2021–2025

Southern Plains

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*).

1. Executive Summary

The development of the Southern Plains (SP) Drought Early Warning System (DEWS) was initiated in 2011 during a record-setting drought across the southern tier of the United States. From 2010–2015, drought persisted throughout parts of the region, impacting portions of Texas, Oklahoma, and New Mexico. This drought cost several billion dollars and was considered a major disaster for the region. Today, the Southern Plains region continues to face challenges brought about by drought and other extreme weather events that significantly affect communities and local economies. The Southern Plains DEWS provides leaders across sectors and levels of government with timely information on drought conditions, forecasted outlooks, and impacts to engender better informed and more timely decisions.

The Southern Plains DEWS 2021–2025 Strategic Plan is designed to set priorities and suggest measurable actions that can create value in this drought-prone region, with the ultimate goal of making stakeholders across the region more resilient during times of drought.

1.1 OVERVIEW OF THE 2021–2025 STRATEGIC ACTION PLAN

The 2021–2025 Strategic Plan was developed following a series of stakeholder meetings held virtually in October 2020. Each virtual meeting was focused on the needs of one of the following sectors: farming and cropping; livestock; water management; energy and industry; and forestry, ecology, and fire management. Attendees were asked about how drought impacted their lives, their jobs, and their businesses. They were then asked to identify gaps and needs in the drought information they use and need. The output from each of these meetings was combined and distilled to identify common themes across sectors and strongly emphasized points within sectors. These meetings were used to guide the priorities and activities that are highlighted in this Strategic Action Plan. It should be noted that this plan is intended to be a "living

WHAT IS NIDIS? In 2006 (Public Law 109-430), Congress authorized the National Integrated Drought Information System (NIDIS) 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 DEWS? A Drought Early Warning System (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.

document" that can evolve with the changing needs of people in the region. It is intended to become a resource document that provides a snapshot of the current needs and gaps of drought early warning in the SP DEWS, and can be used as a standard to objectively measure the alignment of future projects with the needs of the region. The three priority areas for the SP region for the next five years are:

1. Build resilience and mitigate economic, human health, ecological, and other costs of drought.
2. Deliver earlier warning of drought.
3. Improve or build a comprehensive understanding of drought impacts in the region.

More details on each of these priorities are given in Section 4.3.

The following table contains desired outcomes that the SP DEWS network will focus on, organized by components of a drought early warning system. More detailed information about these outcomes and the proposed suite of activities to help accomplish each one can be found in Section 4.5. Annual meetings will be used to reassess priorities and direct action within the DEWS during the life of the plan.

Planned Outcomes to be Accomplished by the SP DEWS
NETWORK COORDINATION AND INTEGRATION
The SP DEWS network is strengthened by improving drought communication and coordination.
Stronger network connections directly between the research community and primary producers, practitioners and decision makers.
New partnerships are built within the SP Region that enable the DEWS to reach currently underserved partners.
DROUGHT PREDICTIONS AND FORECASTING
Improved information about when drought will start and end, especially when it happens rapidly.
Drought predictions for ecological drought are available in the region.
Expanded and/or improved value-creating prognostic tools.
DROUGHT OBSERVATIONS AND MONITORING
Improved water quality and temperature monitoring that would be beneficial for public health, wetland, stream and river ecology, angling, energy and industry.
Monitoring station locations are known and gaps in coverage are addressed.
The US Drought Monitor (USDM) provides improved representation of local conditions and impacts.
DROUGHT PLANNING AND PREPAREDNESS

Planned Outcomes to be Accomplished by the SP DEWS
Drought plans within the region are tested and improved.
Farmers and other land managers are prepared to do maintenance/improvements on infrastructure (nature-based solutions, farm dams, ponds, irrigation ditches, etc.) during the next drought.
Progress is made toward mitigating the lingering impact to livestock producers who must reduce their herd during a drought.
DROUGHT COMMUNICATION AND OUTREACH
Natural resource managers, forest and ecosystem managers, and other land managers have access to improved, high-quality, and impactful drought outreach materials and management tools.
Drought and climate information is incorporated into tools that agricultural producers are already using.
Information on available drought information resources, how to access them, how to use them, etc. is readily available for the general public.
Forecast probability and forecast uncertainty is clearly communicated.
INTERDISCIPLINARY RESEARCH AND APPLICATIONS
Improved understanding of the regional propensity and vulnerability to drought now and in future climate scenarios on local, state and regional scales
The interaction between surface water and groundwater when in drought is quantified.
The suite of actions to prepare for and respond to drought that increase resilience over the long-term are understood and shared.
Data, products, and services are improved and/or expanded to better serve the region.

2. The National Integrated Drought Information System and the Southern Plains Drought Early Warning System

2.1 NATIONAL INTEGRATED DROUGHT EARLY WARNING SYSTEM

Congress created the National Integrated Drought Information System 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 has been reauthorized in 2014 (Public Law 113-86) and again in 2019 (Public Law 115-423). NIDIS is working toward this goal by developing a network of regional DEWS across the nation. 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, and partnerships. This relationship ensures a robust, "ground-up" regional DEWS that is well-networked and responsive to the specific needs of each region.

2.2 COMPONENTS OF A DROUGHT EARLY WARNING SYSTEM

Early warning is the provision of timely and effective information, through identified institutions, 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 (Figure 1) have been identified as necessary for drought early warning. In order for these systems to be successful, they must support efforts to understand past,

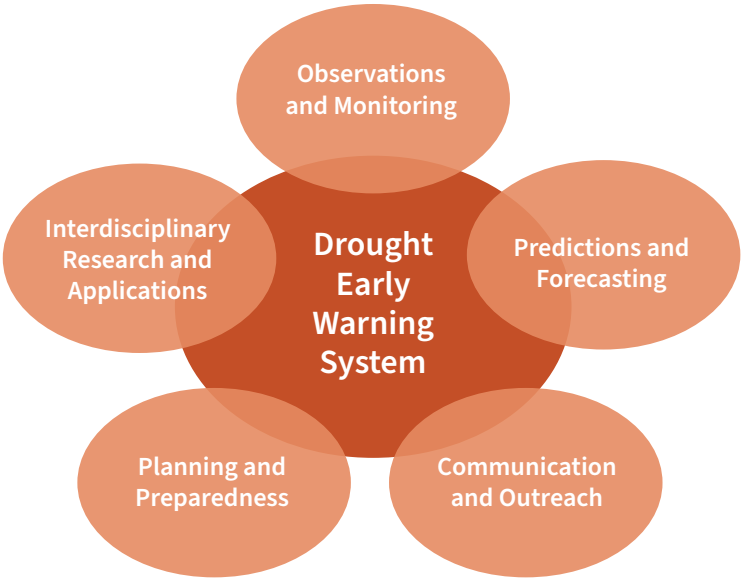

Figure 1: A Drought Early Warning System(DEWS) is made up of five components including: Predictions and Forecasting, Observations and Monitoring, Planning and Preparedness, Communications and Outreach, and Interdisciplinary Research and Applications. Credit: NOAA NIDIS, Fiona Martin

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 SCALES

NIDIS employs a systems, or holistic 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. This capitalizes on the strengths in part of the system to address needs in another. The regional DEWS provides a foundation on which a national early warning system rests (Figure 2). Regional gaps, needs, and input are incorporated into national products and processes. Initiatives that cross DEWS boundaries, or are larger than any one 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 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 national early warning across diverse sectors of the economy.

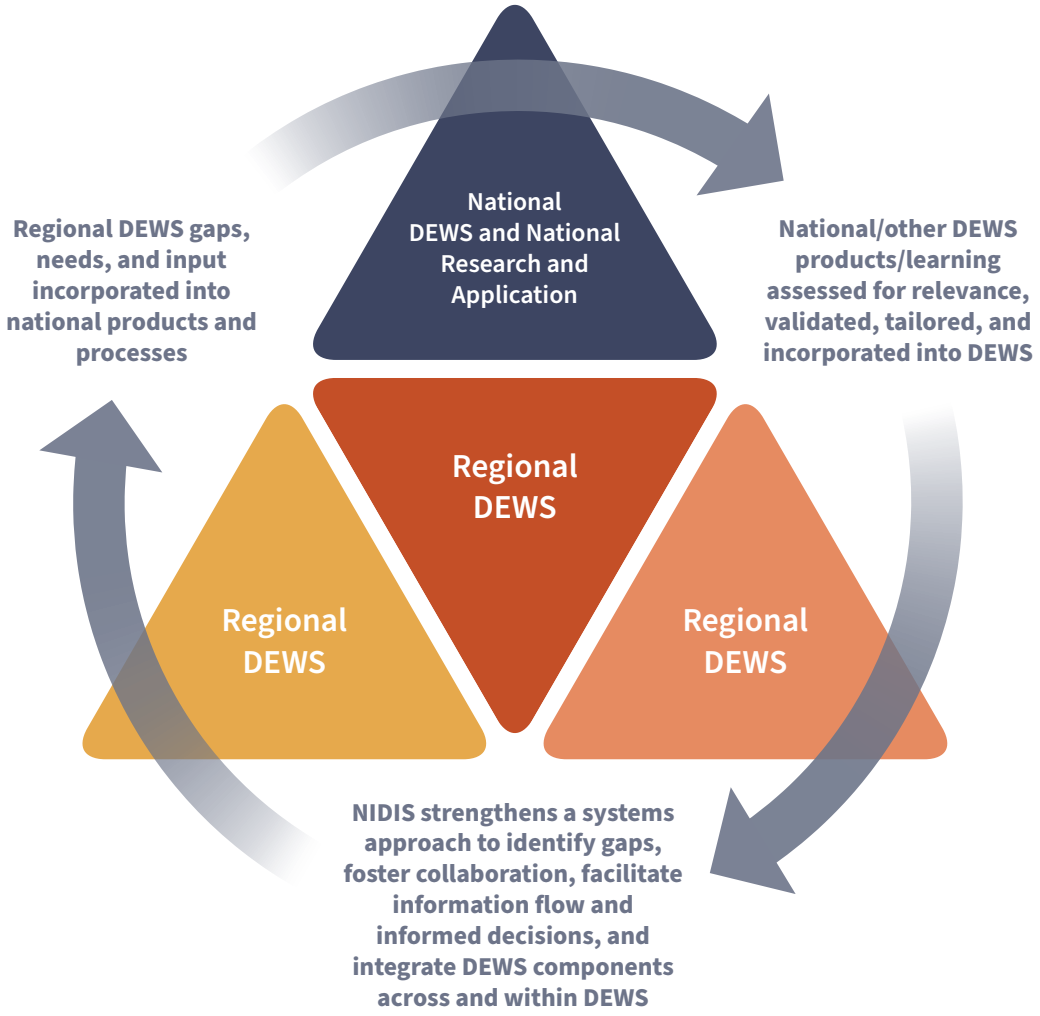

Figure 2: This diagram illustrates the regional DEWS as the foundation of a national DEWS and how the needs of the regions inform activities at the national level and how learning is shared across the components of the system. Credit: NOAA NIDIS, Fiona Martin

3. The Southern Plains DEWS

3.1 DROUGHT IN THE SOUTHERN PLAINS

The Southern Plains (SP) region contains diverse climates, such as the semi-arid region of the Texas and Oklahoma panhandles and western Kansas, the Chihuahuan Desert in southern New Mexico and Big Bend region of western Texas, and the hot, humid subtropical Gulf Coast. Weather across the region can change quickly; the region is prone to severe thunderstorms, tornadoes, and hurricanes in the summer, and snow and occasional blizzards in the winter.

The region is also prone to drought conditions regularly, including flash droughts that have a rapid onset. Since 1980 drought has cost between $20B and $50B in Texas alone. Drought in the Southern Plains can occur during any time of the year, but those that coincide with critical stages of crop growth can be especially costly. Drought can usually be identified by observing precipitation, temperature, and evapotranspiration together, as water can quickly leave the landscape during times of high evaporative demand. Other indicators include streamflow, soil moisture, and groundwater, and various derived indices for monitoring drought in the region.

In Texas and parts of Oklahoma, droughts closely align with the El Niño–Southern Oscillation climate pattern. Some of the driest years in Texas have been La Niña years, including the majority of years during the severe drought in the 1950's, the record-setting 2011–2015 drought, and the 2020–2021 drought. In most historical droughts, impacts are numerous across economic sectors and usually continue for a few years after the La Niña wanes. For example, the damage to grazing ranchlands during an intense drought can persist for several years. The purchase of supplemental feed to sustain a herd during times of drought can be unsustainable for the farm business. This was the most costly impact of the 2011–2015 drought to the agriculture industry in the region and will be a strong focus of activities in the SP for the 2021–2025 strategic plan. The same drought caused critical municipal water shortages and led to wildfire danger and other ecological impacts. Despite a few near-average water years, many of these impacts lingered until an El Niño pattern developed in 2015, which replaced drought with flooding rains.

Figure 3: Location and spatial extent of the Southern Plains (SP) Drought Early Warning System (DEWS). Credit: NOAA NIDIS, Fiona Martin

Often, the economic impact of drought lasts for several years after the drought ends. The economy of most rural and regional locations in the SP is primarily based on agriculture, mostly beef and wheat production. Purchasing feed for livestock is the most costly agricultural impact from drought in the region. Many producers will need to tap into feed or cash reserves to manage through the drought, which will take time to restore. Some farm businesses will need to access loans, which will take time to pay back. When a producer has to sell down their herd, it may take up to a decade to restore the herd to the same pre-drought size. Forage surplus in wet years is only partly a remedy for forage deficits in dry years as de- and re-stocking herds and building storage for feed is a lengthy and expensive process. The inherently slow response in herd management and projected increases in future climate variability may exacerbate the vulnerability of ranchers and make it more difficult for their operations to adapt and remain economically viable.

3.2 A SHORT HISTORY AND CONTEXT

The development of the Southern Plains Drought Early Warning System (DEWS) was initiated in 2011 during a record-setting drought across the southern tier of the United States. From 2010–2015, drought conditions persisted throughout parts of the region, impacting western portions of Texas and Oklahoma and eastern New Mexico as well as many other areas in these states.

The Southern Plains DEWS was launched to meet the diverse needs of stakeholders who needed information on drought conditions. Since its launch, drought decision support services have been developed by

partners in the region, including the monitoring of drought conditions, data analysis, planning and preparedness assistance, and many stakeholder engagement activities. The DEWS network has brought together decision-makers and resource managers from regional, state, and local entities, professional associations, independent farmers, and ranchers to proactively address drought risk.

3.3 SOUTHERN PLAINS DROUGHT EARLY WARNING SYSTEM PROGRESS TO DATE

The previous SP DEWS Strategic Plan from 2017–2018 focused on five priorities: (1) Foster Stakeholder Collaboration, Coordination, and Relationship Building; (2) Improve Drought Early Warning Outreach and Communication; (3) Support Research on Key Water Resources and Land Management Topics; (4) Improve the Application of Climate Forecasts; (5) Improve Drought Planning. Subsequent work around these priorities included several workshops, research projects, and webinars dedicated to drought resilience in the SP, the future of drought, improved drought communication, and water management. This 2021–2025 strategic plan intends to build on the strengths and previous accomplishments that have been achieved within the DEWS since its inception.

The following table summarizes some of the key outcomes and progress that has been made by partners in the SP DEWS (see Appendix 1) from the preceding strategic plan. This is not an exhaustive list, but it provides a sense of how drought early warning capacity was enhanced in the SP through the network in this region.

Key Outcomes and Progress
DROUGHT PREDICTIONS AND FORECASTING
The Simple Planning Tool was produced by the Southern Climate Impacts Planning Program (SCIPP) in 2019. This tool is a compilation of relatively easy-to-use online interactive tools, maps, and graphs to assist planners and emergency managers in the states of Oklahoma and Arkansas who are assessing their long-term climate risks, both historically and in the future. The tools are available at the following links: • Oklahoma: *http://www.southernclimate.org/documents/SPTOK.pdf* • Arkansas: *http://www.southernclimate.org/documents/SPTAR.pdf*
Probabilistic forecast tools were developed by the Texas Water Development Board to improve probability forecasts (*https://waterdatafortexas.org/drought/rainfall-forecast-info*).
The Southern U.S. Drought Tool is intended to answer the question of "how dry (or wet) have recent weather conditions been where I live". This tool is an experimental product developed by the Southern Regional Climate Center (SRCC) and Southern Climate Impacts Planning Program (SCIPP) Regional Integrated Sciences and Assessment (RISA) program. The tool is available at *http://drought.srcc.lsu.edu*.

Key Outcomes and Progress
DROUGHT OBSERVATIONS AND MONITORING
Visual Drought Index: The Community Collaborative Rain, Hail & Snow Network (CoCoRaHS) and SCIPP engaged citizen scientists to submit photos of their landscape. Approximately 2,000 photos were ranked according to severity of drought and then compared to the U.S. Drought Monitor and other established drought indices at the time the photo was taken. The report is available at: *http://www.southernclimate.org/documents/Visual_Drought_Index.pdf.*
Drought Tracker Mobile App developed in partnership with SCIPP and Weather Decision Technologies Inc. (WDT). The app collects drought condition and impact reports and connects those reports to archives at the NDMC Drought Impacts Reporter.
The Water Reservoir Data Visualization Tool was developed by SCIPP and SRCC and is available here: *http://reservoir.srcc.lsu.edu*
DROUGHT PLANNING AND PREPAREDNESS
Coordination among DEWS partners and stakeholders enabled prompt response to the drought that emerged in Fall 2017 that quickly escalated in severity, with a large portion of Oklahoma and the Texas Panhandle reaching D4, exceptional drought. Climate Service Providers communicated frequently and coordinated drought response actions.
DROUGHT COMMUNICATION AND OUTREACH
Drought emerged in Fall 2017 and quickly escalated in severity, with a large portion of Oklahoma and the Texas Panhandle reaching D4, exceptional drought. In response, NIDIS and the National Weather Service (NWS) Southern Region organized monthly webinars; NDMC, the USDA Southern Plains Climate Hub, State Climatologists, SCIPP and other partners organized expert presenters and provided guidance and input to the webinars. The webinars received wide national and regional media coverage.
For each webinar, a written Drought Status Update was produced and distributed widely.
A series of drought information webinars and Drought Status Updates were produced for the 2020 drought in Southern Texas
INTERDISCIPLINARY RESEARCH AND APPLICATIONS
Dedicated research to improve understanding and messaging of the relationship between groundwater and surface water. The Texas Water Development Board (TWDB) completed a project to compile the best available scientific information concerning the hydrogeology of Val Verde County, where there is a close connection between groundwater and surface water.
Dedicated research to improve capabilities to support reservoir management. The TWDB is charged with collecting, processing, and disseminating reservoir evaporation data over the state. These data are used as input to the water availability models run by the Texas Commission on Environmental Quality for water rights permitting purposes and by the regional water planning groups to assess the availability of surface water resources over a 50-year time period. In February 2019, the TWDB and the Lower Colorado River Authority jointly organized a workshop on Surface Water Evaporation Monitoring in Texas. With NIDIS support, the TWDB and the University of Texas-Arlington hosted a workshop on Forecast Informed Reservoir Operations and Water Resource Management for Texas and Oklahoma in September 2019.

4. The Southern Plains 2021–2025 Strategic Action Plan

4.1 BUILDING A SP DEWS STRATEGIC ACTION PLAN

The 2021–2025 strategic plan was developed following a series of stakeholder meetings held virtually in October 2020. Each meeting was focused on one of the following sector needs: farming and cropping; livestock; water management; energy and industry; and forestry, ecology and fire management. Each meeting followed an open discussion format where participants were asked about how drought impacted them, their jobs, and their businesses. Attendees were asked to identify gaps and needs in the drought information they use and need. The output from each of these meetings was combined and distilled to the priorities and activities that are highlighted in this Strategic Action Plan.

4.2 PURPOSE AND EMERGING ISSUES

Partners from across the SP met in sector-focused virtual meetings in October 2020. In these meetings the attendees discussed the needs of these individual sectors and priority changes to drought early warning that each sector needs right now. These meetings were held during a time that severe drought was affecting western Texas, and much of the discussion was centered around the impacts of the current drought and those of the 2011–2015 drought. Attendees discussed the financial and non-financial costs of drought in the region, which impacts were the most costly on their operations, and common problems among those within the sectors. A few common themes arose from these meetings as issues flagged for priority action in the region, including:

- Tribal Engagement: Stronger relationships with Tribal communities must be built, incorporating Tribal needs and expertise into future DEWS activities in accordance with *NIDIS's Tribal Engagement Strategy 2021–2025*.
- Water quality: While water quality deterioration is often considered an ecological drought impact, poor water quality due to drought can affect energy production, industrial operations, animal health, irrigation for agriculture, recreation and tourism, public health, and natural resource management
- Surface water/groundwater interaction: Groundwater is a heavily-used resource in the Southern Plains. Some aquifers, such as the Ogallala, are heavily monitored and have known issues, while other aquifers are less monitored.
- Drought impact to livestock: The most costly impact of drought to the SP agriculture sector is from either the purchasing of supplemental feed for livestock, or destocking (culling or selling cattle) and restocking at a loss due to unfavorable market conditions.
- Future Drought Scenarios: The Southern Plains is a drought-prone region, and droughts of the future may look different from droughts of the past. Water managers and agricultural advisors indicated the need for a better understanding of how future droughts might be different (e.g., more intense or more frequent) from current droughts.

The priorities and activities listed below were developed in consultation with regional stakeholders. The list of activities in this Strategic Action Plan (SAP) are intended to be accomplished in partnership with those and other stakeholders in the region. NIDIS may take a leadership role in some activities, and may take a supportive role in others that are led by partners (see Appendix 1).

4.3 THREE KEY PRIORITIES FOR 2021–2025

The following three key priorities were developed by NIDIS and are based on the themes listed above, discussions within the meetings, and feedback from regional partners. The three key priorities for the Southern Plains regions for the next five years are:

1 Build resilience and mitigate economic, human health, ecological, and other costs of drought. The 2011–2015 drought cost several billions of dollars in economic impacts across the region (*https://www.ncdc.noaa.gov/billions/time-series/TX*), where rural farming communities were hit the hardest. Droughts are a compounding hazard which correlate with increased morbidity and mortality rates due to reduced water and air quality, more frequent heat waves, and increased stress (e.g. on farm business). Some ecosystems are permanently changed by drought as water quality deteriorates and drought tolerant, invasive plant and animal species flourish. The costs of drought can include, but are not limited to, economic, community health, ecological, and other damages or losses in times of drought. Building resilience and mitigating costs is intended to result in less financial loss, few or no lives lost from primary or secondary drought impacts, and ecosystems that are more resilient to drought effects. This will be accomplished by understanding the decisions that stakeholders in the region make when dealing with drought, and focusing on activities that create quantifiable and meaningful impacts within the region.

2 Deliver earlier warning of drought. Enhance collaboration, coordination, and two-way communication among National, Tribal, State, and local partners, Universities, data service providers (public and private), drought resource providers, vulnerable communities and other DEWS regions to strengthen drought early warning efforts across the Southern Plains and provide more advanced notice than is currently available.

3 Improve or build a comprehensive understanding of drought impacts in the region. This includes quantifying: (1) the propensity and vulnerability to drought now and in future climates on local, state and regional scales; (2) drought and the interaction between surface water and groundwater; and (3) connections between drought indicators and potential drought impacts.

4.4 UPDATE CYCLE AND PROCESS

This SAP covers five years, and is considered a living document. Through annual DEWS meetings, priority activities will be selected and the SAP will be adapted to address emerging issues as needed.

4.5 ACTIVITIES FOR 2021–2025

This SAP is organized around the five components of a drought early warning system. This approach helps to make valuable linkages to the NIDIS Working Groups more explicit, as they are also organized around the components of drought early warning. The Working Groups exist to provide technical, subject matter expertise and to identify core competencies, gaps, and paths of action on intergovernmental activities as part of the NIDIS consultation process. The NIDIS Program Office supports a network of regular communication and information sharing between these Working Groups to ensure meaningful engagement and effective collaboration on priorities and activities.

4.5.1 SP 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 identify key lessons to share within and across the DEWS. This convening role is a key aspect of what NIDIS provides to the SP DEWS.

Outcome 1.1: The SP DEWS network is strengthened by improving drought communication and coordination.

Activity 1.1a Hold annual DEWS partner meetings

Activity 1.1b Improve engagement with the tribal nations in the SP

Activity 1.1c Strengthen mechanisms of communication and coordination amongst partners and engage new partners.

Outcome 1.2: Stronger network connections directly between the research community and primary producers, practitioners and decision makers.

Activity 1.2a Meet at least annually with researchers at university extension offices

Activity 1.2b Host at least one topic-based workshop (e.g. flash drought, surface water, groundwater interactions) that would encourage networking among researchers and practitioners.

Activity 1.2c Explore and/or develop a mechanism for sustained collaboration, which could be a new funding program or a “matchmaking” activity to create researcher/practitioner teams that can tap into existing funding programs.

Outcome 1.3: New partnerships are built within the SP Region that enable the DEWS to reach currently underserved partners.

Activity 1.3a Engage with minority serving colleges and universities in the region to further drought research and outreach efforts.

Activity 1.3b Improve communication with tribal nations and bring additional federal partners to the table, including the Environmental Protection Agency, Indian Health Services, and the Bureau of Indian Affairs.

Activity 1.3c Build and maintain on-the-ground networks to facilitate two-way communication between those engaged in the DEWS and the public to optimize the dissemination of information (e.g., early warning information, response options, preparedness activities).

Activity 1.3d Strengthen the partnership between NIDIS and the National Weather Service (NWS) to deliver timely information concerning drought through Weather Forecast Offices and River Forecast Centers in the region.

4.5.2 PREDICTIONS AND FORECASTING

There are many challenges to improved drought predictions and forecasting. Drought characteristics and physics must be understood in space and time for droughts to be predicted with skill. While larger efforts are aimed at improvements in areas such as subseasonal-to-seasonal (S2S) forecasting, improvements can be made with partners to better communicate the uncertainties of predictions and forecasting and make this information more accessible and useful in this region.

Outcome 2.1: Improved information about when drought will start and end, especially when it happens rapidly.

Activity 2.1a Continue flash drought research and coordination. Flash drought is a national issue of particular importance in the SP DEWS due to the large amount of agriculture in the region and the sensitivity to drought during particular times in the cropping cycle. The 2012 drought is an example of when a flash drought became a very costly disaster for the region. NIDIS is already proactive in the flash drought arena, but there is still a need for flash drought information to percolate to the business management level. This activity will focus on making connections between flash drought research and SP regional stakeholders and the SP DEWS network, in accordance with NIDIS' national Flash Drought strategy.

Activity 2.1b Improve communication on drought persistence and amelioration forecasts. This will include, but is not limited to: emailed drought status updates; regional webinars; and targeted, sector-specific drought information briefings.

Activity 2.1c Work with the Climate Prediction Center, NWS forecast offices, and other NOAA partners, universities, and relevant state agencies to communicate user needs to forecast developers and encourage forecast improvement where possible (See Appendix 2).

Outcome 2.2 Drought predictions for ecological drought are available in the region.

Activity 2.2a In coordination with the national NIDIS program, and in partnership with Federal, State and Tribal partners, clarify what drought information is useful for natural resource managers in the SP DEWS region and what decisions that information would influence, and what value would be created by a tailored drought forecast for ecosystems.

- There are still many unknowns about what an effective ecological drought prediction would look like. This activity will help answer these questions: What does an ecological drought look like in the SP?

How is it different for forests, grasslands, or wetlands? How do natural resources managers know they are in a drought? In what timeframe do they make strategic and operational decisions? Even if we could provide a perfect forecast at the ideal lead time, what would they do with that information? What parts of their operation could they change?

Activity 2.2b In coordination with the national NIDIS program initiatives, work with the Climate Prediction Center, NWS forecast offices and other NOAA partners, universities, and relevant state agencies to develop useful forecasts of ecological drought indicators.

Outcome 2.3 Expanded and/or improved value-creating prognostic tools

Activity 2.3a Invest in research that would expand or improve crop/pasture/vegetative forecast models, such as GrassCast, FuelCast, etc.

- Several existing challenges with GrassCast could be addressed with additional research to add value for the SP region.
  - Some fire managers use GrassCast as a proxy for fuel curing. The problem is that GrassCast only works over grassland prairies and cannot (or should not) be used in forest areas. Other tools, such as FuelCast, should be con sidered. If it is found that the "right" tool does not exist yet, a purpose-built fuel-curing product/tool should be developed in alignment with NIDIS' NDAWN strategy.
  - Lack of data and poor statistical relationships have prevented the expansion of GrassCast into eastern Kansas and Oklahoma or southern Texas.
  - GrassCast is poor at predicting pasture health through the SW monsoon season, meaning forecasts for New Mexico and western Texas at the beginning of the season for the end of season conditions always show a large scenario spread.

Activity 2.3b Work with the private sector to (1) understand what private sector prognostic tools are available, and (2) find ways to get NOAA's predictions into tools people already use.

Activity 2.3c Facilitate scenario planning for farms and other businesses regarding potential (i.e. forecast) drought conditions.

Activity 2.3d Promote and expand the *Forecast Informed Reservoir Operations* project in the region.

4.5.3 OBSERVATIONS AND MONITORING

There is a general consensus that more in situ measurements, especially of soil moisture, are needed across the SP, and that this should be accomplished through the continued support of existing stations and networks in addition to new stations being deployed in areas lacking coverage. But this need extends

beyond precipitation, temperature, and soil moisture measurements, stakeholders expressed a need for enhanced accuracy of reservoir evaporation measurements and improved riverine monitoring that includes water quality, salinity, temperature, and flow rate. Many of the ecological drought impacts upstream can also impact on businesses downstream, and more upstream monitoring can lead to better early warning for everyone along the river.

Outcome 3.1 Improved water quality and temperature monitoring for the benefit of public health, wetland, stream and river ecology, angling, energy and industry.

Activity 3.1a: Include water quality measurements in drought updates and other SP DEWS communications. This would include existing measurements from the USGS and National and State Fish and Wildlife agencies and any other publicly available datasets.

Activity 3.1b: Help promote and encourage increased observation of water temperature and quality including from citizen science efforts, and make that data more widely available.

Outcome 3.2: Monitoring stations locations are known and gaps in coverage are addressed.

Activity 3.2a Understand key gaps in monitoring stations, with analysis including remote sensing data, to determine where additional monitoring is needed. Determine how ongoing programs and initiatives might be leveraged to meet these needs holistically and cost effectively.

Activity 3.2b Engage with tribal nations to install weather/mesonet stations on tribal lands to increase drought monitoring for the tribes in this region. This includes identifying funding sources that could be used (e.g., USBR Water Smart Program, NRCS programs, Conservation District Programs) and/or programs with which to coordinate and partner (e.g., Tribal Soil Climate Analysis Network [NRCS]).

Activity 3.2c Develop partnerships and/or agreements with the Tribal Colleges and Universities to deploy and maintain stations on tribal lands as well as explore how traditional ecological knowledge can be incorporated along with western science to better understand drought on the landscape.

Activity 3.2d Examine what other metrics can be monitored (e.g., stock ponds), including the complexities that might affect the data and meaning (outtake and input levels in stock ponds, associated soil types, and seepage) to better understand local conditions.

Activity 3.2e Support research projects that include an expanded monitoring component and seek out transition partners who will maintain the new observation station after the research project has finished.

Outcome 3.3 The US Drought Monitor (USDM) provides improved representation of local conditions and impacts.

Activity 3.3a Work with NDMC to update drought impact tables for the states of Texas, Oklahoma, Kansas, and New Mexico based on input from the region.

Activity 3.3b Work with local partners to improve the input into the U.S. Drought Monitor (USDM), including active drought conditions reporting through established channels such as the CoCoRaHS conditions monitoring reports, the NDMC Condition Monitoring Observer Reports, social media using #Drought, or the Drought Impact Reporter.

Activity 3.3c Encourage participation in citizen science activities and crowdsourced data collection through programs like CoCoRaHS, CrowdHydrology, the National Phenology Network, and others.

Activity 3.3d Support research that compares standardized drought impact reports with objective drought indicators to identify the most reliable objective tools.

4.5.4 PLANNING AND PREPAREDNESS

Across the SP, partners have made great improvements in communicating and responding to drought. However, there is still a desire to take explicit preparedness actions on the ground that build long-term resilience. Planning and preparedness efforts in the SP should effectively communicate what needs to be done before a drought and what should be done during a drought to successfully emerge from drought conditions unscathed. These planned activities will be different for various regions, economic sectors, and business sizes.

Outcome 4.1: Drought plans within the region are tested and improved.

Activity 4.1a Facilitate scenario planning exercises for States, industry, water managers and/or any others who would like to test their plan before the next drought.

Activity 4.1b Support agencies/entities/governments who are updating drought and related plans to move to more proactive plans with technical information, research, tools, and lessons learned from other groups who already have mature and seasoned plans in place.

Outcome 4.2: Farmers and other land managers are prepared to do maintenance/ improvements on infrastructure (Nature-based solutions, farm dams, ponds, irrigation ditches, etc.) during the next drought.

Activity 4.2a Develop list of programs, practices, and assistance used to build resiliency (NRCS, BLM, States, Conservation Districts, USBR and others), highlighting key practices for various land uses.

Activity 4.2b Develop case studies that highlight successful examples of resilient farms, businesses, municipalities/cities, and communities.

Activity 4.2c Use regional partners (especially those who BLOG), drought.gov, webinars, and/or local meetings to promote some of the programs that provide advice and resources to farmers to make on-farm improvements during a drought.

Activity 4.2d Work with local partners to create a regional peer-to-peer network(s) devoted to sharing ideas about what infrastructure projects that should be done during a drought to improve efficiency and resiliency for the future and which indicators should be used to trigger drought-related improvement and activities.

Outcome 4.3: Progress is made toward mitigating the lingering impact to livestock producers who must reduce their herd during a drought, and value is created.

Note on Outcome 4.3: There was a lot of discussion about the lingering impact to livestock producers by severe and lasting drought. If a livestock producer needs to sell off part of their herd during a drought, it may take 6–10 years to rebuild to pre-drought stocking levels (depending on market conditions and subsequent seasonal conditions). Meaning, even after the drought ends the impacts remain. This was raised in the

meetings for the livestock sector, the farming and cropping sector (many farmers run mixed operations), and by the forestry and ecology sector. It should be documented as a major impact of drought in the SP DEWS region.

Activity 4.3a Work with the USDA and other key beef industry stakeholders to discuss, investigate, test, and potentially pursue ideas that could build resilience and mitigate loss for drought affected livestock producers who reduce their herd size and mitigate the lingering impacts on operations that come from selling livestock in a drought. Potential solutions include cattle markets for drought affected farmers or subsidized livestock purchasing for farmers recovering from drought.

4.5.5 COMMUNICATION AND OUTREACH

The SP DEWS network has grown since the inception of the DEWS, but there are many ways to improve communication and outreach. One of the improvements that were recommended by local stakeholders is targeted drought information that is tailored to the specific needs of individual sectors, similar to the information that is already available for the agriculture sector. Stakeholders also expressed a desire to use the DEWS network to provide training on various products and tools, improve communication with the public, and improve drought impact reporting.

Outcome 5.1: Natural resource managers, forest and ecosystem managers, and other natural land managers have access to improved, high-quality, and impactful drought outreach materials and management tools.

Activity 5.1a Prioritize building better communication and networks with natural resource managers in the SP DEWS region to understand what information is needed, what format is useful, and what communication channels work best.

Activity 5.1b Work with regional partners (inc. SC CASC, SCIPP) to develop tools and resources that are tailored to natural resource managers' needs and will create value.

Activity 5.1c When in drought, provide regular drought status updates that include information for forest, grassland and other natural land managers.

Activity 5.1d Encourage natural resource managers to report drought impacts through established channels, such as the CoCoRaHS conditions monitoring reports, the NDMC Condition Monitoring Observer Reports, social media using #Drought, or the Drought Impact Reporter.

Outcome 5.2: Drought and climate information is incorporated into tools that agricultural producers are already using.

Activity 5.2a Build partnerships with private sector companies that are producing apps, dashboards, or tools that are already being used by producers.

Activity 5.2b Where appropriate, work with private-sector app and tool developers to include forecast information in the tools that farmers are already using.

Outcome 5.3: Information on available tools, how to access them, how to use them, etc. is readily available for the general public.

Activity 5.3a In partnership with local data providers, ensure that the SP region and state drought pages, on drought.gov, include a full list of local drought tools and resources.

Activity 5.3b In partnership with local data providers, produce a series of high-production quality, short, instructional videos for local tools, such as the drought dashboard on Water Data for Texas, and Texas "Interactive State Water Plan" and possibly also national tools like the Climate Engine, the Climate Toolbox, PRISM, NCEI tools etc.

Outcome 5.4: Forecast probability and forecast uncertainty is clearly communicated.

Activity 5.4a Work with forecast creators/producers to communicate forecasts in a way that will meet the needs of those who use them. This includes, where appropriate, the production of new forecast products that may be based on existing forecast data but consider the decision-making process of end users.

Activity 5.4b Work with extension agents to provide training or other tools that help people get the most from drought/rainfall/temperature outlooks. Also, use feedback from extension agents and their stakeholders to inform the production of new, meaningful and impactful forecast tools.

4.5.6 INTERDISCIPLINARY RESEARCH AND APPLICATIONS

There are still many questions to answer in the SP region concerning drought evolution and impacts to inform early warning products and services. In the regional DEWS meeting, Texas was described as a land of both drought and flooding rains. Stakeholders asked, "How can we better quantify regional propensity and vulnerability to drought now and in future climates on local, state and regional scales? How does the surface water/groundwater interaction in the region change during drought? What practical methods can be used within the SP DEWS to improve drought resilience during times without drought?" We are committed to work closely with academic institutions, including Tribal colleges and other minority serving universities within the SP DEWS region where possible, to research these questions, and to proactively share research results pertaining to these issues among regional stakeholders and research partners.

Outcome 6.1: Improved understanding of the regional propensity and vulnerability to drought now and in future climate scenarios on local, state, and regional scales.

Activity 6.1a Support research and tools that helps people understand and plan for the climate they live and work in, now and into the future. How likely are they to see extreme dry conditions? What is their rainfall variability like? Are they likely to see rapid swings from wet to dry conditions?

Activity 6.1b Support research on drought frequency, duration, and intensity within the SP DEWS region.

Activity 6.1c Use the SP DEWS drought.gov pages as a place to access drought climatological information for the region. This may include information like rainfall variability and monthly mean evaporation rates.

Outcome 6.2: The interaction between surface water and groundwater when in drought is quantified.

Activity 6.2a Build on existing research, and previous work by the TWDB to support and promote continued surface/groundwater research and measurements with/by key research partners in the region, especially in areas where this interaction is not well understood. There is a general understanding of the physical process linking surface water and groundwater, but water managers expressed that they are missing quantitative data at a local (locality/river/catchment/aquifer) scale.

Activity 6.2b Support partners and projects within groundwater-dependent regions, such as the Ogallala Aquifer region, to help build sustainability and resilience to changing groundwater quantity and quality.

Outcome 6.3: The suite of actions to prepare for and respond to drought that increase resilience over the long-term are understood and shared.

Activity 6.3a Support research to explore the root causes/solutions that are common to multiple complex problems (e.g., drought, flooding, wildfires, reductions in soil quality) to provide better guidance on which adaptation actions have the potential to result in co-benefits and avoid maladaptation. This activity will be done in alignment with NIDIS' NDAWN strategy, national drought and public health initiatives, flash drought strategy and any other national drought initiatives.

Activity 6.3b Support research to prioritize adaptation actions. Determine what actions are more impactful that can be implemented now (e.g., forecasting, long-term analytics, state and local plans, water storage, ecosystem restoration, soil conservation).

Outcome 6.4: Data, products, and services are improved and/or expanded to better serve the region.

Activity 6.5a In coordination with local partners, such as the Interagency Flood Risk Management, investigate the possibility of expanding the FIRO project to cover Texas. Or, look at other research that can help predict inflow into reservoirs.

Activity 6.5b Examine drought response needs between large and small farming operations and understand where their needs overlap and where they are different. Consider the range of responses to the range of drought (moderate to severe). Work with data providers to ensure access to data, products, and services are fit for purpose for a range of operations sizes.

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 three key priorities. The table below indicates how the outcomes are linked with the three priorities.

Mapping Outcomes to Priorities in the SP DEWS Strategic Action Plan			
	PRIORITY 1	PRIORITY 2	PRIORITY 3
	Build resilience and mitigate economic, human health, ecological, and other costs of drought.	Deliver earlier warning of drought	Improve or build a comprehensive understanding of drought impacts in the region
Outcome 1.1	X	X	
Outcome 1.2		X	X
Outcome 1.3	X	X	
Outcome 2.1	X	X	X
Outcome 2.2	X	X	X
Outcome 2.3	X	X	
Outcome 3.1	X	X	X
Outcome 3.2	X	X	X
Outcome 3.3			X
Outcome 4.1	X		
Outcome 4.2	X		
Outcome 4.3	X		
Outcome 5.1	X	X	X
Outcome 5.2	X	X	X
Outcome 5.3	X	X	
Outcome 5.4	X	X	
Outcome 6.1	X	X	
Outcome 6.2	X		X
Outcome 6.3	X		X
Outcome 6.4	X	X	X

National and 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, the NIDIS Coping with Drought grant program, understanding a healthy water cycle and healthy soil, and soil moisture monitoring. Regional DEWS have the ability to tap into these larger 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 SP.

National/Cross-DEWS Initiatives	SP 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 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. The SP region has some especially difficult forecast challenges, for example, where tropical and extratropical weather systems interact creating high seasonal climate variability. Activities 2.1a, 2.1b, 2.1c, 2.2a, and 2.2b will provide a regional application to these national initiatives.
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 enabling 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. Activities 6.1a, 6.1b, 6.2a and 6.5a will provide a regional application to these national initiatives.
Tribal Engagement Strategy	NIDIS's *Tribal Engagement Strategy* was written for the Missouri River Basin (MRB) and the Midwest DEWS but is being applied nationally. There are many similarities in the gaps and needs in the MRB and Midwest DEWS and the SP DEWS. By considering the principals of engagement that are enumerated in the Tribal Engagement Strategy and engaging the tribal nations of the Southern Plains in a meaningful way, we will achieve many of the outcomes in both documents. Activities 1.1b, 1.3b, 2.2a, 3.2b, 3.2c, and 4.1a will provide a regional application to these national initiatives.
National Coordinated Soil Moisture Monitoring Network	There is a clear need for increased observation network density in the SP, and some of these data gaps apply to soil moisture sensors. The National Coordinated Soil Moisture Monitoring Network Strategy will have impactful applications within the region. Activities 3.2b and 3.2e will contribute to this national effort.

National/Cross-DEWS Initiatives	SP DEWS Activities
NIDIS Drought and Wildland Fire Nexus Strategy (NDAWN)	The National Integrated Drought Information System (NIDIS) *Drought and Wildland Fire Nexus (NDAWN)* defines the needs and challenges of fire managers to effectively utilize drought information and aims to meet those needs and to establish a robust drought and wildland fire decision-support information network. A recently completed NASA DEVELOP project improved a tool for the Great Plains to incorporate drought information into daily fire risk maps. There is a desire to expand the geographic coverage of this tool. Activities 2.3a and 6.3a may have some application to this national program.
NIDIS Coping with Drought	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 FY20 competition is focused on indicators, impacts, and triggers which aligns with priorities 1 and 2 for this region.
Drought and Human Health	NIDIS is engaged in developing a Drought and Human Health Strategy. There are opportunities to hold regional workshops on the topic. Activities 3.1a and 3.1b may contribute to this national initiative.
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. Activities 3.3a, 3.3b, 3.3c and 5.1d will all help with drought impact reporting and analysis in the region.
Improving Indicator Use and Linking to Triggers	A common refrain from partners across 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 with NDMC and internationally with the Commission on Environmental Cooperation (CEC) to contribute answers to these questions. Deliberate efforts to share learning across these initiatives will hopefully accelerate this work. Activities 4.1a, 4.1b, 4.2d will contribute to this national and international effort within the SP region.
National Drought Forum	The National Drought Forum held in 2019 resulted in ten priority actions, many of which are reflected in the SP strategic action plan. These include, but are not limited to, work to improve flash drought forecasts (Activity 2.1a), enhancements to observations and monitoring and decision support tools (Outcome 3.2), better quantification of drought impacts (Activity 3.3c), and ecosystem restoration to mitigate drought impacts (Outcomes 2.2 and 3.1). The synergies between priorities at the regional and national effort should amplify our progress in addressing these complex challenges.

National/Cross-DEWS Initiatives	SP DEWS Activities
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. Presentation recordings, meeting materials, and a flash drought literature review are available on the workshop page. A workshop report will be published in 2021. Activities 1.2b, 2.1a, will provide a regional application to this national initiative.

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 to 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 SP, key regional partners include the USDA Southern Plains Climate Hub, the National Drought Mitigation Center, the USGS South Central Climate Adaptation Science Center, and the NOAA High Plains and Southern Regional Climate Centers, and the Southern Climate Impacts Planning Program. The activities above call out many places where linkages are being made with these regional partners and programs. These linkages have been key in much of the past progress and will continue to be key moving forward. 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 SP 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 implementation of the SP DEWS. This list of partners is not exhaustive and will evolve as new regional partnerships form.

Partner Agencies and Organizations
Kansas Climate Office/Kansas State University
Office of the Texas State Climatologist/Texas A&M University
New Mexico Climate Office/New Mexico State University
Meadows Center for Water and the Environment at Texas State University
National Drought Mitigation Center (NDMC) National Oceanic and Atmospheric Administration (NOAA) • National Weather Service (NWS) Weather Forecast Offices (WFO) • High Plains Regional Climate Center (HPRCC) • Southern Regional Climate Center (SRCC)
US Department of the Interior (DOI) • U.S. Bureau of Reclamation (USBR) • U.S. Geological Survey (USGS) • South Central Climate Adaptation Science Center (SC CASC) • North Central Climate Adaptation Science Center (NC CASC)
U.S. Department of Agriculture (USDA) • Southern Plains Climate Hub • Southwest Climate Hub
Oklahoma Water Resources Board
Texas Water Development Board
Kansas Water Authority/Kansas State University
Dow Inc.

Partner Agencies and Organizations
Southwest Electric Power Company
Brazos River Authority
Phillips 66
Texas Oil and Gas Assn.
Chickasaw Nation
Choctaw Nation
Noble Research Institute
Bureau of Economic Geology, Jackson School of Geosciences, University of Texas
US Army Corps of Engineers
Lower Colorado River Authority (Texas)

Appendix 2: Critical Forecast Timeframes and Decisions in the Southern Plains

Sector-focused stakeholder meetings in the Southern Plains DEWS region revealed the following information about critical forecast timeframes and the decisions that could be made with good forecasts at each lead time. This list represents the needs expressed in the meetings, but is incomplete and should be expanded upon.

Forecast Lead Time	Decisions Made
Weeks to Months	• Energy and industry could mobilize water filtration equipment and reverse osmosis machines before dry conditions in place. Fill waste water ponds for additional storage capacity • Agriculture could purchase feed or water
Months to Seasons	• Cropping would decide which crop variety to plant • Buy or sell livestock • Within this timeframe, Livestock producers would also like to know if the season will start bad but turn good.
Seasons to Years	• If a drought will be a multi-year event, livestock producers want to know as soon as possible to reduce their herd or make arrangements to move cattle to another location • For livestock management, the ideal forecast lead time would be 6 months to begin planning in the winter for summer pasture conditions. • Water managers would begin planning for a multi-year drought.

Based on this information, Forecast improvement priorities should include:

- Forecasts in Jan/Feb for spring and summer provide the most value to livestock producers and farmers.
- Will there be any extreme event throughout the season (e.g. heat waves, early frosts, etc.).
- General timing of rainfall events, e.g. “The outlook for the next three months show increased odds of below normal rainfall, most rainfall for the season is expected in the first month”

Appendix 3: Disclaimer

The Southern Plains Drought Early Warning System (DEWS) Strategic Action Plan 2021–2025 is a collaborative federal, state, tribal, and local interagency effort to improve early warning capacity and resilience to drought in the Southern Plains. The contents of this plan should not be used as evidence against any Southern Plains 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 Southern Plains. Nothing in the Plan is intended to, nor shall the Plan be construed so as to, interpret, diminish, or modify the rights of any Southern Plains 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.

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