APALACHICOLA CHATTAHOOCHEE FLINT RIVER BASIN DROUGHT EARLY WARNING SYSTEM

6/19/2017

2017-2018 Strategic Plan

Document prepared by the National Integrated Drought Information System (NIDIS) in partnership with key stakeholders, including Auburn University, University of Florida, and the National Drought Mitigation Center (NDMC)

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DISCLAIMER

The Apalachicola-Chattahoochee-Flint (ACF) River Basin Drought Early Warning System (DEWS) is a collaborative Federal, state, tribal and local interagency effort to improve early warning capacity and resilience to drought in the ACF Basin. This region encompasses the basin's headwaters in the southern Blue Ridge Mountains of Georgia, part of southeastern Alabama, and the panhandle of Florida. The DEWS was initiated in December 2009, following a drought from mid-2006 to early 2008 in northern Georgia and Alabama. There have been more than 25 years of ongoing disputes among the states of Florida, Alabama, and Georgia concerning water allocation in the upper and lower portions of the ACF River Basin. The purpose of ACF River Basin DEWS Strategic Plan (Plan) is to improve drought early warning capacity and long-term drought resilience throughout the region. The contents of this plan should not be used as evidence against any ACF Basin 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 among Florida, Alabama, Georgia, and the U.S. Army Corps of Engineers, 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 ACF basin. Nothing in the Plan is intended to, nor shall the Plan be construed so as to, interpret, diminish, or modify the rights of any ACF Basin 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 stakeholders 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 stakeholder 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.

APALACHICOLA-CHATTAHOOCHEE-FLINT DROUGHT EARLY WARNING SYSTEM

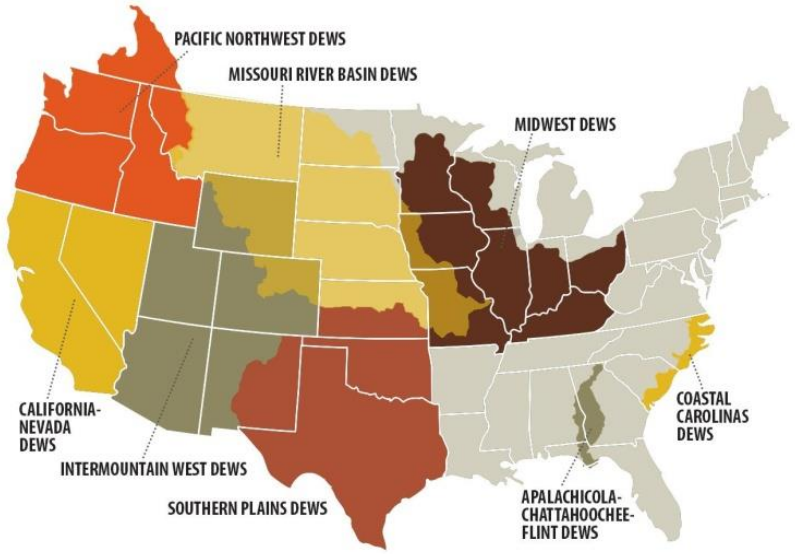
The National Integrated Drought Information System and Drought Early Warning Systems

In 2006, 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). NIDIS is working toward this goal by developing a network of regional DEWS (see map, below). 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.

WHAT IS NIDIS?
The National Oceanic and Atmospheric Administration's (NOAA) National Integrated Drought Information System (NIDIS) was authorized by Congress in 2006 (Public Law 109-430) with an interagency mandate to develop and provide a national drought early warning information system, by coordinating and integrating drought research, and building upon existing federal, tribal, state, and local partnerships.

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.

A regional DEWS is supported by stakeholders, comprised 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. NOAA and the NIDIS program did not establish the DEWS and do not control or manage the DEWS functions or operations; rather, the DEWS constitute the continuation, and leveraging, of existing partnership networks.



The Apalachicola-Chattahoochee-Flint DEWS

The Apalachicola-Chattahoochee-Flint (ACF) River Basin covers over 12 million acres of watershed across Georgia, Alabama and Florida. With its headwaters in Georgia, the ACF Basin terminates in the Apalachicola Bay along the coast of Florida's panhandle. Starting north of Atlanta, the 430-mile long Chattahoochee River flows southwest, where the west bank of the river forms the state boundary between Alabama and Georgia. The Flint River begins near Atlanta's airport and flows south and then southwest through an intensively farmed region in Georgia before it meets the Chattahoochee at Lake Seminole. The waters of Chattahoochee and Flint flow into Lake Seminole, which passes through Jim Woodruff Lock and Dam to form the Apalachicola River and Bay. The Apalachicola River flows out of Lake Seminole and meanders through the flat Florida panhandle, where agricultural uses of groundwater likely have the capacity to alter natural flows. The Apalachicola empties into Apalachicola Bay, an ecologically sensitive ecosystem important for oyster, shrimp, and finfish fisheries.

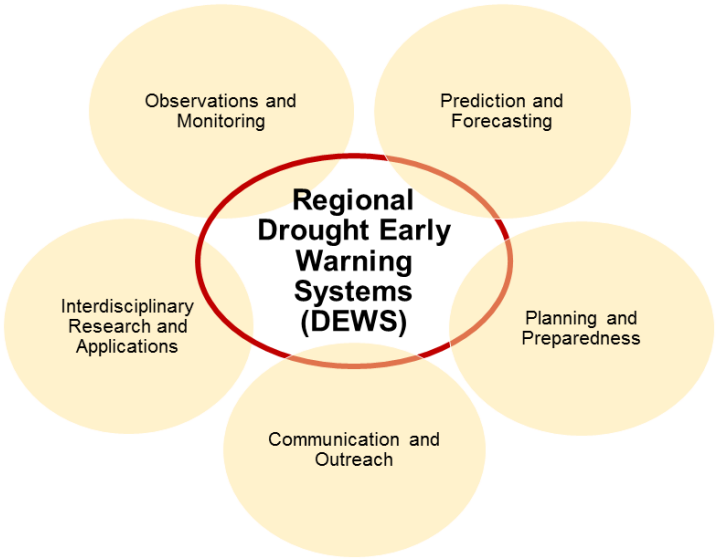
ACF DEWS Region
Note: While the brown shading denotes the ACF DEWS region, where the majori of DEWS actions focus, activities may extend beyond the shaded area when needed.

Metropolitan Atlanta, with a population of more than 5 million, relies upon Lake Lanier and the Chattahoochee River for approximately 70% of its water supply. Groundwater as well as surface water from the lower Flint and the upper Apalachicola are an important source for agricultural irrigation. The lower ACF is also the home to 29 species of freshwater mussels, of which four are threatened and two are federally listed as endangered (USFWS, 2016).

The ACF Basin has several multi-purpose reservoirs constructed by the U.S. Army Corps of Engineers (USACE) and nonfederal entities, resulting in a highly regulated and controlled water system that serves both environmental needs and diverse consumptive and non-consumptive water users. The majority of regulation occurs on the Chattahoochee River, while the Flint River is largely unregulated. USACE operates the federal reservoirs for a variety of congressionally authorized project purposes. These include (1) navigation, (2) flood risk management, (3) hydropower, (4) water supply, (5) water quality, (6) recreation, and (7) fish and wildlife species management. Water in the ACF Basin meets a range of needs, including, but not limited to, municipal and industrial water supply, agricultural irrigation, hydroelectric generation and thermoelectric cooling, and environmental and instream flows. Since the 1980s, the Basin has been at the heart of disputes over the allocation of water resources among the three states.

Water supplies and instream flows have become stressed during periods of drought, due in part to population and irrigation growth. In December 2009, recurring droughts led NIDIS to select the ACF Basin as a high priority for developing a DEWS in the Southeastern United States, largely because of the breadth and complexity of the Basin's ongoing water management challenges. NIDIS and its partners held a series of stakeholder meetings and workshops in the Basin from 2009 to 2011, where stakeholders expressed the need for better coordination and information sharing before, during, and after drought events.

Key components of NIDIS Regional Drought Early Warning Systems



Purpose of the ACF DEWS

The ACF DEWS is a collaborative federal, state, and local interagency effort to improve drought early warning capacity and long-term drought resilience throughout the region. This is accomplished through local stakeholder-driven activities encompassing data collection and monitoring; research; planning for climate extremes; and communication, education, and outreach. ACF DEWS activities occur throughout the ACF Basin in west Georgia, east Alabama, and northern Florida in the panhandle.

Specific goals of the ACF DEWS include:

- Engage stakeholders with diverse interests to continue to elevate science and tools available on climate and drought early warning and resiliency.
- Foster collaboration among federal, state and local entities on aspects of drought early warning capacity and long-term resilience that stakeholders may cooperatively address, while recognizing that ongoing litigation over the ACF Basin involving DEWS partners may affect the ability of the group to address certain matters.
- Develop tools, information, and other resources that will help water and land managers, decision makers, and the general public integrate drought information into planning and management activities.

THE ACF DEWS STRATEGIC PLAN

Plan Purpose and Development

The ACF DEWS Strategic Plan (Plan) outlines priority tasks and activities across the region to build drought early warning capacity and resilience. It includes a list of current partners (listed in Appendix

A), outcomes, and key milestones. This Plan is a "living document" to which additional actions and partners may be added as needed.

A Strategic Plan Development Workshop at Auburn, Alabama on October 12 and 13, 2016, introduced stakeholders to the strategic planning process. Participants discussed existing drought-related activities and needs as well as preliminary strategies to address those needs. Workshop participants included federal, state, academic partners and other key stakeholders with a range of interests and expertise.

Apalachicola-Chattahoochee-Flint DEWS Priorities and Activities

The ACF DEWS prioritizes the following aims necessary to building drought early warning capacity and long-term drought resilience throughout the ACF River Basin:

- **Priority 1 – Foster Stakeholder Collaboration, Coordination and Relationship Building** - This priority calls for cultivating a culture of interagency collaboration and information sharing in the ACF Basin. Related actions include developing a federal interagency working relationship with the ACF Stakeholders; coordinated calls, meetings and workshops to facilitate discussion on drought among federal, state and local agencies; an inventory of drought-related activities in the ACF Basin; and efforts to broaden stakeholder engagement within the ACF DEWS.

- **Priority 2 – Improve Drought Early Warning Outreach and Communication Capacity -** This priority focuses on actions that can improve communications and outreach on drought and drought-related climate events. Related actions include improved communications on the U.S. Drought Portal's (www.drought.gov) ACF DEWS webpage and targeted communications and outreach to key stakeholders on drought and climate outlook information.

- **Priority 3 - Integrate Stakeholder Input to Inform Drought Mitigation, Planning and Messaging –** This priority focuses on linking scientific data with on-the-ground stakeholder knowledge to improve drought mitigation and planning, as well as messaging to the public. Related actions include workshops and studies to improve dialogue on (1) local and state drought planning efforts, (2) drought implications and associated risk among regional water users and land managers, and (3) communication with the public.

- **Priority 4 – Engage in Scientific Research that Addresses Key Information Gaps –** This priority focuses on research to address stakeholder-identified gaps in drought information. Related actions include scientific studies and modeling exercises; improvements to the monitoring of key drought indicators (e.g. groundwater, soil moisture, evapotranspiration, and coastal salinity); and research on how changes in climate could influence the ACF Basin in the long-term.

- **Priority 5 – Collect Drought Impact Data and Conduct Vulnerability Assessments –** This priority capitalizes on recent stakeholder observations and experiences during the current drought (in 2016 and 2017). Related actions include collecting recent drought impact observations and investigations on how the current drought has impacted human populations that may be highly

vulnerable to decreased water availability during a drought in the ACF River Basin.

For each priority, some of the associated activities outlined in this Plan have been started, while other activities will be initiated over the next two years. The corresponding schedule summarizes the expected timeframe for each activity's implementation. Milestone dates are based on the following quarters, designated by seasons: Winter (Jan, Feb, Mar); Spring (Apr, May, Jun); Summer (Jul, Aug, Sep); and Fall (Oct, Nov, Dec).

Additionally, some of the Activities are funded while other Activities will require efforts to acquire funding. Funding sources include NIDIS and DEWS partners. As the ACF DEWS continues to develop, it will be important to identify and leverage resources and available funding among DEWS partners.

Coordination with NIDIS Working Groups

Vital to the mission of NIDIS are its six interagency Working Groups, each focused on a different component of NIDIS activities within and across government agencies and throughout the country. These six areas of focus are: (1) education and public awareness, (2) monitoring and observations, (3) predictions and forecasting, (4) interdisciplinary research and applications for risk assessment, (5) planning and preparedness, and (6) the U.S. Drought Portal for improving accessibility to usable drought risk information. The NIDIS Implementation Plan December 2016 Update provides additional information on the NIDIS Working Groups.

Coordination, communication, and transferability of information and actions between the NIDIS Working Groups and the DEWS is essential to the overall process of building an integrated drought information system. The NIDIS Program Office supports a network of regular communication and exchange of information between these entities to ensure meaningful engagement and effective collaboration on priorities and activities. Appendix B illustrates how each of the activities in this Plan correlates with the Working Group(s).

Priority 1 – Foster Stakeholder Collaboration, Coordination, and Relationship Building

The ACF DEWS seeks to develop a robust and active network of federal, state, and local stakeholders that promote drought early warning capacity and long-term resilience in a coordinated manner. Associated activities include routine conference calls among stakeholders to provide input on key ACF DEWS decisions.

Activity 1.1 Develop an ACF Stakeholders (ACFS) and Federal Partnership

The ACF Stakeholders (ACFS, www.acfstakeholders.org) recently completed a Sustainable Water Management Plan (SWMP) to address sustainable water management in the ACF Basin. The SWMP reflects the following:

"Sustainable water management requires attention to the challenges of maintaining a healthy aquatic ecosystem, particularly as the capacity of the system to meet all stakeholder needs becomes strained. ACFS members have concluded that improvements in meeting stakeholder needs and concerns in the

ACF Basin, as compared to current conditions, are possible and that planning for dry and drought years has become critical."

The SWMP highlights the need for effective drought management planning in the Basin to ensure that the needs of environmental resources and consumptive water users are sufficiently met. ACFS and federal agencies are discussing the opportunity to define a collaborative effort to address a range of topics, including: new studies focused on climate forecasting and reservoir operations; drought indicators and triggers; drought management and response; and how interagency coordination may meet the diverse portfolio of environmental and water user needs in the Basin. The collaborative effort will employ currently available data, models, and existing scientific studies. Potential partners include: the ACFS, USACE, IWR, Auburn University, Georgia Tech, U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), U.S. Department of Agriculture (USDA), and others.

Activity 1.1 Outcomes

- Scope of work, including specific tasks, frequency of interagency meetings, roles of ACFS and federal agencies, standard methods of communication, outcomes, timelines, etc. [Summer 2017 – Winter 2018]
- Outcomes identified in the scope of work [Winter 2018 – Completion of Project]

Activity 1.2 Host Partnership Conference Calls with Federal Agencies

Federal agencies throughout the Southeast (many of which are ACF DEWS partners) hold quarterly conference calls to inform each other of their activities to address climate resiliency within the region, including drought resiliency. ACF partners will continue to engage in this process, exchanging information and resources from the ACF DEWS where beneficial. Partners include: the Environmental Protection Agency (EPA) (lead in organizing the calls), Carolinas Integrated Sciences Assessments (CISA), Department of Interior (DOI) Southeast Climate Science Center (CSC), NIDIS, North Carolina Water Resources Research Institute, Sea Grant programs of North Carolina and South Carolina, the DOI South Atlantic Landscape Conservation Cooperative (SA LCC), NOAA's Southeast Regional Climate Center (SERCC), USDA's Southeast Regional Climate Hub (SERCH), and U.S. National Park Service (NPS).

Activity 1.2 Outcomes

- Routine reports back to ACF DEWS stakeholders on relevant coastal drought and climate-related activities discussed during the call [Winter 2017 – Fall 2018]
- Outcomes associated with any ACF-related project that emerges [Winter 2017 – Fall 2018]

Activity 1.3 Coordinate with Federal Climate Services Providers in the Region

Multiple federal-level regional climate service providers provide routine climate services, conduct weather-related research, and communicate the state of knowledge around weather and climate with audiences across the ACF Basin. These include the DOI's Southeast CSC,[1] the USDA's SERCH,[2] NOAA's

[1] The Southeast CSC is engaged with a variety of projects that address climate, drought and ecological systems and are currently at the onset of a program strategic planning process. Over the next few years, they plan to further develop their study of drought and ecosystems in the Southeast portion of the U.S. As the ACF DEWS and Southeast CSC continues to progress, there will likely be ample opportunity to collaborate and leverage resources on a multi-agency level.

[2] SERCH is working to increase the resilience of agriculture, forest, and rangelands to climate variability and change through

SERCC, [3] and NOAA's National Weather Service (NWS) Southeast River Forecast Center (SERFC).[4]

These providers are important partners, participating in DEWS stakeholder group activities such as conference calls, webinars, and/or in-person meetings. NIDIS will convene regular calls and deliver routine correspondence to connect with these climate service providers and exchange information as well as identify opportunities for collaborate and leveraging of resources.

Activity 1.3 Outcomes

- Routine communication between NIDIS and federal entities described above on collaboration and leveraging resources and coordinating ACF DEWS relevant activities [Winter 2017 - Fall 2018]

Activity 1.4 Develop an Inventory of Drought Activities in the ACF Basin

Federal, state, academic, and local entities throughout the ACF Basin are engaged in climate- and drought-related efforts that can benefit resource managers, planners, and other decision makers affected by or interested in drought. DEWS partners will create an inventory of these activities. Documenting and updating the inventory will provide opportunities for information exchange, collaboration, and leveraging of other activities and resources among the entities.

The completed inventory will be made publicly available on the Drought Portal (www.drought.gov) and will be updated regularly. Partners may include Auburn University, the University of Florida, NOAA's National Marine Fisheries Service (NMFS), USFWS (Helen, Georgia and Panama City, Florida offices), EPA, USGS, USACE, Florida State University Marine Lab, Apalachicola Riverkeeper, ACFS, Georgia Water Resources Institute, and other Florida (FL), Georgia (GA) and Alabama (AL) state and local agencies.

Activity 1.4 Outcomes

- A survey will be circulated among ACF DEWS stakeholders to obtain information on existing and planned activities and projects, including lead entities and participating partners, funding, timing, and contact information.
- Draft of drought-related projects and activities inventory in the ACF DEWS delivered [Spring 2017 - Fall 2017]

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adaptive management. SERCH is actively developing and delivering science-based tools and resources for natural resource managers that enable climate-smart decision-making. SERCH serves agriculture and natural resource professionals across the eleven states in the Southeastern region. SERCH plans to continue its work on drought impacts and adaptive management responses.

[3] SERCC monitors the climate and provides expertise on weather and climate data. They maintain the automated climate information system and develop various climate products. This includes monthly, seasonal, and quarterly reports that summarize the state of the climate, including droughts and their impacts across the region. They also develop special reports on extreme events. SERCC develops products and tools that are tailored to various stakeholder needs, especially in the realm of public health. They carry out applied research that focuses on climate-public health and hydroclimate extremes, including droughts and their impacts.

[4] SERFC has been an active member of the NIDIS ACF DEWS since its advent. Serving as a primary participant in the NIDIS ACF webinars, SERFC has provided both the probabilistic and deterministic forecasts for the chance of the average mean daily flows over 30-day and 90-day forecast periods to fall in the above, near, and below normal range at eleven different forecast locations across the Apalachicola river watershed. The primary mission functions and products within the SERFC operational field office are also commonly used in the drought community and this looks to expand as the NWS becomes more decision support positioned.

Priority 2 – Improve Drought Early Warning Outreach and Communication Capacity

The ACF DEWS will provide information on drought early warning tools and resources through a centralized communication hub (U.S. Drought Portal), and will engage in outreach to stakeholders in need of drought and climate outlook information. NIDIS and stakeholders may also consider additional tools to improve drought early warning communication, like special webinars, presentations, and social media.

Activity 2.1 Update and Maintain the ACF DEWS Information on the U.S. Drought Portal

NIDIS will work with its partners to update and maintain the ACF DEWS pages of the U.S. Drought Portal. This site provides up-to-date information on DEWS activities (e.g., workshop dates and summaries, research, outreach activities, etc.). Additional information will be added to the U.S. Drought Portal as it becomes available, to include innovative drought research, drought vulnerability research, best management practices (BMPs), success stories, and lessons learned from drought mitigation and response.

NIDIS will work with ACF DEWS stakeholders as well as subject matter experts of the NIDIS Drought Portal Working Group to provide recommendations for ACF DEWS webpage improvements, using Google analytics data to inform discussion. Suggested improvements may include the selection of specific climate tools to post on the site that are useful for stakeholders, and/or measures to enhance the user experience through diverse, interactive mediums.

Activity 2.1 Outcomes

- Regular enhancements to the ACF DEWS webpage, to include timely updates, relevant content, and visual improvements in layout and formatting. [Winter 2017 – Fall 2018]

Activity 2.2 Host ACF Webinars and Southeast River Forecast Center Regional Climate Briefings

The ACF River Basin Drought Early Warning Webinars (ACF Webinar) are one of the major mechanisms to communicate climate and drought conditions to ACF DEWS stakeholders. The webinars have been operating on a monthly (biweekly basis during droughts) since 2011. These webinars are organized by Auburn University Water Resources Center and funded by NIDIS. The content of the webinars includes current drought status, seasonal forecasts and outlooks, current streamflow and groundwater conditions, streamflow forecasts, reservoir conditions, state drought response activities, salinity levels in the Apalachicola Bay, and a summary of these findings. The stakeholders who attend the webinars can ask experts directly about drought monitoring and forecasts. Webinar summaries are circulated to over 300 stakeholders within two days of the webinars. ACF DEWS partner organizations that contribute regularly to the ACF Webinar include the Florida State University SCS, USGS South Atlantic Water Science Center, NWS SERFC, and USACE. Other organizations such as the University of Alabama-Huntsville Earth System Science Center, Georgia Environmental Protection Division's Office of the State Climatologist, and University of Georgia Crop and Soil Science, and Alabama Office of Water Resources also contribute to the webinars.

Efforts will be made to broaden the audience of the webinar to new participants such as extension specialists and agents, state and local governments, water authorities, master gardeners, NRCS, and

agricultural producers, Alabama Drought Monitoring and Impact Group, and to work with webinar presenters to ensure that content is timely and understandable to all audiences. The University of Florida will analyze participation in the webinars, including attendance and the number of email recipients that open the announcement emails and summary emails.

In addition to the ACF Webinar, the SERFC provides a Water Resources Outlook Multimedia briefing every three to four weeks for the region, including Alabama, Georgia, Florida, South Carolina, North Carolina, Mississippi and Virginia. The briefing provides information on historical and current reservoir levels, precipitation, drought monitor information, short-term weather outlook, El Niño Southern Oscillation (ENSO), monthly and seasonal climate outlooks, current flood risk, etc.

Activity 2.2 Outcomes

- Monthly ACF Webinars (or biweekly webinars during droughts) and posting of ACF Webinar summaries, slides and recordings [Winter 2017 – Fall 2018]
- Status report summarizing ACF Webinar participation by the University of Florida [Fall 2017]
- Report on Auburn University's efforts to broaden the audience and improve ACF Webinar content. [Summer 2017]
- SERFC Water Resources Outlook Multimedia briefings [Winter 2017 – Fall 2018]

Activity 2.3 Provide Educational Modules and an Electronic ACF Water Newsletter

Some ACF Webinar audience members may not understand several scientific terms and concepts regularly used in the webinars. To improve understanding, Auburn University will develop four educational modules (10-15 min in length) for presentation during the ACF Webinars to explain and elaborate on key technical content, concepts, and processes. Examples include explanation of El Niño/La Niña, reservoir rule curves and their significance in reservoir management, monitoring, and forecast skill associated with key drought indicators, and the difference between drought indicators and triggers, etc. The educational modules will be converted into either factsheets or videos and archived online.

The University of Florida will be organizing and hosting three webinars in addition to the monthly/biweekly ACF Webinars on topics such as skill of forecasts, how to use forecasts, how ecological systems are impacted by drought, and the connection between groundwater and surface water in many parts of the Southeast. An educational factsheet will be developed from each webinar, and made available online.

All education modules, webinars and factsheets will be available for review before publication. Partners include Auburn University, University of Florida, NIDIS, presenters of the ACF Webinar mentioned in Activity 2.2 and others that may be identified during the educational module development.

Additionally, the University of Florida will continue publication of the electronic ACF Water newsletter, which began in 2011. The newsletter has served as an aggregator of information related to water, climate and drought in the ACF Basin, including recent scientific studies, forecasts, and media articles. The newsletter has historically had 165 subscribers as well as social media presence. The University of

Florida will work with Auburn University to ensure that the newsletter mailing list is coordinated with the ACF webinar contact list to expand the audience. A minimum of ten newsletters will be produced, and effectiveness will be evaluated after one year of production. Partners include the University of Florida, the Florida Water and Climate Alliance and Florida Extension.

Activity 2.3 Outcomes

- Four educational modules in the form of webinars, factsheets and videos developed by Auburn University [Winter 2017 – Summer 2017]
- Three educational fact sheets and webinars developed by the University of Florida [Winter 2017 – Fall 2017]
- A minimum of ten ACF Water Newsletters [Winter 2017 – Fall 2017]

Activity 2.4 Expand DEWS Outreach to a Wider Group of Stakeholders

NIDIS and ACF DEWS stakeholders will explore new ways to foster relationships and grow the network of those invested in building drought early warning capacity in the ACF Basin. These efforts will include individual outreach to new partners such as water utilities in the ACF Basin and agricultural Extension offices. Information will be exchanged to help assess new partners' climate and drought-related needs, and encourage their ongoing engagement with DEWS related activities. Existing partners in this effort may include Auburn University, University of Florida, NDMC, participants in the ACF stakeholder group, state agencies from GA, FL, and AL, and other local organizations.

Activity 2.4 Outcomes

- The addition of new relationships to the ACF DEWS network as a result of expanded outreach efforts [Winter 2017 – Fall 2018]
- Progress report from Auburn University on stakeholder outreach efforts, including a summary of outreach activities and stakeholder groups contacted, quantifiable benefits to the ACF DEWS because of this effort (e.g. increased participation), lessons learned, and recommendations for continued growth [Winter 2016 - Summer 2017]

Activity 2.5 Conduct Research on Effective Drought Messaging

Stakeholders at the 2016 Plan Development Workshop indicated that public messaging on drought needs to be well-defined, consistent, and credible. This Activity includes a collection of best practices on the content and timing of drought messaging, the effectiveness of different communication methods, and how public messaging can address the impacts of drought on key economic sectors. This activity also includes research on how drought impacts and BMPs (e.g. residential water restrictions) can be best communicated and marketed to the public. Recommendations from this research will inform new public outreach actions for the ACF DEWS. Methodologies incorporated into the study may entail case studies, surveys, workshops, interviews and other social science-based investigations. Partners may include NDMC, the NIDIS Education and Public Awareness Working Group, the Atlanta Regional Commission, the University of Georgia River Basin Center, and other universities specializing in social science, public communications, water and climate.

Activity 2.5 Outcomes

- Report providing background, methods, collection of resources used during the study, results, conclusions and recommendations for future DEWS public outreach actions [Summer 2017 – Summer 2018]

Priority 3 – Integrate Stakeholder Input to Inform Drought Mitigation and Planning

Stakeholders at the 2016 Plan Development Workshop emphasized the need for constructive dialogue, collaboration, and integrating available scientific information to improve water management and drought resiliency throughout the Basin. This priority calls for improved communication on local and state drought planning among agencies and water users, as well as on drought implications and associated risk among water users and land managers.

Activity 3.1 Host Regional, State, and Local Drought Planning Workshop

Stakeholders at the 2016 Plan Development Workshop indicated that local, state, and regional drought planning efforts lacked coordination and consistency in the Basin, and that improved communication among local, state and federal agencies involved with drought and water resources planning could strengthen planning. While the interstate water litigation could limit the information that can be disclosed among states, some information may be shared within an appropriate context and levels among agencies, so that agency staff can learn from each other. This information may include climate forecasting, use of drought indicators and triggers in planning efforts, drought plans and response activities during and post-drought, as well as challenges and lessons learned from managing and responding to the current drought.

The ACF DEWS stakeholders, along with NIDIS, will produce a workshop to bring together key federal, state, and local (e.g. county) agency staff involved with water resources, land management, and drought planning within the ACF Basin to discuss their experiences planning for, mitigating, and responding to drought, while respecting the limits on information sharing resulting from the interstate water litigation.

Outcomes of the workshop may include recommendations for how to communicate in light of the litigation, training modules/tutorials that could assist state and local planners in the Basin, common scientific and technical resources that could enhance drought planning (e.g. climate forecasting, drought indicators, indices). Partners may include NDMC, water resources associations and organizations such as Georgia Association of Water Professionals, Georgia Municipal Association, Florida Water Management Districts, Alabama Rural Water Association, state Extension agencies, key Riverkeeper organizations in the ACF Basin and FL, AL, and GA state agencies.

Activity 3.1 Outcomes

- Workshop communication guidelines [Summer 2017]
- Materials needed for workshop (e.g. agenda, invitee list, presentations, etc.) and workshop [Fall 2017 -Winter 2018]
- Summary report following the workshop highlighting the major findings and next steps [Winter 2018]

Activity 3.2 Host Drought Risk Dialogue Workshop

Drought affects various economic sectors in different ways, and consequently, the level of risk and impacts associated with drought differ among geographic areas, economic sectors, and individual water users. For example, a farmer relying on groundwater is impacted by drought in a different manner than a municipal water provider relying on surface water or a wildlife refuge relying on surface water flows to sustain aquatic habitat.

In the ACF Basin, many water users do not understand how risk is managed in their local area. One of the keys to fostering constructive dialogue on drought planning and resiliency is to understand how individual water users and managers perceive and manage drought risk. This includes understanding how individual water users may be affected by drought, the types of decisions and trade-offs that managers confront when addressing drought, and the consequences that could occur under different drought severities. A deeper understanding of risk can improve the motivation for water users and managers to develop relationships and potentially form beneficial strategies/deals before and when a drought occurs and water supplies are stressed. Such relationships can be a significant component to an entity's drought mitigation tactics and increase adaptive capacity within a region.

This Activity entails an interactive drought-risk dialogue workshop, convening diverse water users and land managers from a selected area in the ACF Basin. These stakeholders from various sectors (municipal, environmental, agriculture, power, etc.) will share how they address risk at the onset, during, and following a drought. Specific information may include drought impacts, lessons learned following a drought, response and best management practices, drought planning efforts, drought indicators, triggers and tools used, decision-making issues, climate information and forecasting needs, public messaging, future opportunities for collaboration and recommendations for next steps. Workshop follow-up will ask what participants learned, how useful the dialogue was, and whether similar forums could benefit other regions. Partners may include NDMC (lead), Atlanta Regional Commission, ACFS, state agencies from GA, FL and AL, and other local organizations identified during planning.

Activity 3.2 Outcomes

- Materials needed for workshop (e.g. agenda, invitee list, presentations, etc.) and workshop [Fall 2017 –Summer 2018]
- Post- workshop summary report including key discussion items, findings, and recommendations for future actions including the transferability of this workshop model to other DEWS regions [Summer 2018 – Fall 2018]

Priority 4 – Engage in Scientific Research that Addresses Information Gaps

Stakeholders at the 2016 Plan Development Workshop identified key questions and drought information gaps, including interaction of surface water and groundwater, the monitoring of key drought indicators (e.g. groundwater, soil moisture, evapotranspiration, and coastal salinity), and how changes in climate could influence the ACF Basin in the long term. Activities include scientific studies, modeling exercises, and assessments that help to meet these information gaps.

Activity 4.1 Assess Climate Change and Adaptation Planning for River Basins with Estuarine Resources

The Georgia Water Resources Institute (GWRI) at Georgia Institute of Technology has received a NOAA Sectoral Applications Research Program (SARP) grant to conduct the study outlined in this activity. The lead partner is GWRI, with funding from NOAA and NIDIS. This project was not developed as part of the DEWS process. It is a separate grant-based project that is included here because it has information-sharing potential as part of a drought early warning system in this region.

The ACF Basin covers a three-state region subject to varying climatic and hydrologic regimes, largely regulated by reservoir operations, with diverse water users and environmental needs. Modeling studies have proven to be useful to evaluate the implications of climate and reservoir operation scenarios and inform water resources management and planning.

The goals of the Activity are to:

(1) utilize a series of climate, hydrologic and hydrodynamic models in conjunction with stakeholder input to evaluate the potential implications of climate variability on water users and environmental needs; and

(2) transfer the new information, knowledge, and tools to the ACFS, the SERFC, the USACE, and other planning and management agencies.

Activity 4.1 Outcomes

- Report providing background, methodologies, results, key findings, conclusions, and recommendations for next steps [Winter 2017 – Fall 2018]

Activity 4.2 Develop Coastal Salinity Index in the ACF Basin

Studies have shown a correlation between freshwater discharges and salinity concentrations in certain estuarine systems. This correlation may be used to develop new drought indices in the Apalachicola Bay. Auburn University and the University of Florida are working together to investigate a variety of potential drought indices for the Bay. This project was not developed as part of the DEWS process. It is a separate grant-based project that is included here because it has information-sharing potential as part of a drought early warning system in this region.

Specific activities include:

- Testing the application of the coastal salinity index (CSI), initially developed by the USGS in the Coastal Carolinas, in the Apalachicola Bay.
- Evaluating a standardized river discharge-based index following a similar methodology to the one used to develop the CSI in the Coastal Carolinas.
- Developing a methodology for producing seasonal outlooks for the indices discussed above, using SERFC stream-flow forecasts for the Apalachicola Bay and the correlated relationships among ENSO, near-coast salinity and freshwater discharge into the Bay.
- Exploring the development of a multivariate drought index called “Composite Coastal Drought

Index" (CCDI), incorporating a variety of parameters (e.g., precipitation, streamflow, salinity and water temperature) that may present a more complete picture of drought in coastal regions than the single-variant CSI and river discharge-based indices.

- Assessing the potential value of the developed indices by identifying whether there are correlations to coastal drought response parameters such as harmful algal bloom occurrences, tree growth and litter fall in tidal marshes, *Vibrio* infection occurrences, shellfish harvesting data, shark attacks, water quality and quantity, habitats, species and certain estuarine processes. The drought response parameter(s) evaluated will be determined in consultation with the community-led Seafood Management Assistance Resource and Recovery Team (SMARRT).

Partners include Auburn University (co-lead), the University of Florida (co-lead), NMFS, USGS and CISA.

Activity 4.2 Outcomes

- Report on background, approach, results and findings, conclusions, next steps and approach for making the most useful index operational. [Winter 2017 – Summer 2017]

Activity 4.3 Determine Spatiotemporal Characteristics of Projected Future Droughts

Stakeholders in the Southeast often inquire about whether or not future droughts are projected to become more severe and widespread. This activity investigates different indicators and variability in future drought characteristics in the Southeast. Specific objectives are to use data from Global Climate Model, that incorporate midrange and high climate-change scenario simulations to analyze future drought characteristics for early (2010-2039), mid- (2040-2069), and late (2070-2099) century time periods. Partners include Auburn University (lead).

Activity 4.3 Outcomes

- Report summarizing results of work [Winter 2017 – Fall 2017]
- Manuscript submitted for publication in a peer-reviewed journal [Fall 2017]
- Dissemination of study findings throughout the ACF DEWS network via the Drought Portal, formal publication and presentations at regional/national conferences [Fall 2017]

Activity 4.4 Identify Opportunities to Improve Drought Monitoring and Information Dissemination

Data on groundwater levels, groundwater withdrawals, soil moisture, and evapotranspiration (from agriculture and ecological systems) may be used independently or in combination to inform other drought indicator products. Collection of monitoring data within the ACF Basin and throughout the Southeast is managed by a variety of agencies and organizations. The monitoring networks need to be better coordinated and funded to develop more robust datasets that are easily accessible and usable to stakeholders, and that sufficiently cover key geographic areas of study.

This activity entails a series of assessments to develop recommendations on how monitoring can be improved for groundwater levels, well-pumping, soil moisture and evapotranspiration within the ACF Basin. These assessments may include the following activities:

- Compiling an inventory of existing monitoring networks and means of disseminating data.
- Where applicable, identifying and prioritizing areas in need of better monitoring (e.g. areas to

improve understanding of the local interactions between surface and groundwater).
- Identifying spatial gaps in existing monitoring networks in order to improve the density and geographic robustness of existing data sets.
- Discussing methodologies and applicability of incorporating satellite imagery in data analyses.
- Developing a comprehensive understanding of the larger contextual questions that may be addressed using monitoring data (e.g. how groundwater level reductions during drought influence revenues for crops that rely on pumping groundwater).
- Identifying institutional barriers to a comprehensive monitoring program.
- Identifying resources and funding that could be leveraged to establish and /or better coordinate existing monitoring programs.
- Identifying organizations that would be willing to lead coordinated efforts to improve monitoring.
- Developing a list of next steps to improve monitoring robustness and delivery of information to stakeholders. This could also include recommended methods to standardize monitoring techniques, and improvements to existing or new products that may be used to deliver information to stakeholders.

These assessments will be done in coordination with larger regional or national monitoring initiatives, such as the National Soil Moisture Network being led by NIDIS, USGS, Texas A&M University and Natural Resources Conservation Service (NRCS). Partners may include NOAA, USGS, National Aeronautics and Space Administration (NASA), USDA, universities, existing professional organizations, and GA, FL and AL state agencies.

Activity 4.4 Outcomes

- Assessments reports on each of the following: 1) groundwater levels, 2) well-pumping, 3) soil moisture, and 4) evapotranspiration monitoring based on the bulleted activities above [Fall 2017 – Fall 2018]

Priority 5 - Collect Drought Impact Data and Conduct Vulnerability Assessments

Collecting drought impact data can inform drought planning, research, and future decision-making. This priority capitalizes on the current Southeast drought (in 2016 and 2017) by collecting drought impact observations and investigating how the current drought has impacted highly vulnerable populations in the ACF Basin.

Activity 5.1 Collect Drought Impacts from Recent Drought (2016 to 2017 drought)

Several central databases report drought impacts, such as NDMC's Drought Impact Reporter. However, many stakeholders remain unaware of these tools or do not report drought impacts. Additional efforts are needed to document the impacts associated with the recent (2016-2017) drought.

This Activity involves a comprehensive collection of drought impact data from the current drought. A series of interviews, surveys, working group conference calls, etc., can collect drought impact data from the following sectors: municipal, agriculture, recreation and tourism, power, large industry, fisheries, and health. Participants in the study will be asked to identify existing central database tools that are used to collect impacts and identify how potential participants may be motivated to report

such impacts. Additionally, a targeted study may be conducted on the economic implications of a selected category of impacts, through which economic evaluation methodologies will be developed and tested for potential larger scale application. Partners may include NDMC (lead), ACFS, Auburn University, National Phenology Network, Troy University Center for Water Resource and Economics, and Atlanta Regional Commission.

Activity 5.1 Outcomes

- Comprehensive assessment of drought impacts from the recent drought (2016- 2017), by economic sector [Spring 2017 – Fall 2018]
- Report providing results, key findings and next steps [Fall 2018]

Activity 5.2 Conduct Vulnerability Assessments on Drought High Risk Human Populations

This Activity entails five vulnerability assessments (as case studies) regarding human populations that are subject to the highest drought risk levels in the ACF Basin due to decreased water availability during a drought. An example population group could be a rural county population where water availability is limited during a severe drought. The objectives of these vulnerability assessments are to:

(1) develop a deeper understanding of how these communities are impacted by drought;
(2) identify the causes and effects associated with these individual vulnerabilities/impacts;
(3) determine how each community addressed and managed impacts during drought;
(4) assess the communities' experiences recovering from drought (e.g. did they recover, if so, how?); and
(5) identify resources that could assist these communities to reduce future vulnerabilities.

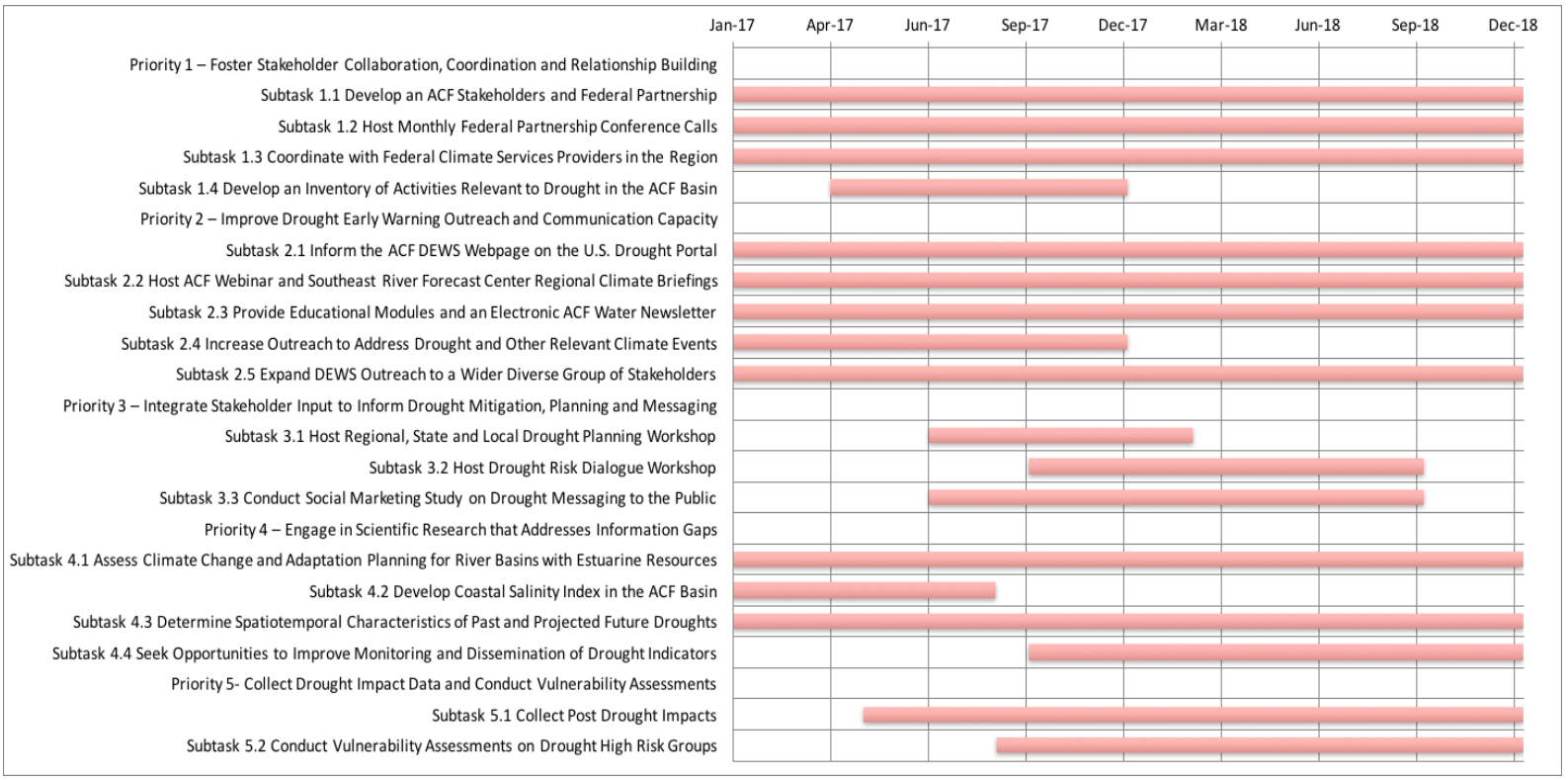
These case studies will be compared to investigate and report out on common themes and where innovative programs and partnerships may reduce vulnerability. Partners may include: NDMC, county Extensions, Atlanta Regional Commission, University of Georgia, Auburn University, Troy University, regional planning councils and Apalachee Regional Planning Council.

Activity 5.2 Outcomes

- Vulnerability assessments as case studies, and report summarizing results, key findings and next steps [Fall 2017 – Fall 2018]

SCHEDULE

Figure 1 - ACF DEWS Strategic Plan Milestones



Appendix A: DEWS Partners in Development of the Strategic Plan

The development of this ACF DEWS Strategic 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 ACF DEWS. This list of partners is not exhaustive and will evolve as new regional partnerships are formed.

Table A: Partner Agencies and Organizations
Apalachicola-Chattahoochee-Flint Stakeholders
Alabama Office of Water Resources
Apalachicola River Keeper
Atlanta Regional Commission
Auburn University Water Resources Center
City of Griffin
Columbus Water Works
Flint River Water Policy Center
Florida State University
Joseph Jones Ecological Research Center
Lake Lanier Association
National Drought Mitigation Center
National Oceanic and Atmospheric Administration
National Weather Service
National Weather Service Southeast River Forecast Center
National Center for Environmental Information
National Estuarine Research Reserves
Southeast Regional Climate Center
Riparian County Stakeholder Coalition
State Climate Office of Alabama
State Climate Office of Florida
State Climate Office of Georgia
Troy University Center for Water Resource and Economics
University of Alabama in Huntsville
University of Florida
USACE Mobile District
USACE Institute for Water Resources
U.S. Department of Agriculture
Southeast Regional Climate Hub
U.S. Department of Interior
Southeast Climate Science Center
U.S. Geological Survey

Appendix B: NIDIS Working Groups

Coordination, communication, and transferability of information and actions between the NIDIS Working Groups and the ACF DEWS is essential the overall process of building a collaborative information system. The table below highlights how each of the activities in the Plan correspond with NIDIS Working Groups. As the ACF DEWS and Working Groups continue to develop, activities among each of these groups will be coordinated.

Table B –ACF DEWS and NIDIS Working Groups

Activity	NIDIS Working Groups					
	Education and Public Awareness	**Monitoring and Observa-tions**	**Predictions and Forecasting**	**Interdisciplinary Research and Applications**	**Planning and Prepared-ness**	**U.S. Drought Portal**
Priority 1 – Foster Stakeholder Collaboration, Coordination, and Relationship Building						
Activity 1.1 Develop an ACF Stakeholders and Federal Partnership					**X**	
Activity 1.2 Host Partnership Conference Calls with Federal Agencies					**X**	
Activity 1.3 Coordinate with Federal Climate Services Providers in the Region					**X**	
Activity 1.4 Develop an Inventory of Drought Activities in the ACF Basin					**X**	
Priority 2 – Improve Drought Early Warning Outreach and Communication Capacity						
Activity 2.1 Update and Maintain the ACF DEWS Information on the U.S. Drought Portal	**X**					**X**

Activity 2.2 Host ACF Webinar and Southeast River Forecast Center Regional Climate Briefings	X	X	X		X	
Activity 2.3 Provide Educational Modules and an Electronic ACF Water Newsletter	X	X	X		X	X
Activity 2.4 Expand DEWS Outreach to a Wider Group of Stakeholders	X	X	X		X	X
Activity 2.5 Conduct Research on Effective Drought Messaging	X					
Priority 3 – Integrate Stakeholder Input to Inform Drought Mitigation and Planning						
Activity 3.1 Host Regional, State and Local Drought Planning Workshop					X	
Activity 3.2 Host Drought Risk Dialogue Workshop		X		X	X	
Priority 4 – Engage in Scientific Research that Addresses Information Gaps						
Activity 4.1 Assess Climate Change and Adaptation Planning for River Basins with Estuarine Resources				X		
Activity 4.2 Develop Coastal Salinity Index in the ACF Basin		X	X	X		

Activity 4.3 Determine Spatiotemporal Characteristics of Past and Projected Future Droughts		**X**	**X**	**X**		
Activity 4.4 Identify Opportunities to Improve Drought Monitoring and Dissemination		**X**	**X**	**X**	**X**	
Priority 5- Collect Drought Impact Data and Conduct Vulnerability Assessments						
Activity 5.1 Collect Drought Impacts from Recent Drought (2016-2017)		**X**			**X**	
Activity 5.2 Conduct Vulnerability Assessments on Drought High Risk Human Populations		**X**		**X**	**X**	

APPENDIX C: ACRONYMS

ACF	Apalachicola-Chattahoochee-Flint
ACFS	Apalachicola-Chattahoochee-Flint Stakeholders
AL	Alabama
BMP	Best Management Practices
CISA	Carolinas Integrated Sciences Assessments
CSC	Climate Science Center
CSI	Coastal salinity index
DEWS	Drought Early Warning System
DOI	Department of Interior
ENSO	El Niño Southern Oscillation
EPA	Environmental Protection Agency
FL	Florida
GA	Georgia
GWRI	George Water Resources Institute
NCEI	National Centers for Environmental Information
NASA	National Aeronautics and Space Administration
NDMC	National Drought Mitigation Center
NMFS	National Marine Fisheries Service
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic Atmospheric Administration
NPS	U.S. National Park Service
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
SA LCC	DOI South Atlantic Landscape Conservation Cooperative
SARP	Sectorial Applications Research Program
SERCC	Southeast Regional Climate Center
SERCH	Southeast Regional Climate Hub
SERFC	Southeast River Forecast Center
SMARRT	Seafood Management Assistance Resource and Recovery Team
SWMP	Sustainable Water Master Plan
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey