (virtual and/or in-person), bringing together drought stakeholders and decision-makers across the Midwest working at various scales (regional to local). In these discussions, share ongoing drought-related activities, explore emerging issues and opportunities, and identify collaborations to advance drought early warning and preparedness in the Midwest. These virtual or in-person forums are opportunities for peer-to-peer learning and could focus on a specific topic or sector for more targeted discussions.
2. Foster a trusted and collaborative network that strengthens relationships, encourages knowledge sharing, navigates conflict constructively, and supports collective action.
3. Improve federal government coordination on drought activities in the Midwest across NOAA line offices and with other federal agencies.

Lake Winnibigoshi, Minnesota within the Chippewa National Forest.
Photo credit: Jacob/Adobe Stock.

4. Identify key drought-impacted sectors, stakeholder groups, and private sector entities not currently well integrated into the Midwest DEWS. Increase engagement with these sectors to understand their challenges, decisions, and priorities related to drought management (e.g., agriculture, industry, insurance, navigation, transportation, energy production, water supply).
5. Explore the feasibility and usefulness of completing a "network analysis" of the Midwest DEWS to identify who the network is reaching, and those sectors or groups the network does not reach. This analysis may evaluate how various sectors and groups prefer to receive information, which can improve messaging from the Midwest DEWS (supporting Goal 2).
6. Ensure Tribal Nations across the Midwest and Great Lakes are invited to be part of the Midwest DEWS while respecting tribal sovereignty, protecting tribal data, and building and maintaining relationships based in trust and reciprocity.
7. Partner with interstate and watershed-scale organizations to identify and address drought and water supply challenges that transcend state boundaries to foster more coordinated monitoring, planning, and management of water resources across the Midwest.
8. Strengthen partnerships between climate, weather, hydrology, ecology, and natural resource research and management communities to identify and address data, information, and decision-support needs related to ecological drought and drought-driven low streamflow in theMidwest. Explore the need to co-develop an ecological drought workshop in the region.
9. Collaborate with health practitioners across the Midwest to incorporate existing research, resources, and tools related to drought impacts on human health into decision-making and outreach efforts. (i.e., **Drought and Health Messaging Framework for Public Health Professionals and Healthcare Providers**).

Performance Metrics

- Number of collaborative projects (funded or unfunded) within the Midwest DEWS.
- Number of partners convened through regional dialogues (in-person or virtual) within the Midwest DEWS that provided a forum for networking, sharing, and learning.

2 STRATEGIC GOAL 2: INFORMATION DELIVERY

Enhance delivery of timely, relevant, and actionable drought information to communities and decision-makers across the Midwest.

Outcomes

The Midwest DEWS network reaches a broad and diverse audience through its information delivery efforts.

Decision-makers and communities across the Midwest have access to actionable information for quick drought response and proactive planning.

Objectives

1. Provide real-time drought conditions, impacts, and outlook information through Drought Status Updates, Drought.gov, webinars, social media, and other communication methods. Leverage the networks of Midwest DEWS partners (e.g., National Weather Service, MRCC, state climate offices, and others) to amplify message reach.
2. Provide updated and relevant resources for drought monitoring, prediction, planning, and communication through the state and regional Midwest DEWS page on the U.S. Drought Portal (**Drought.gov**).
3. Improve understanding of drought-related decisions across sectors at regional, state, and local scales to inform more targeted and actionable messaging.
4. Develop effective and action-based communication materials to convey drought conditions, impacts, risks, outlook information (including uncertainty), and recommend mitigation or preparedness actions. Leverage findings from social science research and best practices from entities across the region or other regions. In addition, build on the drought risk communication efforts with the Natural Hazards Center.
5. Support Tribal Nations and state and local agencies updating drought and related plans with technical guidance about indicators and drought impact assessments. Ensure connections to other entities to share lessons learned and best management practices.
6. Better integrate news media into the Midwest DEWS communication efforts. Explore establishing a network of broadcast meteorologists within the Midwest DEWS and providing drought-related training.

Performance Metrics

- Number of views for drought status updates, webinars, and newsletters that convey regional drought conditions, impacts, and outlooks and/or drought-related resources.
- Representation from different economic sectors and type of entity (e.g., Federal, tribal, private sector) within the Midwest DEWS.

3 STRATEGIC GOAL 3: CASCADING IMPACTS

Advance understanding of the cascading impacts of drought across the Midwest and enhance drought impact monitoring to enable earlier warning and more proactive planning.

Outcomes

Improved understanding of drought impacts across the region enables more proactive planning and earlier identification of emerging drought conditions.

Improved system-specific drought impact monitoring across the Midwest, resulting in greater understanding of how drought affects interconnected systems and integration of those impacts into monitoring efforts.

Dried, cracked soil in a wheat field.
Photo credit: Alex Milan/Adobe Stock.

Objectives

1. Increase on-the-ground reports through systems like Condition Monitoring Observer Reports (CMOR) and CoCoRaHS Condition Monitoring to improve statewide monitoring and validate drought indicator's depiction of drought. Provide regional CMOR training opportunities and share successful models to gather more on-the-ground reports. Incorporate findings from social science studies on factors that motivate participation in community science.
2. Harness emerging technologies (e.g., machine learning) to analyze patterns of drought data and/or impacts in the Midwest.
3. Identify sector-based impacts of flash drought in the Midwest by time of year and location. Use this information to improve messages to decision makers about the risks associated with flash drought.
4. Develop drought assessments that evaluate and document the economic impact of both short- and long-term drought across a broad range of drought-impacted sectors in the region (e.g., public health, agriculture, navigation, energy production, ecosystems, recreation/tourism, water supply, infrastructure).
5. Identify sector-based impacts resulting from the rapid transition between precipitation extremes (from too much to too little water) and the time of year when this rapid shift creates the most negative impacts on sectors across the region.

6. Convene a regional working group with drought management experts from across the Midwest to develop a proactive drought management framework that addresses rapid shifts between precipitation extremes, acknowledges tradeoffs in managing different weather extremes, integrates effective flash drought response, and identifies multi-hazard mitigation actions to include in a shared database to assist drought mitigation, planning, and response across the region.
7. Improve understanding of the cascading effects of drought and/or low streamflows on ecosystems across the Midwest, including the impact of flash drought. Document regional sources of ecological data (e.g., fish or wildlife population, tree health, bird surveys, invasive species) to analyze the connection between drought and ecosystem impacts.
8. Assess, on an annual basis, the previous year's ecological drought impacts across the Midwest, in partnership with the U.S. Geological Survey Midwest Climate Adaptation Science Center (CASC). Consider identifying "representative species" for various types of ecosystems in the Midwest to routinely track and assess the impact of drought in the region.
9. Improve understanding of the characteristics and risks of wildland fire in the Midwest and its intersection with drought. Bridge this understanding and effort with NIDIS's Drought and Wildland Fire Nexus (NDAWN) Strategy.

Performance Metrics

- Volume and geographic distribution of condition monitoring reports through CMOR (Condition Monitoring Observer Reports) and CoCoRaHS.
- Development of new methodologies to "quantify and monetize" drought impacts on non-traditional sectors like public health and ecosystem services.

Aerial view of agricultural silos and wind turbines in Brookston, Indiana. Photo credit: Zenstratus/Adobe Stock.

4 STRATEGIC GOAL 4: DATA AND INDICATORS

Strengthen the availability, comprehension, and effective application of critical data and indicators to support drought monitoring and preparedness across the Midwest.

Outcomes

Improved drought monitoring and assessment in the Midwest allows for more effective, proactive preparedness, and targeted relief and response efforts.

Drought plans across the Midwest use the most relevant, region-specific indicators to improve monitoring and guide timely response and mitigation efforts.

Midwest stakeholders have access to high-quality, real-time soil moisture, evapotranspiration, streamflow, and groundwater data, which were identified by the Midwest DEWS as crucial data gaps for drought monitoring in the region.

Drought along the Mississippi River by the confluence with the Missouri River. Photo credit: Rob Sheppard/Danita Delimont/Adobe Stock.

Objectives

1. Identify seasonal, sectoral, and geographical applications for drought indicators and indices in the Midwest.
2. Identify the most appropriate indicators, timescales, and products to monitor flash drought development and its evolution in the Midwest.
3. Identify drought indicators, triggers, and thresholds that work well for ecological drought monitoring in the Midwest, and how we can use these to anticipate impacts on ecosystems and species.
4. Provide training and technical assistance for users across the Midwest to incorporate various drought data, indicators, and tools into work flows and state or local planning to inform better management.
5. Support expanded state mesonets in the Midwest to monitor crucial variables like precipitation, soil moisture, temperature, and evaporation, and improve access to this data. Leverage national initiatives (e.g., National Mesonet Program) to aid this effort. Utilize the Midwest DEWS network to showcase successful state network expansions and new research showing the value of soil moisture data through the Upper Missouri River Basin Soil Moisture and Plains Snow Data Value Study.
6. Champion efforts to improve soil moisture products (including communication of soil moisture data), in coordination with the National Coordinated Soil Moisture Monitoring Network. Additionally, through research and/or experience, identify the most representative soil moisture products for the Midwest.
7. Improve collection and delivery of shallow groundwater data and/or aquifer data across the Midwest.
8. Identify means to access real-time evapotranspiration data in a format useful for drought monitoring (e.g., comparison to normal). Explore opportunities and collaboration with NASA's third phase of the North American Land Data Assimilation System version 3 (NLDAS-3) and the OpenET platform.

Performance Metrics

- Improved access (e.g., improved quantity, quality, and/or delivery) to value-added products for key drought monitoring datasets, such as soil moisture, evapotranspiration, and groundwater.
- Number of plans informed by NIDIS-supported research and information, or through interaction and/or technical support with the Midwest DEWS.

5 STRATEGIC GOAL 5: RESEARCH

Advance and integrate interdisciplinary research to address emerging issues and challenges related to monitoring, predicting, and managing drought in the Midwest.

Outcomes

Decision-makers have the best available science to inform and improve short- and long-term drought risk assessment, decision-based applications, and actions.

Natural resource managers have access to the data and information they need to make short- and long-term decisions around ecological drought and/or low flow conditions.

Objectives

1. Support research that uncovers a more holistic understanding of the physical and social (e.g., development, industry shifts) drivers of drought in the region, identify potential sources of additional predictability for drought, and learn these may change in a nonstationary climate.
2. Support Indigenous-led collaborative research with Indigenous communities to integrate Indigenous Knowledge and Traditional Ecological Knowledge into drought monitoring, assessment, and resilience efforts to holistically address emerging drought challenges across the Midwest.
3. Improve indicators and datasets to better assess precipitation effectiveness, which current drought metrics do not accurately capture. As the Midwest trends toward heavier precipitation events, it is increasingly important to account for the greater proportion of rainfall lost to runoff, rather than contributing to root zone moisture, groundwater recharge, and stream baseflow.

Aerial view of a narrow strip of the Mississippi River.
Photo Credit: kustvideo/Adobe Stock.

4. Improve understanding of shifts in drought behavior and impacts in the Midwest for various temporal and spatial scales of drought. Possible questions may include: Has the seasonality of drought shifted? How are critical windows in various sectors like agriculture affected by these possible shifts? How does wind contribute to drought development in the region?
5. Improve understanding of future drought risk and potential shifting characteristics (including the whiplash between too much and too little water) in the Midwest in a nonstationary climate.
6. Conduct a literature review about the impact of drought and drought-driven low flow to ecosystems across the Midwest and synthesize results for Midwest stakeholders.
7. Analyze the multi-layered impacts of long-term drought and rising water temperatures on the Great Lakes ecosystem. Evaluate how these climate stressors interact to drive hazards (such as algal blooms), disrupt ice cover dynamics, accelerate evaporation, and create navigation hazards in shallower basins due to wind-induced water level drops.

Performance Metrics

- The number of multidisciplinary research projects and/or publications (e.g., studies co-authored by diverse fields) funded or facilitated by the Midwest DEWS.

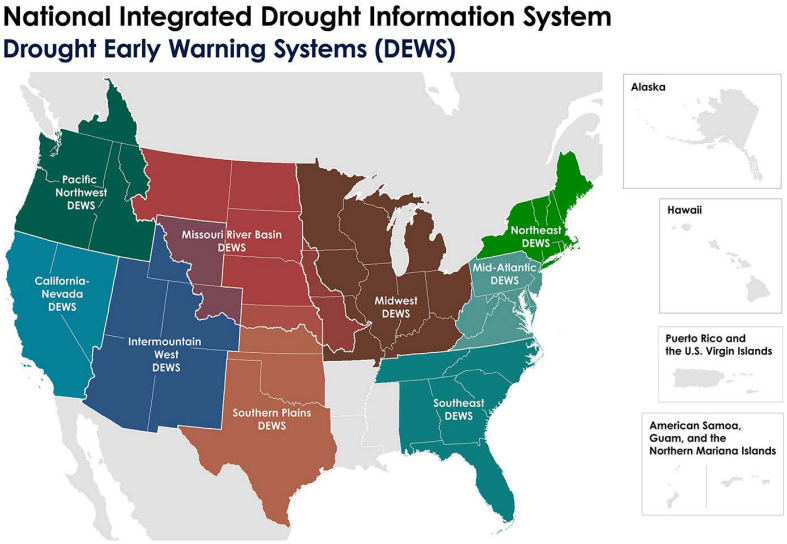
Extreme low water conditions on Mississippi River showing exposed cliffs of sand in Missouri. Photo credit: steheap/Adobe Stock.

Implementation of the Midwest DEWS Strategic Plan

REGIONAL APPROACH

Recognizing drought characteristics and impacts vary across the country, NIDIS implements DEWS at the regional level to better respond to specific geographic, hydrologic, and stakeholder needs.

Partnerships are central to a robust and effective drought early warning system. Strengthening these connections within the Midwest enhances the region's ability to plan for and respond to drought, while also providing a valuable network for partners to learn, share knowledge, and implement solutions to complex drought challenges.



A map showing the boundaries of the NIDIS Drought Early Warning Systems (DEWS).

Building on these partnerships, the Midwest DEWS will leverage existing networks and regional efforts to implement the actions identified in this Plan, advancing strategic goals and long-term outcomes through coordinated, collective action.

In addition, collaborating with partners from other regional DEWS adds significant value to the Midwest network. Engaging with regions like the Western U.S.—which frequently manages severe drought—allows the Midwest to adopt proven research, lessons learned, and best management practices to accelerate its own drought resilience.

NATIONAL APPROACH

The regional DEWS are the foundation of a national early warning system. Regional priorities, gaps, and stakeholder needs help shape national products, services, and research investments, while national-scale advancements provide new tools, data, and resources to strengthen drought preparedness and response at the regional level.

Challenges that extend beyond a single DEWS region are elevated for national coordination and investment. Complex issues, such as subseasonal-to-seasonal drought forecasting and flash drought, require sustained research, cross-sector collaboration, and decision-support tools that can be applied nationwide. By addressing these challenges at the national scale, NIDIS accelerates innovation and delivers benefits to stakeholders across the regions.

Direct Midwest investments

$1.4 million

Additional investments at the national level that benefit Midwest stakeholders

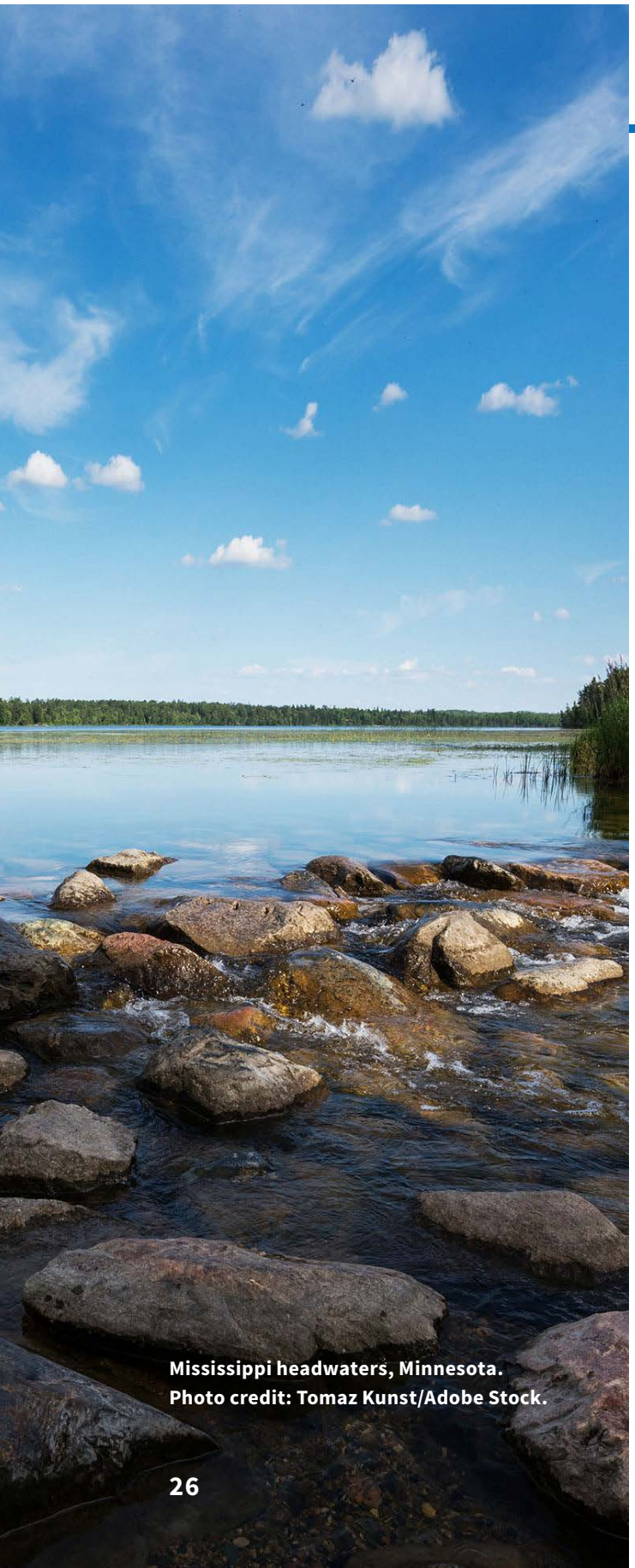
$20.5 million

across different areas including...

- Improving drought monitoring
- Understanding drought impacts
- Advancing predictions and forecasting
- Improving access to drought information and data

Since 2021, NIDIS has invested more than $1.4 million directly within the Midwest DEWS. In addition, NIDIS has invested more than $20.5 million nationally since 2021[4] in efforts that support Midwest stakeholders. Examples of these national investments include advancements in seasonal-to-subseasonal drought forecasting, drought and public health resources, the National Coordinated Soil Moisture Monitoring Network, soil moisture monitoring, and improved access to drought indicators and decision-support tools. These investments help ensure Midwest communities have access to the science, information, and partnerships needed to anticipate, prepare for, and respond to drought.

4 For Fiscal Year (FY) 2022–FY 2026, NIDIS received an average allocation from Congress of $12.6 million per fiscal year.



Mississippi headwaters, Minnesota.
Photo credit: Tomaz Kunst/Adobe Stock.

Conclusion

Through a robust consultative process over the last decade, the Midwest DEWS has matured and expanded its reach and services. The future growth identified and captured in this Plan is vital to increase the Midwest's resilience in the face of drought.

This Strategic Plan, developed through extensive engagement with federal, Tribal, state, and local partners, outlines the collective path forward to strengthen drought early warning and preparedness across the region for the next five years. Our five Strategic Goals focus on enhancing the delivery of timely, relevant, and actionable information (Goal 1), strengthening the availability and application of critical data and indicators (Goal 2), increasing the understanding and monitoring of cascading drought impacts (Goal 3), fortifying coordination and collaboration among all regional entities (Goal 4), and advancing interdisciplinary research to address emerging challenges (Goal 5).

Successfully implementing these goals will rely on a coordinated regional approach that leverages national efforts and commits to measurable outcomes. This will ensure the Midwest DEWS continues to serve as an effective, integrated information system that proactively manages and builds resilience to climate and water risks across the region.

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Appendix

Appendix A: Key Drivers for the Midwest DEWS Strategic Plan

- **NIDIS Public Law and Reauthorizations**
  - **NIDIS Act of 2006, Public Law 109-430**
  - **NIDIS Reauthorization Act of 2014, Public Law 113-86**
  - **NIDIS Reauthorization Act of 2018, Public Law 115-423**
- **2024 Midwest Drought Early Warning System (DEWS) Partners Meeting: Summary Report**
- **2021-2024 Midwest Drought Early Warning System (DEWS) Strategic Action Plan**
- **2022-2026 NIDIS Strategic Plan**
- **Regional Partner Documents**
  - **Midwest Climate Adaptation Science Center (CASC) 5-Year Science Agenda**
  - **U.S. Department of Agriculture Climate Hubs Strategic Plan 2020-2025**
  - **Mississippi River Watershed Partnership Goals and Actions**

Appendix B: Disclaimer

The Midwest DEWS Strategic Plan is a collaborative federal, state, tribal, and local interagency effort to improve early warning capacity and resilience to drought in the Midwest. The contents of this plan should not be used as evidence against any Midwest DEWS state; any federally recognized tribe; or the federal government in any administrative, judicial, or other proceeding. The assumptions, conclusions, and other information contained in the Plan do not represent a legal interpretation or legal position related to any issue raised in, or otherwise relevant to, litigation, nor do they represent a consensus view of federal agencies or other stakeholders involved in the Plan's development. The Plan is not intended as an attempt to resolve any particular dispute within the Midwest. Nothing in the Plan is intended to, nor shall the Plan be construed so as to, interpret, diminish, or modify the rights of any Midwest state, any federally recognized tribe, or the Federal government under Federal or state law or administrative rule, regulation, or guideline.

Finally, all parties recognize partners participating in this process may disagree over the appropriate scope, methods, results, or interpretation of technical analyses performed in developing or implementing this DEWS. As such, neither the Plan, nor any work performed pursuant to it, shall be attributed to any organizations or individuals by virtue of their participation as a partner in this process. Nor shall any party be deemed to accept or agree with any particular assumption, conclusion, and other information contained in the Plan or its resulting studies, unless explicitly stated by those parties.

Midwest

Drought Early Warning System (DEWS) Strategic Plan

NOAA Technical Report OAR-NIDIS-008