2022-2025

# Southeast

Drought Early Warning System (DEWS) Strategic Action Plan



Document prepared by the National Integrated Drought Information System (NIDIS) in partnership with key stakeholders in the region (*Appendix 1*).

**On the cover:** Cotton fields ready for harvesting. Credit: Muratart

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### **Executive Summary**

### **1.1 DROUGHT IN THE SOUTHEAST**

The Southeast U.S. region generally receives substantial precipitation and is often considered water-rich. However, the region is increasingly experiencing recordbreaking droughts, highlighting competing water demands. Drought conditions can develop rapidly in the Southeast, especially when the lack of rain and high temperatures combine to increase evapotranspiration of water in the soils. Climate trends suggest the potential for more extreme droughts due to increased temperatures in the region.

### **1.2 THE SOUTHEAST DEWS**

Recognizing a need to improve drought early warning across the full geographic footprint of the Southeast, and in response to requests from regional stakeholders, NIDIS launched a newly expanded Southeast regional Drought Early Warning System (DEWS) in 2020. This Southeast DEWS will build on the partnerships and successes from the Apalachicola Chattahoochee and Flint (ACF) River Basin DEWS (launched in 2009) and the Coastal Carolinas DEWS (launched in 2012), replacing these two DEWS with a larger geographic footprint that allows for enhanced information sharing across this unique region. A DEWS improves the regional capacity to respond to, and cope with drought by utilizing existing networks to make climate and drought science readily available, easily understandable, and usable. The key components of a DEWS include: observations and monitoring, predictions and forecasting, research and applications, planning and preparedness, and communications and outreach.

**WHAT IS NIDIS?** The National Integrated Drought Information System (NIDIS) is a multi-agency partnership that coordinates drought monitoring, forecasting, planning, and information at national, state, and local levels across the country with a mission to improve the nation's capacity to proactively manage drought-related risks. Congress created NIDIS in 2006 (Public Law 109-430) with a mandate for interagency coordination and integrated drought research that builds upon existing federal, tribal, state, and local partnerships to create a national drought early warning system (DEWS). The program was reauthorized in 2014 (Public Law 113-86) and again in 2019 (Public Law 115-423).

**WHAT IS A DROUGHT EARLY WARNING SYSTEM (DEWS)?** A DEWS utilizes new and existing networks of federal, tribal, state, local, and academic partners to make climate and drought science accessible and useful for decision makers; and to improve the capacity of stakeholders to monitor, forecast, plan for, and cope with the impacts of drought.

### **1.3 BUILDING A SOUTHEAST DEWS STRATEGIC ACTION PLAN**

The purpose of the 2022–2025 Southeast DEWS Strategic Action Plan is to clearly articulate jointly identified information needs, set priorities for the DEWS network, and suggest measurable actions to improve drought early warning and preparedness for the region. This Plan is intended to be a resource document that **provides a snapshot of the current** 

**needs and gaps of drought early warning in the Southeast,** and can be used as a standard to objectively measure the alignment of future investments by Southeast DEWS partners with the needs of the region. It is also intended to be a "living document" that can evolve with the changing needs of partners in the region.

This 2022–2025 Southeast DEWS Strategic Action Plan was developed following a series of stakeholder meetings held virtually between October 2020 to March 2021, and an assessment of drought information gaps and needs identified through previous workshops and strategies. The virtual meetings included targeted dialogues around flash drought, agriculture planning, regional coordination, and ecosystem impacts. As a result of these discussions, four priorities and a series of outcomes and actions organized by the five components of a DEWS were identified to guide the work of the Southeast DEWS network over the next five years.



Observations and Monitoring

of five components including Predictions and Forecasting, Observations and Monitoring, Planning and Preparedness, Communications and Outreach, and Interdisciplinary Research and Applications. Credit: NOAA NIDIS, Fiona Martin

### **1.4 FOUR KEY PRIORITIES FOR 2022–2025**

**1. Coordination and Knowledge Exchange:** Enhance the exchange of information and approaches through collaborative efforts among national, tribal, state, and local partners and between DEWS regions. This will help strengthen drought

awareness, communication, collaboration, preparedness, and resilience across the Southeast.

- 2. Early Warning Information: Improve early warning of droughts in the Southeast, including rapid onset (flash) droughts, by building an understanding of the drought indicators/indices used in the Southeast to better demonstrate their value, limitations, and sector-specific, seasonal, and geographical applications. This will help both providers and users focus on information that is important to the region and specific decisions, to better inform drought preparedness and action.
- **3. Understanding Drought Impacts and Risk:** Increase our comprehensive understanding of drought impacts across key sectors [e.g., ecosystems, human health, fire management, agriculture] to inform future research needs, management practices, and adaptation planning. This will allow decision-makers to take a more holistic view when planning and responding to drought.
- **4. Providing Solutions for Drought Resilience:** Identify proactive measures and provide actionable information that can be taken before or during the development of drought to build resilience and strengthen drought response, with a focus on management decisions in the context of the region's multiple hydroclimate extremes.

The following table contains planned outcomes that the Southeast DEWS (SE DEWS) network and its partners will focus on, organized by components of a DEWS. More detailed information on the suite of recommended activities to accomplish these outcomes in the Plan can be found starting on *page 16*.

#### Planned Outcomes to be Accomplished by the Southeast DEWS in 2022-2025

#### NETWORK COORDINATION AND INTEGRATION

The SE DEWS network is strengthened by improving the exchange of best practices, lessons learned, and peer-to-peer exchanges to build drought resilience across the region.

Coordination and communication before, during, and after a drought is improved through network collaboration and sharing.

#### DROUGHT PREDICTIONS AND FORECASTING

Drought forecast information is effectively communicated to, and utilized by, stakeholders across the Southeast.

Forecasts are improved by incorporating unique characteristics of Southeast drought into existing products and services.

Hydrologic forecasts are improved by advances in monitoring and modeling.

#### Planned Outcomes to be Accomplished by the Southeast DEWS in 2022–2025

#### DROUGHT OBSERVATIONS AND MONITORING

Observational data in the region are expanded and improved to address data gaps and utilized to inform applications for drought early warning across a range of sectors.

Drought impact reporting through available and new mechanisms are expanded and utilized to better understand on-the-ground conditions and to assist in decision making.

Drought monitoring and indicator products are improved and/or expanded to better reflect the needs of the Southeast region.

Southeast conditions are accurately reflected in the U.S. Drought Monitor through strengthened state and regional collaboration and input.

#### **DROUGHT PLANNING AND PREPAREDNESS**

Drought risks are reduced through the development of tailored guidance on how to proactively plan for and prepare for drought in different sectors.

States and communities are prepared for future droughts with updated drought, water, and hazard plans for response and communication.

Adaptation strategies to minimize drought risk are understood and implemented.

Drought is better incorporated into long-term resilience planning in the context of multiple hazards facing the region.

#### DROUGHT COMMUNICATION AND OUTREACH

Awareness and utilization of drought information relevant to the Southeast are increased, with processes to integrate user feedback into different stages of product development.

Capacity across the region is improved through training and learning opportunities on tools and products relevant to the Southeast region.

#### INTERDISCIPLINARY RESEARCH AND APPLICATIONS

Planning for future droughts is improved through research to understand vulnerability in the Southeast.

Drought impacts on ecosystems and human health are better understood, to inform drought, water, and natural resource actions.

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### The National Integrated Drought Information System & the Southeast Drought Early Warning System

#### 2.1 NATIONAL INTEGRATED DROUGHT EARLY WARNING SYSTEM

In 2006, the National Integrated Drought Information System (NIDIS) was created by Congress with a mandate for interagency coordination and integrated drought research that builds upon existing federal, tribal, state, and local partnerships to create a National Drought Early Warning System (DEWS). Recognizing that drought characteristics and impacts vary across the country, NIDIS is working toward this goal by developing a network of regional DEWS across the nation (*Figure 1*). These regional DEWS utilize existing networks to make climate and drought science readily available, easily understandable, and usable; and to improve regional capacity to respond to and cope with drought.

A regional DEWS is supported by stakeholders, composed of relevant partners and community members across the region, including universities, the private sector, and federal, tribal, state, and local entities. Stakeholders participate in the NIDIS consultation process and they support NIDIS priorities by leveraging existing resources, programs,

**WHAT IS NIDIS?** The National Integrated Drought Information System (NIDIS) is a multi-agency partnership that coordinates drought monitoring, forecasting, planning, and information at national, state, and local levels across the country with a mission to improve the nation's capacity to proactively manage drought-related risks. Congress created NIDIS in 2006 (Public Law 109-430) with a mandate for interagency coordination and integrated drought research that builds upon existing federal, tribal, state, and local partnerships to create a national drought early warning system (DEWS). The program was reauthorized in 2014 (Public Law 113-86) and again in 2019 (Public Law 115-423).



### **DROUGHT EARLY WARNING SYSTEM**

Early warning is the provision of timely and effective information that allows individuals exposed to a hazard to act to avoid or reduce their risk and prepare for effective response. In the case of drought, **five components have been identified as necessary for drought early warning** (*Figure 2*). In order for these systems to be successful, they must support

**WHAT IS A DROUGHT EARLY WARNING SYSTEM (DEWS)?** A DEWS utilizes new and existing networks of federal, tribal, state, local, and academic partners to make climate and drought science accessible and useful for decision makers; and to improve the capacity of stakeholders to monitor, forecast, plan for, and cope with the impacts of drought.

efforts to understand past, present, and future conditions, and to plan proactively and respond using an adaptive management process that applies learning to improve future outcomes. Activities and actions in one component inform those in other components, and in the early warning system itself, there is feedback and learning that informs and improves the system over time.

### 2.3 BRINGING IT TOGETHER ACROSS REGIONAL AND NATIONAL SCALES

NIDIS employs a systems approach to identify gaps, foster collaboration, facilitate information flow and informed decisions, and integrate the five components of drought early warning both across and within regional DEWS. The regional DEWS provide a foundation on which a national early warning system rests (Figure 3). Regional gaps, needs, and input are incorporated into national products and processes. Initiatives that cross DEWS boundaries, or are larger than any single regional DEWS, are elevated to be addressed holistically by NIDIS and partners at a national scale. This includes complex issues such as the close relationship between drought and wildland fire or drought and public health, which require larger investments in research and targeted decision support tools. In the same way, these national efforts, products,



Figure 3: This diagram illustrates the regional DEWS as the foundation of a national DEWS and how the needs of the regions inform activities at the national level and how learning is shared across the components of the system. Credit: NOAA NIDIS, Fiona Martin

and learning can be assessed for relevance, validated, tailored, and then incorporated into the regional DEWS. It is this cross-scale exchange of information and learning that helps to improve our capacity for early warning across diverse sectors of the economy.

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### **The Southeast DEWS**

### **3.1 LAUNCHING THE SOUTHEAST DROUGHT EARLY WARNING SYSTEM**

The Southeast region (*Figure 4*) contains diverse climates and boasts tremendous diversity across both the natural environment and the people living in the region. Climate and weather patterns vary across the region and can be prone to extreme events such as thunderstorms, tornadoes, and tropical storms. The Southeast region generally receives substantial precipitation and is often considered water-rich. However, the region is increasingly experiencing record-breaking droughts such as in 2006–2008 and 2011–2012, which has elevated the awareness of competing water demands. Drought conditions can develop rapidly in the Southeast especially when the lack of rain and high



Figure 4: Location and spatial extent of the Southeast Drought Early Warning System (DEWS). Credit: NOAA NIDIS, Fiona Martin temperatures combine to increase evapotranspiration of water in the soils.

Over the course of NIDIS's first 10 years, several regional DEWS were formed to test new approaches for drought early warning and to transfer lessons learned to other regions; over time building a distributed national DEWS. Two of these DEWS were located in the Southeast region. Recurring droughts in 2009 led NIDIS to establish the Apalachicola-Chattahoochee-Flint (ACF) River Basin Drought Early Warning System (DEWS) because of the breadth and complexity of the Basin's ongoing water management challenges. The Coastal Carolinas DEWS was established in 2012 following a series of droughts that exposed existing and emerging drought vulnerabilities that are particular to coastal regions.



#### **3.2 PROGRESS FROM PREVIOUS DEWS IN THE SOUTHEAST REGION**

The following table summarizes some of the key outcomes and progress that has been made by partners from the preceding ACF and Coastal Carolina DEWS strategic plans. This is not an exhaustive list, but it provides a sense of how drought early warning capacity was enhanced in the region through a DEWS network and targeted investments in this region.

#### Key Outcomes and Progress from the previous ACF and Coastal Carolina DEWS

#### DROUGHT PREDICTIONS AND FORECASTING

Improved understanding of climate variability impacts on drought and incorporated climate change scenario simulations to analyze future droughts in the Southeast.

Improved forecasting of the South Carolina Blue Crab Fishery.

#### DROUGHT OBSERVATIONS AND MONITORING

Assisted coastal zone fire risk monitoring and management by expanding soil moisture monitoring in coastal North Carolina.

Improved understanding and information about drought impacts and risks within the broader hydroclimate context (droughts and floods) with the *Carolinas Precipitation Patterns and Probabilities Atlas*.

Increased drought impact reporting through Community Collaborative Rain, Hail, and Snow (CoCoRaHS) Condition Monitoring.

#### Key Outcomes and Progress from the previous ACF and Coastal Carolina DEWS

#### DROUGHT PLANNING AND PREPAREDNESS

Expanded access and utilization of drought information in the ACF by setting up the need and identifying components for a new ACF Drought Dashboard.

Developed a Sustainable Water Management Plan (SWMP) led by the ACF Stakeholders, which represents the first water management plan for the entire ACF Basin.

DROUGHT COMMUNICATION AND OUTREACH

Expanded dissemination and use of drought information through a long-standing ACF Drought and Water Monthly Webinar Series.

Improved drought communications for North Carolina decision-makers.

Improved understanding of drought and climate processes in the ACF through the development of targeted educational modules and fact sheets.

#### DROUGHT INTERDISCIPLINARY RESEARCH AND APPLICATIONS

Improved ability to plan for future droughts through targeted climate and water research projects.

Improved drought monitoring at the freshwater–saltwater interface through the development of a new Coastal Salinity Index (CSI).

Recognizing a need to improve drought early warning across the full geographic footprint of the Southeast, and in response to requests from regional stakeholders, NIDIS launched a newly expanded Southeast Drought Early Warning System (DEWS) in 2020. This 2022– 2025 Southeast DEWS Strategic Action Plan intends to build on the partnerships and successes from the ACF and the Coastal Carolinas DEWS, while replacing these two DEWS with a larger geographic footprint that allows for enhanced information sharing across this unique region.

# 4

### The Southeast DEWS Strategic Action Plan

### **4.1 PURPOSE AND INITIAL PRIORITY AREAS**

The purpose of the 2022–2025 Southeast DEWS Strategic Action Plan is to clearly articulate jointly identified information needs, set priorities for the DEWS network, and suggest measurable actions to improve drought early warning and preparedness for the region. This Plan is intended to be a resource document that provides a snapshot of the current needs and gaps of drought early warning in the Southeast and can be used to inform future activities by Southeast DEWS partners with the needs of the region.

This 2022–2025 Southeast DEWS Strategic Action Plan was developed following a series of stakeholder meetings held virtually between October 2020 to March 2021, and an assessment of drought information gaps and needs identified through previous workshops and strategies. The virtual meetings included targeted dialogues around flash drought, agriculture planning, regional coordination, and ecosystem impacts. Through this consultative process with regional partners, which included a public review, the following was identified to guide the work of the Southeast DEWS network over the next five years:

- Four key priority areas
- A series of desired outcomes and recommended actions for each outcome, organized by the five components of a DEWS.

This 5-year *Strategic Action Plan* will be in effect from 2022 through 2025. The plan is considered a "living document" that can be adjusted to address emerging issues as needed, based on input received from annual Southeast DEWS meetings and other network mechanisms.



Solution hole holding scarce water in severe drought in Everglades National Park, Florida in early summer. Credit: Francisco Blanco



#### **4.2 FOUR KEY SOUTHEAST DEWS PRIORITIES FOR 2022–2025**

- **1. Coordination and Knowledge Exchange:** Enhance the exchange of information and approaches through collaborative efforts among national, tribal, state, and local partners and between DEWS regions. This will help strengthen drought awareness, communication, collaboration, preparedness, and resilience across the Southeast.
- 2. Early Warning Information: Improve early warning to droughts in the Southeast, particularly rapid onset (flash) droughts, by building an understanding of the drought indicators/indices used in the Southeast to better demonstrate their value, limitations, and sector-specific, seasonal, and geographical applications. This will help both providers and users focus on information that is important to the region and specific decisions, to better inform drought preparedness and action.
- **3. Understanding Drought Impacts and Risk:** Increase our comprehensive understanding of drought impacts across key sectors [e.g., ecosystems, human health, fire management, agriculture] to inform future research needs, management practices, and adaptation planning. This will allow decision-makers to take a more holistic view when planning and responding to drought.
- **4. Providing Solutions for Drought Resilience:** Identify proactive measures and provide actionable information that can be taken before or during the development of drought to build resilience and strengthen drought response, with a focus on management decisions in the context of the region's multiple hydroclimate extremes.

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### Planned Outcomes & Recommended Activities for 2022–2025

This Plan is organized around the five components of a drought early warning system (*see Figure 2, page 9*). Each DEWS component has (1) desired outcomes that the Southeast DEWS network and its partners will focus on, and (2) a recommended suite of activities to help accomplish each outcome. The activities listed below were developed in consultation with stakeholders as a means to identify concrete, measurable actions that address key information gaps in the region. They are intended to be accomplished in partnership with stakeholders in the region. NIDIS may take a leadership role in some activities, while other partners will lead and/or contribute their efforts in other activities (see *Appendix 1*).

### 5.1 SOUTHEAST DEWS NETWORK COORDINATION AND INTEGRATION

Networks and partnerships require time and attention to be maintained and to grow. The need exists to support partners, convene the network around various drought-related topics, and provide opportunities to share information and key lessons within and across the DEWS.



Aerial view of planted fields and irrigation equipment in Homestead, Florida on a sunny winter morning. Credit: Francisco Blanco

### Outcome 1.1: The SE DEWS network is strengthened by

improving the exchange of best practices, lessons learned, and peer-to-peer exchanges to build drought resilience across the region.

<u>Activity 1.1a:</u> Hold annual DEWS partner meetings, alternating between broader region-wide discussions (2022, 2024) and targeted smaller thematic discussions

(2023), and held in conjunction with partner events as appropriate.

<u>Activity 1.1b</u>: Use other federal, tribal, state, and professional association meetings as an opportunity to consult with and engage new partners in the DEWS and encourage collaboration, coordination, and regular two-way communication.

<u>Activity 1.1c:</u> Hold regular discussions amongst National Weather Service entities in the region to further improve drought communication and information dissemination in the region.

<u>Activity 1.1d:</u> Share information through the U.S. Drought Portal and other SE DEWS communications about state and regional activities, and funding opportunities related to drought.

### Outcome 1.2: Coordination and communication before, during, and after a drought is improved through network collaboration and sharing.

<u>Activity 1.2a:</u> NIDIS will coordinate the messaging and dissemination of regional drought information during a drought, as deemed necessary by the DEWS partners.

<u>Activity 1.2b:</u> NIDIS will coordinate and support post-drought assessments in the Southeast in partnership with the DEWS network, as deemed necessary by the character, duration, or impact of drought.

<u>Activity 1.2c:</u> NIDIS will support additional regional or subregional activities (webinars, workshops, briefings, etc.), as deemed necessary by the DEWS partners.

<u>Activity 1.2d:</u> NIDIS will continue to co-organize the Southeast Monthly Webinar Series, in partnership with the Southeast Regional Climate Center and the National Weather Service, to provide region-wide early warning information on drought.



Water gauge showing historically low water level during drought. Chattooga River, Georgia and Florida. Credit: JayL

### 5.2 PREDICTIONS AND FORECASTING

While larger national efforts are aimed at improvements in areas such as subseasonal to seasonal (S2S) forecasting, there are things that can be done with SE DEWS partners to better understand and communicate drought predictions in a regional context and make this information more accessible and useful across the region.

### Outcome 2.1: Drought forecast information is effectively communicated to, and utilized by, stakeholders across the Southeast.

<u>Activity 2.1a</u>: Develop effective, simple, and targeted communication materials that include confidence and uncertainty, to help different sectors understand long-term forecasts and outlooks in the context of their planning decisions.

<u>Activity 2.1b:</u> Conduct a series of drought-fire workshops to improve the incorporation of drought forecasts and indicators into wildland fire products where appropriate, including prescribed burn management. This will build on the NIDIS Drought and Wildland Fire Nexus Strategy and other regional efforts.

### Outcome 2.2: Forecasts are improved by incorporating unique characteristics of Southeast drought into existing products and services.

<u>Activity 2.2a:</u> Conduct research to better capture rapid-onset (flash drought) and termination in the Southeast, such as utilizing regional dynamic vegetation models, soil moisture, and remote sensing expertise to improve forecast products development.

<u>Activity 2.2b</u>: Utilize the SE DEWS network as a platform for two-way communication with the NOAA Climate Prediction Center, to provide regional feedback on operational product development.

### Outcome 2.3. Hydrologic forecasts are improved by advances in monitoring and modeling.

<u>Activity 2.3a:</u> Work towards enhancing probability based rainfall and streamflow forecasts, including the implementation of the NWS Hydrologic Ensemble Forecast Service (HEFS) across the Southeast.

<u>Activity 2.3b:</u> Conduct research to improve regional hydrological modeling, forecasting, and water budgets.

<u>Activity 2.3c:</u> Improve the access to reservoir and water information, to better inform water supply decisions during a drought.

### **5.3 OBSERVATIONS AND MONITORING**

There is a general consensus that more in situ measurements, especially of soil moisture, are needed across the Southeast. This need can be accomplished through the continued support of existing stations and networks, in addition to new stations being deployed in areas lacking coverage. Improved understanding of indicators most reflective of Southeast characteristics, and additional drought condition monitoring, can further assist in ongoing drought monitoring efforts across the region.



Apalachicola National Forest, located in the Florida panhandle. Credit: Jacob Boomsma

#### Outcome 3.1. Observational data in the region are expanded and improved to address data gaps and utilized to inform applications for drought early warning across a range of sectors.

Activity 3.1a: Expand network coverage of in-situ soil moisture data in the region through the assessment and utilization of lowcost sensors and apply this data to agriculture tools, with an initial focus on Alabama, Florida, and Georgia.

<u>Activity 3.1b:</u> Ensure that DEWS partners are connected to regional and national monitoring networks (e.g., National Coordinated Soil Moisture Monitoring Network Strategy, USFS Forest Soil Moisture Monitoring Network, USGS WaterWatch System) to exchange recommendations and best practices for existing and new stations, and to strengthen mesonet networks.

<u>Activity 3.1c:</u> Understand key gaps in Southeast precipitation monitoring, including remote sensing data, to identify where additional stations are needed at the county and local levels. Determine how ongoing programs and initiatives might be leveraged to meet these needs holistically.

<u>Activity 3.1d:</u> Expand datasets, such as streamflow statistics, to better track drought onset or termination.

# Outcome 3.2. Drought impact reporting through available and new mechanisms are expanded and utilized to better understand on-the-ground conditions and to assist in decision making.

<u>Activity 3.2a:</u> Conduct an assessment on the status of condition monitoring and drought impact reporting in the Southeast and share best practices and approaches.

<u>Activity 3.2b:</u> Establish targeted communications and discussions through agricultural extension and other trusted networks on the importance of consistent impact reporting, to increase reporting before and during drought.

<u>Activity 3.3c:</u> Recruit new networks of citizen and expert observers to submit condition monitoring reports and/or drought impacts through available mechanisms such as NDMC's Condition Monitoring Observer Reports (CMOR), CoCoRaHS Condition Reporting, and other individual state-based impact reporting efforts. In addition to agriculture, outreach should address less-reported impacts such as human health, ecosystems, and longer-term impacts.

<u>Activity 3.4d:</u> Conduct research and activities to understand how quantitative impact information can be utilized to inform triggers and decisions.

### Outcome 3.3. Drought monitoring and indicator products are improved and/or expanded to better reflect the needs of the Southeast region.

<u>Activity 3.3a:</u> Identify the most effective drought indicators for specific types of drought monitoring in the Southeast (e.g., hydrological, agricultural, ecological, and rapid-onset/flash drought) at different times of the year, for going into and coming out of a drought. Use this to refine communications when conditions are setting up for potential drought.

<u>Activity 3.3b</u>: Determine if the reliability of drought indicators has changed over time and if there is a need to explore new indicators in the context of climate change and regional water use.

#### Outcome 3.4. Southeast conditions are accurately reflected in the U.S. Drought Monitor through strengthened state and regional collaboration and input.

<u>Activity 3.4a:</u> Exchange state-level approaches and share lessons from previous droughts related to monitoring and communicating drought conditions.

<u>Activity 3.4b:</u> Continue to strengthen formal and informal collaborative mechanisms between states for weekly U.S. Drought Monitor input.

<u>Activity 3.4c:</u> Update and improve the NDMC state drought impact tables by working with state agencies and other state partners.



Cypress trees and their roots and knees on banks of Fisheating Creek, Florida. Credit: Francisco Blanco

### 5.4 PLANNING AND PREPAREDNESS

Southeast DEWS partners are very interested in planning and preparedness efforts to build long-term resilience. This includes efforts to effectively communicate what needs to be done both before and during a drought to mitigate risks in different sectors. Partners in the Southeast DEWS also identified a need to frame drought planning in the context of a region that frequently deals with too much water.

## Outcome 4.1: Drought risks are reduced through the development of tailored guidance on how to proactively plan for and prepare for drought in different sectors.

<u>Activity 4.1a:</u> Produce tailored regional planning products and guides that will help farmers proactively plan for and prepare for drought.

<u>Activity 4.1b:</u> Understand the decision points of various sectors and use this knowledge to help information providers better target their drought communications, with an initial focus on agricultural decisions.

<u>Activity 4.1c:</u> Improve the incorporation of relevant drought information into existing sector-based decision products and tools, such as AgroClimate.

<u>Activity 4.1d:</u> Increase efforts to encourage water conservation practices as a mechanism to mitigate drought risk before and during a drought.

### Outcome 4.2: States and communities are prepared for future droughts with updated drought, water, and hazard plans for response and communication.

<u>Activity 4.2a:</u> Share approaches and advance efforts on how to best integrate proactive drought planning with hazard, water, and land use planning.

<u>Activity 4.2b:</u> Utilize drought scenario exercises (tabletop exercises) to inform drought early warning and preparedness in the region, especially during non-drought times, to inform communication pathways and actions to prepare for the next drought.

### Outcome 4.3: Adaptation strategies to minimize drought risk are understood and implemented.

<u>Activity 4.3a:</u> Conduct research to assess the role of specific actions (e.g., conservation, hydrologic restoration, irrigation) on future drought risk mitigation.

<u>Activity 4.3b</u>: Educate and encourage drought-resilient practices that provide co-benefits and resilience to other extremes such as floods (e.g., hydrological restoration and green infrastructure).

<u>Activity 4.3c:</u> Incorporate and encourage the health of soils in drought planning for agricultural landscapes.

<u>Activity 4.3d:</u> Assess how forest management and other practices can reduce the impact of droughts on ecosystems.

### Outcome 4.4: Drought is better incorporated into long-term resilience planning in the context of multiple hazards facing the region.

<u>Activity 4.4a:</u> Conduct research and share solutions across locations and sectors on approaches utilized in planning for multiple extremes (including drought/flood flip flops) in the Southeast.

<u>Activity 4.4b:</u> Identify and share current methodologies for drought vulnerability assessments and how to utilize this information to inform multi-hazard planning activities (e.g., Agricultural Resource Management Plans, Integrated Resource Management Plans, All-Hazard Mitigation Plans, river basin planning).



Aerial view of Museum Park and residential towers in Miami, Florida. March 20, 2021. Credit: Francisco Blanco

### 5.5 COMMUNICATION AND OUTREACH

Future droughts will allow for the application of the SE DEWS network in supporting state and regional communication and outreach activities, in particular those that are tailored to specific audiences. There is also a desire to use the network to provide training on various products and tools and to improve communication with the public.

### Outcome 5.1: Awareness and utilization of drought

### information relevant to the Southeast are increased, with processes to integrate user feedback into different stages of product development.

<u>Activity 5.1a</u>: Identify key audiences that use drought information for decisions and planning, and understand which communication channels are most effective for each target group. Apply this knowledge to improve drought communication and messaging at appropriate sector and geographic scales.

<u>Activity 5.1b</u>: Develop and support web portals where stakeholders can find timely, relevant, and authoritative drought information. This includes national (e.g., U.S. Drought Portal/Drought.gov, USGS National Water Dashboard), regional (e.g., ACF Drought and Water Dashboard, Southeast Regional Climate Center), and state-level climate and drought portals.

<u>Activity 5.1c</u>: Assess effective communication approaches for rapid-onset (flash) drought in the Southeast that incorporates specific sector impacts.

# Outcome 5.2: Capacity across the region is improved through training and learning opportunities on tools and products relevant to the Southeast Region.

<u>Activity 5.2a</u>: Provide continued training opportunities and tailored communication products for the U.S. Drought Monitor and other key drought information products and tools.

<u>Activity 5.2b</u>: Scale up lessons learned and effective strategies from previous drought communication efforts that address barriers in drought communication, including how to communicate during rapidly changing conditions.

### 5.6 INTERDISCIPLINARY RESEARCH AND APPLICATIONS

Additional research is needed to better understand the role of drought on natural ecosystems and other overlooked sectors. Southeast DEWS partners are also very interested in research that helps the region understand what droughts in the future may look like and how to incorporate this information into drought planning and communication.



Low water level during drought conditions at Lake Lanier, Georgia. Credit: Sandra Burm

#### Outcome 6.1: Planning for future droughts is improved through research to understand vulnerability in the Southeast.

<u>Activity 6.1a:</u> Conduct regional level research in both urban and rural settings to improve understanding of drought vulnerability in the context of future climate, population, and land-use scenarios.

<u>Activity 6.2b</u>: Evaluate and communicate the potential implications of climate change and variability for specific drought-sensitive uses in the Southeast including water management, agriculture, and environmental needs.

<u>Activity 6.3c:</u> Evaluate water availability and use to meet social and ecological needs in the Southeast, in the context of competing water demands and future droughts.

<u>Activity 6.3d</u>: Develop a better understanding of the socio-economic impacts of drought in the SE, and communicate this information to inform adaptation and drought planning.

### Outcome 6.2: Drought impacts on ecosystems and human health are better understood, to inform drought, water, and natural resource actions.

<u>Activity 6.2a:</u> Synthesize and assess available information on drought impacts on terrestrial and aquatic ecosystems in the Southeast, to inform future information needs.

Activity 6.2b: Understand what species populations and habitats are more at risk than

others to future droughts and incorporate this into strategies for species management and habitat restoration.

<u>Activity 6.2c:</u> Conduct research to better understand the interaction of water supply and water quality during and following low-flow conditions.

<u>Activity 6.2d:</u> Improve the incorporation of ecosystem characteristics into the current suite of drought indicators by translating conventional indicators in a natural resource management context or developing new metrics where identified.

<u>Activity 6.2e:</u> Enhance the USGS Coastal Salinity Index (CSI) as a drought monitoring tool that was developed out of the Coastal Carolina DEWS through research on CSI applications for coastal resource decision making and expanding the CSI geographic coverage across the Southeast region.

<u>Activity 6.2f</u>: Conduct an assessment of the linkages between drought and human health vulnerabilities in the Southeast (e.g., mental, animal and ecosystem health), and utilize this assessment to increase awareness of drought impacts to the public health community and identify information needs at the drought–human health interface. 6

### Linking Outcomes to Priorities

Given that the outcomes and activities in the Plan are organized by DEWS components, it might be difficult to discern at first glance how they contribute to the four key priorities. The table below indicates how the outcomes are linked with the four priorities:

- **Priority 1, Coordination and Knowledge Exchange:** Enhance the exchange of information and approaches through collaborative efforts among national, tribal, state, and local partners and between DEWS regions.
- **Priority 2, Early Warning Information:** Improve early warning of droughts in the Southeast, including rapid onset (flash) droughts, by building an understanding of the drought indicators/indices used in the Southeast to better demonstrate their value, limitations, and sector-specific, seasonal, and geographical applications.
- **Priority 3, Understanding Drought Impacts and Risk:** Increase our comprehensive understanding of drought impacts across key sectors [e.g., ecosystems, human health, fire management, agriculture] to inform future research needs, management practices, and adaptation planning.
- Priority 4, Providing Solutions for Drought Resilience: Identify proactive measures and provide actionable information that can be taken before or during the development of drought to build resilience and strengthen drought response, with a focus on management decisions in the context of the region's multiple hydroclimate extremes.



A prescribed burn in Rock Springs Run State Reserve in Florida. Credit: Joe C. Tabb

Mapping Outcomes to Priorities in the SE DEWS Strategic Action Plan				
OUTCOME	PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4
1.1	X	X		
1.2	X	x	x	
2.1	X	x		
2.2	X	x		
2.3	X	X		
3.1	X	x	x	
3.2	X	X	X	
3.3	X	X	x	
3.4	X	X	x	
4.1	X			X
4.2	X	X		X
4.3	X		x	X
4.4	X		x	X
5.1	X	X	X	
5.2	X	X	X	
6.1	X	X	X	X
6.2	X		X	X
6.3	X		X	



Aerial view of Apalachicola, Florida. Credit: Jacob Boomsma

### Linking National & Cross-DEWS Initiatives

NIDIS has implemented regional DEWS as the foundation on which to provide national drought early warning, in recognition that impacts and early warning information differ across the regions. There are also challenges that cross multiple regions or require a coordinated effort at the national level. These include issues like the complex interactions of drought and wildland fire, drought and human health, tribal engagement, drought impact reporting, and analysis, linking drought triggers and indicators, understanding a healthy water cycle and healthy soil, and soil moisture monitoring. Regional DEWS has the ability to tap into national initiatives where there is interest and need, again providing an opportunity for cross-regional and scalable (regional to national) learning and progress. The table below illustrates some of these linkages as they apply in the Southeast region.

National/Cross- DEWS Initiatives	Northeast DEWS Activities
Weather Research and Forecasting Innovation Act of 2017 (Weather Act)	The Weather Act calls for NOAA to prioritize weather research in part to improve forecasts and warnings for the protection of life and economy, to improve understanding of forecast capabilities for atmospheric events and their impacts, and to make reliable and timely foundational forecasts of subseasonal (2 weeks – 3 months) to seasonal (3 months to 2 years) forecasts of temperature and precipitation. While there are many other initiatives included in the Weather Act, these are the areas that NIDIS also has a strong interest in, in terms of drought early warning. NIDIS is making and leveraging investments in regards to the same temporal scale as they apply to drought in partnership with the NWS regional and local forecast offices, the Climate Prediction Center, and the Office for Oceanic and Atmospheric Research.
Water Prediction Center/NOAA Water Initiative	NOAA has multiple efforts aimed at water security that NIDIS plays a role in. The Water Initiative aims to improve the Nation's water security by providing science-based information and services that address vulnerability to water risks and enable greater efficiency and effectiveness in the management of water resources. NOAA will advance this mission primarily through transforming integrated water prediction services in collaboration with decision-makers, partners, and users. In addition, the Water Prediction Center focuses on collaborative research to inform essential emergency management and water resources decisions across all time scales. NIDIS is involved in efforts to enhance drought prediction and monitoring, looking at applications of the National Water Model to drought early warning and serving as part of these initiatives where they intersect with drought.
Tribal Engagement Strategy	NIDIS's Tribal Engagement Strategy was originally written for the Missouri River Basin (MRB) and the Midwest DEWs but is starting to be applied nationally. The principles of engagement that are enumerated in the Tribal Engagement Strategy can help the Southeast DEWS engage with the tribal nations of the Southeast region in a meaningful way.
National Coordinated Soil Moisture Monitoring Network (NCSMMN)	There is a clear need for increased observation network coverage in the Southeast. Current efforts in the Southeast to identify cost-effective methodologies and connect to applications will have impactful applications within the region, and will benefit from engagement in the area linked to the National Coordinated Soil Moisture Monitoring Network Strategy.

National/Cross- DEWS Initiatives	Northeast DEWS Activities
NIDIS Drought and Wildland Fire Nexus Strategy (NDAWN)	The Western Regional Climate Center, Desert Research Institute, and NIDIS partnered to form the Drought and Wildland Fire Nexus (NDAWN) to identify priorities and actions to improve products and communication in the drought and fire communities. NDAWN defines the needs and challenges of fire managers to effectively utilize drought information and aims to meet those needs to establish a robust drought and wildland fire decision-support information network. There is a desire to expand the geographic coverage of this Strategy to better incorporate prescribed burning practices common in the Southeast.
NIDIS "Coping with Drought" Grant Competition	NIDIS uses the "Coping with Drought" federal funding opportunity to address research needs gathered through the consultative process within the DEWS. The outcomes of applied research funded through the CWD program will be transferred to the DEWS. For example, the FY22 competition focuses on applied research for ecological drought which aligns with Priority 3 and 4 in the Southeast.
Drought and Human Health	NIDIS is engaged in developing a Drought and Human Health Strategy. There are opportunities to build on those opportunities identified from a Carolinas-focused 2021 virtual discussion.
Drought Impact Reporting and Analysis	NIDIS is involved in efforts nationally to improve reporting and analysis that can inform what is happening at the state and region. This is of high interest to the Southeast DEWS.
Improving Indicator Use and Linking to Triggers	A common refrain from partners across all the DEWS is the desire to better understand which indicators and indices should be used for a region/state both spatially and temporally as well as for different sectors. There are national efforts and international efforts underway to answer these questions, and outputs could be utilized in the Southeast.
Flash Drought	More research is needed to better define flash drought, fully capture flash drought impacts, and determine research needs. On December 1–3, 2020, NIDIS hosted a virtual Flash Drought Workshop to examine flash drought definitions and to coordinate and co-develop a research pathway to address the management and response challenges associated with flash drought. This is a key area of interest for the Southeast.



#### **7.1 LINKAGES TO REGIONAL PARTNERS AND INITIATIVES**

NIDIS has a mandate to work across the federal government, coordinating drought-related activities with other federal agencies, and build upon and leverage existing partnerships, networks, and initiatives. This is especially important in the regional DEWS where these partners and regional organizations are key to realizing success in the region.

In the Southeast, key regional partners include the USDA Southeast Climate Hub, the Department of the Interior Southeast Climate Adaptation Science Center, the NOAA Southeast River Forecast Center, the Southeast Regional Climate Center, the National Weather Service Southern and Eastern Region Headquarters, and the USGS Water Science Centers. The activities above include several places where linkages are being made with these regional partners and programs. Additional partners, programs, assistance, and activities offer additional beneficial linkages that can be developed and built upon to identify more resources, to work across more agencies, to leverage more partnerships, and to utilize more assistance that will result in more efficiency and effectiveness of everyone's contributions and increase co-benefits.

### Appendix 1: Partners

The development of this Southeast DEWS Strategic Action Plan and its associated implementation reflects the knowledge and experience of dedicated individuals, organizations, and partners. Collaboration is the key to improving drought early warning capacity and long-term resilience through the implementation of the Southeast DEWS. This list of partners is not exhaustive and will evolve as new regional partnerships form.

Key Partner Agencies and Organizations
Alabama Department of Economic and Community Affairs
Auburn University
Environmental Protection Agency, Region 4
Florida Climate Center
Florida Department of Environmental Protection
Georgia Environmental Protection Division
Metro Atlanta Commission
National Drought Mitigation Center (NDMC)
National Oceanic and Atmospheric Administration (NOAA)
NWS Southern and Eastern Region
NWS Climate Prediction Center
Southeast Regional Climate Center
<ul> <li>National Center for Environmental Information, Regional Climate Services</li> </ul>
NWS Weather Forecast Offices
NWS Southeast Forecast Center

North Carolina State University

#### **Key Partner Agencies and Organizations**

South Carolina Department of Natural Resources

Tennessee Valley Authority

University of Georgia

- U.S. Department of the Interior (DOI)
  - U.S. Geological Survey (USGS) Water Science Centers
  - Southeast Climate Adaptation Science Center
- U.S. Department of Agriculture (USDA)
  - Southeast Climate Hub
  - Natural Resources Conservation Service (NRCS)
  - U.S. Forest Service (USFS)
- U.S. Army Corps of Engineers (USACE)

University of Alabama at Huntsville

University of Georgia

Virginia Department of Environmental Quality

### Appendix 2: Disclaimer

The Southeast DEWS Strategic Action Plan 2022–2025 is a collaborative federal, state, tribal, and local interagency effort to improve early warning capacity and resilience to drought in the Southeast. The contents of this plan should not be used as evidence against any Southeast DEWS state; any federally recognized tribe; or the federal government in any administrative, judicial, or other proceedings. 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 Southeast region. Nothing in the Plan is intended to, nor shall the Plan be construed so as to, interpret, diminish, or modify the rights of any Southeast state, any federally recognized tribe, or the Federal government under Federal or state law or administrative rule, regulation, or guideline.

Finally, all parties recognize that 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.



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Document prepared by NIDIS in partnership with key stakeholders in the region.