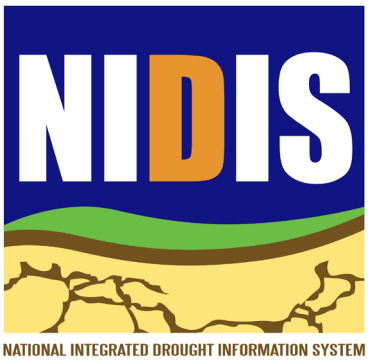
National Integrated Drought Information System – NIDIS



National Integrated Drought Information System (NIDIS)
Southeast-ACF Drought Early Warning Information System Development Workshop
with special emphasis on the Middle Chattahoochee and Flint

May 18-19, 2010, Callaway Gardens, GA

Meeting Notes

Introduction

NIDIS Background:

The National Integrated Drought Information System (NIDIS) is an interagency and interstate effort to establish a national drought early warning information system. NIDIS builds on existing products and service networks like the U.S. Drought Monitor (http://drought.unl.edu/DM/MONITOR.html) and Seasonal Outlooks (http://www.cpc.noaa.gov/products/predictions/90day/) to provide fuller coordination of monitoring, forecasting, and impact assessment efforts at national, watershed, state and local levels. NIDIS is providing a better understanding of how and why droughts affect society, the economy, and the environment, and is improving accessibility, dissemination, and use of early warning information for drought risk management. NIDIS incorporates numerous federal agencies, tribal nations, emergency managers and planners, six Regional Climate Centers, Regional Integrated Sciences and Assessments (RISA), state climatologists, and local NOAA Weather Forecast Offices.

NIDIS Early Warning Information System Pilots:

NIDIS is undertaking several pilot projects to prototype and develop a drought early warning information system for the U.S. The goal of the NIDIS pilots is to explore and demonstrate a variety of early warning and drought risk reductions strategies that incorporate drought monitoring and prediction information in partnership with users and federal, state, regional, tribal and local agencies. Over the next five years, NIDIS will build on the successes of the U.S. Drought Monitor, Seasonal Outlooks, and other tools and products through better coordination of relevant monitoring, forecasting, educational and impact assessment efforts tailored to watersheds, regions, and local levels to design and establish a drought early warning information system. The guiding framework for designing each pilot will be completed over two years and will contain the following steps:

Year 1: Scoping the Drought Early Warning Information System

- Gap analyses: What information exists and how is it being coordinated and used?
- Characterize and communicate risks across timescales-with existing information for 2-3 critical issues.
- Develop subteams to assess (1) Monitoring and forecasting; (2) Impact indicators and triggers (3) Preparedness and education
- Assemble a drought-sensitive planning indicators and management triggers database; Assess present drought information coordination partnerships and processes

- Identify Federal and state-level partnerships, decision support tools and actions needed to improve information development, coordination and flow for preparedness and risk reduction
- Develop an operational plan for designing and implementing an early warning system process

Year 2. Implementation of the Drought Early Warning System (seasonal, multi-year, longer term trends):

- Develop drought sub-portals
- Embed information into preparedness and adaptation plans
- Establish network for ongoing briefings on impacts and projections across climate timescales
- Initiate development region or basin specific Drought Information Monitor and Portal (as a subset of the U.S. Drought Portal [www.drought.gov])
- Develop decision support tools for demand projections and revise triggering criteria
- Prototyping: Given better data and information coordination would responses have been improved for past events? Assess (1) value of improved information using past conditions, (2) responses for projections/ scenarios (decadal, climate change), (3) feedback on priorities (e.g. data gaps) to the NIDIS Executive Council.
- Feedback into regional Drought Monitor and Portal. Early Warning System maintenance (Fed-state-tribal) and transfer to other sub-basins

Purpose of the Southeast-ACF Scoping Workshop:

The goal of the workshop is to prioritize and design the NIDIS Early Warning System pilot over the next two years in the ACF Basin. The ACF Basin will serve as one of three in the first round of NIDIS pilots. The other two pilot projects include the Upper Colorado Basin and California.

Southeast NIDIS Workshops: Key Findings

In developing a drought early warning system in the Southeast, NIDIS has conducted several knowledge assessment workshops. These have included workshops in Peachtree City, GA, Chapel Hill, NC, and Columbus, GA. Also, in June 2008, a workshop was held in Kansas City, Missouri, to discuss the status of Drought Early Warning Systems across the United States. Summaries from most of these meetings can be found under "Events & Announcements" on the NIDIS Drought Portal (www.drought.gov).

National Integrated Drought Information System – NIDIS

Southeast-ACF Drought Early Warning Information System Development Workshop: Middle Chattahoochee & Flint River Basins

May 18-19, 2010, Callaway Gardens, Georgia
Mountain Creek Inn and Conference Center, Room 211
(http://www.callawaygardens.com/)

Tuesday May 18, 2010

8:00 – 8:30 Light continental breakfast

8:30 – 8:35 Welcome – *ADECA Office of Water Resources*

8:35 – 8:50 Introduction to NIDIS Overview and Pilot Goals – *Chad McNutt (NOAA/NIDIS)*

8:50 – 9:05 Overview of Lake Blackshear Meeting and our Meeting Goals – *Lisa Darby (NOAA/NIDIS)*

9:05 – 9:20 Update on the NIDIS ACF Pilot Data Committee activities – *Chad McNutt (NOAA/NIDIS)*

9:20 – 9:35 Climate and Drought in the Middle Chattahoochee & Flint River Basins – *David Stooksbury (Georgia State Climatologist, University of Georgia)*

9:35 – 9:50 Drought Monitoring and Forecasting from the NWS Forecast Office Perspective – *Roger McNeil (National Weather Service Weather Forecast Office, Birmingham, AL)*

9:50 – 10:05 Drought Monitoring and Forecasting for the Middle Chattahoochee & Flint River Basins from the NWS River Forecasting Center Perspective – *Todd Hamill (National Weather Service Southeast River Forecast Center)*

10:05 – 10:30 ***Coffee Break***

10:30 – 10:45 Drought Early Warning and Information Tools – *Keith Ingram (Univ. of Florida)*

10:45 – 11:00 Alabama State Drought Planning – *Tom Littlepage (Alabama Department of Economic and Community Affairs - Office of Water Resources)*

11:00 – 11:15 Georgia State Drought Planning – *Tim Cash (Georgia Environmental Protection Division, Watershed Protection Branch, Chattahoochee and Flint River Basins)*

11:15 – 11:45 ACF Basin Operations: Focus on Middle Chattahoochee & Flint River Basins – *Randall Harvey (US Army Corps of Engineers, Mobile District)*

11:45 – 12:15 Groundwater 101: Groundwater Impacts During Times of Drought – *Joe Volpe (Golder Associates)*

12:15 – 1:45 **Group Lunch**

Lessons from recent droughts

1:45 – 2:00 The Flint River Protection Act and Drought Impacts Observed by the Agricultural Sector – *Mark Masters (Georgia Water Planning and Policy Center)*

2:00 – 2:15 Effectiveness of Existing Drought Indicators and Management Triggers – *David Stooksbury (Georgia State Climatologist, University of Georgia)*

2:15 – 2:30 Streamflow monitoring and lessons learned – *Brian Hughes (USGS)*

2:30 – 2:45 Addressing Drought Using Managed Flows – *Randall Harvey (US Army Corps of Engineers, Mobile District)*

2:45 – 3:00 Hydrologic Change in the Lower Flint River Basin and Responses of Freshwater Mussels to Drought – *Stephen Golladay (The Joseph W. Jones Ecological Research Center)*

3:00 – 3:30 ***Coffee Break***

3:30 – 4:45 Group Discussions - *Victor Murphy (National Weather Service/Southeast Region)*

What are the critical information needs related to drought (e.g. gaps in monitoring and forecasting)
Effectiveness of existing drought indicators and management triggers
How can education, communication and transparency related to current and future drought status be improved in the region

4:45 – 5:00 Meeting wrap-up

6:00 - **Group Dinner** – Dinner and Happy Hour with cash bar, poolside – details to follow

Wednesday, May 19, 2010

8:00 – 8:30 Light continental breakfast

8:30 – 8:45 Review of Day 1

8:45 – 11:00 Group Discussions (with coffee break from 10:00 to 10:15) –
What is needed to improve drought planning and response in Middle Chattahoochee & Flint River Basins? – *David Stooksbury (Georgia State Climatologist, University of Georgia)*

Next Steps: Developing a drought early warning information system

A customized ACF drought monitor: Audience and purpose
For the design of the customized ACF drought early warning information system, what is needed for the Middle Chattahoochee & Flint River Basins? What are the building blocks for the design of this drought early warning information system? What are potential end products?
What actions can local, state, federal and tribal agencies take to lay the groundwork for this drought early warning information system? How best might these be coordinated for information sharing?

11:00 – 12:00 Develop a **plan of action and timeline**: Developing and implementing a drought early warning formation system for the ACF Basin – needs of the Middle Chattahoochee & Flint River Basins - *Keith Ingram (Univ. of Florida)*

12:00 Lunch

Meeting Adjourns

Middle Chattahoochee and Flint River Basin Meeting Notes

Tuesday, May 18, 2010

Climate and Drought in the Middle Chattahoochee & Flint River Basins
David Stooksbury (Georgia State Climatologist, University of Georgia)

- Georgia, Florida and Alabama can have very different precipitation patterns
- If we are in drought on May 1st, we will stay in drought through the summer if there is no significant rainfall. A tropical system can save us, but not take us out of drought.
- Evapotranspiration is a big factor in summer – it outpaces recharge
- The Lawn and Garden Index is good for the short term
- In the Southeast changes in temperature and precipitation have not been changing as in other regions, in part due to land-use changes, such as the conversion of row crops to forest

Drought Monitoring and Forecasting from the NWS Forecast Office Perspective
Roger McNeil (National Weather Service Weather Forecast Office, Birmingham, AL)

Drought Monitoring and Forecasting for the Middle Chattahoochee & Flint River Basins from the NWS River Forecasting Center Perspective
Todd Hamill (National Weather Service Southeast River Forecast Center)

- The River Forecast Center (RFC) monitors reservoirs, rivers and streamflow, not impacts
- The RFC has to work closely with the Corps to model the Chattahoochee because of the dams and reservoirs. There is good coordination between the RFC and the Corps.
- The RFC is constantly QCing rainfall data – their most downloaded product
- The RFC provides multi-media presentations regarding water issues in the Southeast U.S. Five hundred users have signed up for these presentations.

Drought Early Warning and Information Tools
Keith Ingram (Univ. of Florida)

Alabama State Drought Planning
Tom Littlepage (Alabama Department of Economic and Community Affairs - Office of Water Resources)

- Major Questions
  - How much water is available?
  - Who uses it?
  - What are the forecasts?
  - What are the impacts?

- The Corps, Tennessee Valley Authority (TVA) and Alabama Power all collaborate on assessing current conditions (e.g., Lake Lanier action zones, tributary system storage, and Alabama power needs)
- Other products used for assessing conditions:
    - USGS streamflow
    - Alabama real-time groundwater monitoring (product a result of a joint effort among several agencies)
    - Groundwater monitoring
    - Lawn and Garden Moisture Index
    - Crops Moisture Index
    - Palmer Drought Index
    - Keetch-Byram Drought Index
- They struggle with understanding groundwater and surface water interactions (surface water alone is easier to deal with)
- Water Use Reporting Program
    - Registered users comprise all public and non-public water systems and users with the capacity to pump ≥ 100,000 g/day
    - Data are collected annually
        - Most water (83%) is used for thermoelectric power
        - Public supply 8%
        - Commercial/industrial 6%
        - Irrigation 2%; the reporting threshold is 100,000 gallons/day; monthly data are reported
    - Political boundaries are easier to use for dissemination and display of information
    - Information at a higher spatial resolution is needed
    - Climate divisions arose from crop reporting areas/districts
        - Should we look at redefining climate divisions?
- Drought Management Plan
    - The 1st statewide plan was developed in 2004
    - Focus of the plan:
        - Assessment
        - Forecasts
        - Coordination
        - Cooperation
    - They issues advisories, etc. based on Drought Monitor levels
        - D0 and D1 initiate a Drought Advisory
        - D2 Drought Watch
        - D3 Drought Warning
        - D4 Drought Emergency
    - Alabama Drought Assessment and Planning Team (ADAPT) – a cabinet level group that reports to the Governor
    - Monitoring and Analysis Group (MAG) - feeds into ADAPT
    - Drought Impact Group (DIG) – also feeds into ADAPT
    - They issue drought advisories
        - How bad is it?

        - How long will it continue?
    - ADAPT/MAG/DIG became proactive rather than reactive during the last drought – they had good communication
- Alabama needs to be able to step into the Drought Monitor process
- Other regional efforts:
    - TVA partnership
- During the height of the last drought the USGS offered access to Webex for conference calls

Georgia State Drought Planning
Tim Cash (Georgia Environmental Protection Division, Watershed Protection Branch, Chattahoochee and Flint River Basins)

- Drought
    - Human behavior
    - Indicators
    - Triggers
    - Mitigation
    - Response
    - Declaration
- Georgia water supplies
    - North part of state – surface water
    - Middle part of the state – ground water
    - Lower part of the state – artesian aquifer
- Permit required if use is $\geq$ 100,000 gallons/day
- Outdoor water restrictions did save a lot of water

ACF Basin Operations: Focus on Middle Chattahoochee & Flint River Basins
Randall Harvey (US Army Corps of Engineers, Mobile District)

- "Water management" can mean different things to different people, just like drought
- Corps makes an effort to get information to decision makers
- Corps views NIDIS as a good thing
- The Corps has monthly calls with the Southeast River Forecast Center
- Woodruff has variable releases, not a constant 5000 cfs (it's in their documentation)
- The Corps translate lake elevation to conservation amount
- Composite graphic shows stage for the whole system
    - Shows when they are in or out of drought operations
- The Corps would like to have better 2-way data sharing

Groundwater 101: Groundwater Impacts During Times of Drought
Joe Volpe (Golder Associates)

- Groundwater is always flowing – can be very slow

- USGS network has about 180 continuous monitors (groundwaterwatch.usgs.gov)
- Almost all aquifers were affected by drought, depending on
    - Aquifer type
    - Proximity to recharge area
    - Type of recharge and flowpath
    - Compounding usage
    - Water conservation/reuse
- Rate of decline increased as drought progressed
- Q: Can aquifers be used for storage? A: Golder is looking at options for aquifer storage and recovery

The Flint River Protection Act and Drought Impacts Observed by the Agricultural Sector
Mark Masters (Georgia Water Planning and Policy Center)

- Agriculture is the largest consumer of water in the ACF
- Irrigation growth was big in the late 1970's due to the invention of the center-pivot irrigation
- The peak in irrigation occurred around 2000, now it is level or decreasing
- Ag permitting started in 1988 (≥ 100,000 gallons/day)
- A moratorium was placed on new permits in 1999 for the Floridan Aquifer
- Flint River Drought Protection Act 2000 – an auction-based program to temporarily remove irrigated acreage from production in order to protect streamflow
    - Only way to manage water during a drought
    - A lottery system was used – 1st auction held 3/15/01 (surface water users)
    - After this first round, knowledge was gained for the second round in 2002
    - Now groundwater users can participate
    - Partial buy-outs are available (e.g., 1 out of 3 center pivots)
- Passed an Agricultural Water Use Program in 2003 (metering – established reasonable use and increased knowledge for planning)
    - Tied acreage to a pumping point
    - Yearly meter reading
- Passed a Comprehensive Statewide Water Management Planning Act in 2004
- Lower Flint Regional Water Development and Conservation Plan 2006 – permit moratorium

Effectiveness of Existing Drought Indicators and Management Triggers
David Stooksbury (Georgia State Climatologist, University of Georgia)

- We need to manage peoples' response to drought
- The recharge periods before the 2004 and 2005 hurricane seasons were below normal
- Institutional – Governmental Response to drought in 2006/2007
    - June 2006 – Level 1 Drought Management Response
    - May 2007 – Level 2 Drought Management Response
        - Local water authorities increased restrictions as local conditions dictated

    - September 2007 – Level 4 Drought Management Response
        - Almost a complete outdoor watering ban
    - October 2007 – Governor declares a 10% reduction below winter base water use (not effective in winter)
        - Water systems in north Georgia in dire straits – pumping from small streams and no reservoirs
        - Governor forms the Drought Emergency Response team with GEMA, Public Health and EPD as leads
        - State Climatologists of AL, FL and GA jointly issue a La Nina Watch for fall 2007 and winter 2008
        - Massive Educational Campaign spearheaded by UGA Extension Service, Georgia Water Wise Council and Conserve Georgia.
- Lessons learned
    - The infrastructure couldn't handle Level 3 restrictions (water only on weekends). The water turned brown – flushed out the system. Some local communities used it and said it didn't work.
    - The Governors' prayer service did get peoples' attention
    - The current triggers are too complex: spatial scale (climate divisions vs. watersheds), and temporal scale (monthly vs. weekly) need better resolution
    - In Atlanta, fixing leaks in the water system is making a difference
    - Problems occurred if a restriction was mandatory in Georgia, but not in neighboring Alabama or Florida communities
    - Need a common regional framework with a common set of declarations and responses
    - Indices are based on monthly calculations
    - Only Level 4 Response has flexibility
    - Local water systems need the flexibility to respond more aggressively
- Citizens' Response
    - Under Level 1 and Level 2
        - Perception – we are not in a real drought
        - Everything is green (we still get 35+ inches of rain a year)
        - Dropping stream levels are hard to detect visually
        - A drought is just too many beautiful days in a row
    - Mistrust of …
        - Government
        - Climatologists (e.g., believing global warming is a hoax)
        - Media
    - Water Conservation Failed
        - Actual usage went up – Seems the public's perception is that we had better water on days that we are allowed to water.
    - Level 4 and 10% Reduction
        - The drought became visible – Lake Lanier and Bear Creek Reservoir for Athens
        - Media started daily Lake Lanier level watch
        - It became fashionable to show how much one was conserving

    - Water Conservation
        - 20% reduction in water use across north Georgia
    - Confusion between drought (climate) and water resources
    - Perception of a lack of fairness and equity – especially along the state borders where GA was very aggressive and AL and FL were not
    - Many do not know where their drinking water comes from
    - Water Conservation Continued after the drought
        - Economics? or Real Change?
- Industry's Response
    - Green Industry- successfully promoted statutory limitations at local government discretion regarding outdoor watering restrictions, new statute required EPD to approve local changes to state-ordered restrictions. Promoted consumer education on appropriate watering and drought-tolerant landscaping.
    - Water-dependant industrial processing- many industries conducted water audits, invested in water efficiency (carpet industry, poultry processors)
- Media's Response
    - The Good
        - Did a very good job of covering the initial response level changes
        - Once level 4 response was reached, kept the public well informed and offered on-air resources as well as web-based resources
    - The Bad
        - Lack of journalists educated in science
        - Inconsistent coverage during levels 1 and 2
        - Emphasis on Lake Lanier, other water supplies were in much worse shape – Gave the perception that Lanier was the only problem – It was one of many being responded to by the Governor's Emergency Management Team
- Big Picture Lessons
    - Practice conservation in non-drought years so that our systems do not become dependent on water that will not be available during a drought
    - Although lessons learned provide information for improvement, drought management worked in that no Georgia community ran out of drinking water.
    - A common regional framework for basin management and a common set of declarations and responses across state lines is needed (NIDIS)
    - Preparing, especially infrastructure and education, must be done before a drought.
    - Water Conservation Implementation Plan needs aggressive implementation (http://www.conservewatergeorgia.net)

Streamflow Monitoring and Lessons Learned
Brian Hughes (USGS)

- > 9000 surface stations in the US
    - Georgia has 316 USGS streamgages, 251 have raingages, 51 have continuous water quality information, 100% transmit hourly
- Helpful USGS web sites

    - USGS Natural Hazards Support System (www.nhss.cr.usgs.gov)
    - WaterWatch (www.waterwatch.usgs.gov) for water current water resources conditions (real-time streamflow compared to historical streamflow)
    - Streamail – enter a station number and you will receive the latest water data by email or to your cell phone: streamail@usgs.gov
    - WaterAlert (started 5/17/10; http://water.usgs.gov/wateralert) allows you to sign up for streamgage alerts based on a cfs or stage threshold.
    - Peachtree Creek webcam (installed as a result of severe flooding in 2009); user can control the camera! (www.ga.water.usgs.gov/peachtree)
- Lessons learned:
    - Must QA/QC data even more rigorously on a daily basis and respond to gage issues faster because critical decisions are being made with limited resources.
    - Streamgage funding is more prevalent during droughts because of duration and areal extent of droughts compared to floods.
    - Raingages are a critical and relatively inexpensive addition to a streamgage.
    - Drought field operations can be difficult to manage due to the prolonged nature of the event producing long-term personnel needs.
    - Gages must be retrofitted to be able to measure extremely low water levels.
    - Portraying streamflow levels in an easy to comprehend way is very important (see WaterWatch pages).
    - Droughts are not all about lack of water—water quality becomes more important with less water for dilution.
    - Early and continued monitoring of groundwater levels can be critical to understanding the extent of drought problems.

Addressing Drought Using Managed Flows
Randall Harvey (US Army Corps of Engineers, Mobile District)

- NIDIS – lead to better forecasting tools
- There is a shoreline management plan for each project (reservoir)
- There are no stakeholder calls taking place now
- How can the Corps improve their data dissemination?
- The Corps agrees with the push toward transparency
- There has been a heightened national focus on the ACF
- Water management of the future:
    - Operate in a real-time world
    - Better unified system (reservoirs, flow control, structure, levees)
    - Expanded corporate web-based information
- Please use the FOIA process to request Corps data

Hydrologic Change in the Lower Flint River Basin and Responses of Freshwater Mussels to Drought
Stephen Golladay (The Joseph W. Jones Ecological Research Center)

- There are fresh-water mussels in the Lower Flint (3 species are endangered)
- Why mussels are important…
    - High diversity and endemism (mussels not found anywhere else) long recognized
    - Important to stream function
    - Sensitive indicators of stream degradation
    - Mussel populations have been declining, becoming isolated, or becoming extinct
    - "Mussels are charismatic"
    - Mussels have been named in litigation concerning water allocation and ESA
    - Mussel mortality occurs during periods of low flow
- Changes in precipitation and streamflows pre- and post-irrigation were presented (see presentation for more details)

Group Discussions
Victor Murphy (National Weather Service/Southeast Region)

Discussion Questions:

- *What are the critical information needs related to drought (e.g. gaps in monitoring and forecasting)?*
- *What is the effectiveness of existing drought indicators and management triggers?*
- *How can education, communication and transparency related to current and future drought status be improved in the region*

Responses from attendees:

- Soil moisture
    - We need remote sensing due to the heterogeneity of the soil moisture distribution
    - We need models to fill in the observation gaps, but also need to be able to validate them
    - Q: Is soil moisture a good drought indicator? A: Needs research.
- Well data
    - EPD looks at USGS wells as indicators in southwest Georgia
- What about a 6-9 month forecast? How would it be useful?
    - When and what to plant
    - Are the reservoirs normal or not?
    - Do we continue to maintain drought conservation behavior?

Wednesday May 19, 2010

Overview of Day 1 and Charge for the day – Chad McNutt

Group Discussions: What is needed to improve drought planning and response in Middle Chattahoochee & Flint River Basins?
David Stooksbury (Georgia State Climatologist, University of Georgia)

Discussion Questions:

- Next Steps: Developing a drought early warning information system

    - *A customized ACF drought monitor: Audience and purpose*
    - *For the design of the customized ACF drought early warning information system, what is needed for the Middle Chattahoochee & Flint River Basins? What are the building blocks for the design of this drought early warning information system? What are potential end products?*
    - *What actions can local, state, federal and tribal agencies take to lay the groundwork for this drought early warning information system? How best might these be coordinated for information sharing?*

Responses from attendees (grouped by topic):

- **Agriculture**
    - Farmers need to decide in February if they need to buy crop insurance
    - There are anticipated gaps between current and future water demands in the ag community in the lower Flint

- **Forecasting**
    - USDA forecasts/outlooks? Need them throughout the season, not just before the season
    - Improve summer Quantitative Precipitation Forecasts (QPFs)
    - The Southeast Climate Consortium (SECC) has had good results using the Multivariate ENSO Index (MEI) to forecast crop yields in the summer
    - Q: What temporal resolution do people want? A: Trends for 1-3 months
    - What about the level of confidence? Trend products tend to be persistent – you don't see the change coming
    - People are interested in extremes
    - Q: How much has forecasting improved over the years? A: Hurricane forecasting is improving; precipitation forecasting is improving, but it is still hard to predict the "bullseye;" 24-hour precip forecast is good, less confidence in the 48-hour forecast; more confidence in winter forecasts (e.g., precipitation associated with cold fronts) than in summer convective precip forecasts
    - Q: Can we use seasonal probabilities to predict we are coming out of the drought? Are we in a 500-year drought? A: We can use climatology or ENSO information, but not always a reliable predictor
    - Historical analogs are useful
    - Q: Can we get drought information by zip code (like we do for weather forecasts?) A: No
    - It would be helpful to have a 3-month forecast for drought and precipitation to determine if we are entering a drought

- **Presentation of information**
    - Need for the ability to plot overlays of data (e.g., soil moisture, precipitation…)

- People use terciles if nothing else, but prefer to have options
- Q: Do we need a discussion board on the portal? A: We need to be careful about what goes public before the Drought Monitor is published.
- Who is our audience? Who is missing from this meeting?
  - Forestry, vineyards, tourism, recreational fishing, power companies, USFW, subsistence users, utilities, small-scale farming, navigation, social scientists and educators
  - ACF Stakeholders, Inc has identified 13 groups of stakeholders

- **Water Management**
  - Water management vs. onset of precipitation (e.g., refilling of Lake Lanier when climatologically we are out of drought)
  - We need a 2-step process: (1) Early warning; (2) Water management
  - Q: Can the Corps manage to support downstream demands if they know what they are? A: No, the Corps has to manage their projects as prescribed.
  - Minimum flows have become target flows
  - The drought monitor is not designed to reflect a managed system

- **Sectors**
  - We should look at sector needs during drought – they may be different among the sectors

- **Indices**
  - Can we learn lessons from the west regarding their use of a surface water supply index?
    - Is consumptive use and ET included?
  - Do we need a basin index analogous to the Surface Water Supply Index in the west?
  - Confusion still persists on the definition of types of droughts
    - Meteorological, agricultural, hydrologic, etc.
    - Need clear definition
  - Once clearly defined, need at least one tool or index for each
  - Drought monitor useful, but doesn't do a good job monitoring recovery − e.g., indicating that drought is over in the upper basin but not in lower basin
  - Indicators to determine when a drought would end (met, ag, hydro, etc.)
  - Groundwater levels as indicator in the lower Flint

- **Groundwater**
  - The time lag between drought and response in the aquifer is variable
  - Q: Is groundwater flow into the river systems a measurement gap? A: Georgia state water plan is looking at this now
  - Q: What about modeling groundwater in the lower Flint? A: USGS did publish a study

- **Water availability**

- Some suppliers are more vulnerable. During the last drought some people were under restrictions that didn't need to be.

- We were all encouraged to become **observers for CoCoRAHs** (www.cocorahs.org)

- **Preservation of the history and culture** of the basin is important

- **Communication and Education**
  - Potential educators:
    - Alabama Clean Water Partnership is experienced at getting the word out
    - Georgia Environmental Protection Division has an outreach program and is plugged into several groups
    - Auburn University Extension
  - We have to be careful to not have too many people involved
  - Can we identify barriers to communication?
  - There are issues with technical people vs. non-technical people, for instance, some people can relate to streamflow numbers while others can't
  - What about an ACF discussion group?
    - It was stated that the Alabama model is a good one
    - No lawyers or politicians welcome! (Litigation can hamper communication.)
    - May need two different types of calls (drought monitor input vs. operations)
    - We could define triggers to increase or decrease the frequency of the calls (e.g., D1 with trigger a monthly call, D2 a bi-weekly call, D3 a weekly call)
  - Too many portals and sources of information could be confusing
  - The public needs to know there's one entity that declares drought
  - Riverbed intakes – need continuous notice – when will we be out of drought/ how long will it be dry?

- **Data**
  - Need to compile all available data in the sub-basins at a central location
    - Soil moisture data
    - Water withdrawals (from the main stem)
    - Lake levels (large and small lakes/reservoirs)
    - Groundwater pumping rates from GA
    - Drought analogs
  - Fill data gaps once gaps are identified
  - Reliable, 3-month precipitation forecasts starting in the recharge season (mid-Nov)
  - WQ monitoring (ADEM) - need spring and summer flow forecasts by Feb
  - Surface water users rely on what the Corps does. Q: Does the Corps have the best information it needs to make decisions? A: The Corps needs better inflow information and a better QPF.

- Stakeholders need high-quality reliable data. For instance, marina operators use the 5-week lake level forecast from the Corps so they can prepare for changes in lake levels that necessitate changes in boat dock location. They would rather have a reliable 5-week forecast than a less reliable 10-week forecast.
- It's critical that users get flow information during the low-flow times (summer).
- The Corps sends out a 7-day release plan.
- The Corps needs more data regarding withdrawals – they know what they release and what they measure downstream, but they don't know what happens in between.
- Ag meters are read once per year. Could they be read in real-time (does not have to be by farmer, but by area)?
    - Real-time measurements would be overkill for the current hydrologic models
- Big users could send an email if they were withdrawing an extra amount
- Q: What does the tribal community need? A:
    - Groundwater visualization
    - To be able to plug into a model - a tool that shows when groundwater declines and to see patterns
    - Will groundwater declines affect other areas?;
    - When are we going into a drought?
    - Soil moisture data and implications on growing season
    - Water availability - will wells go dry?
    - Are there historical changes in insect and bird behavior that can be drought indicators (short- or long-term)?
- Observation gaps
    - 90 Stations in Georgia measure soil moisture (30-cm integrated measurements). Can find 15-min data on georgiaweather.net (must get permission to download); Auburn Univ also puts out some soil moisture data
    - People are not asking for new streamgages, but sometimes people have to put effort into saving existing streamgages from removal
    - Reservoir storage with historical context (e.g., % remaining, estimate as to when the reservoir will go dry; index for local vulnerability). During the last drought people had to visit the reservoirs to get the true story. Some of the reservoirs that were very low were not in the ACF Basin, but were neighbors to the basin and water managers may have had to look to the basin for help to avert an emergency.
    - No way to get real-time ET information
    - Make effort to get real-time data on soil moisture, stream flows, GW water table depths, reservoir levels, and water withdrawals

- **State drought plans and response**
    - State drought plans need to be complementary, especially near the borders
    - Decisions need to be based on the same information

- In the basin compact that failed, there was a basin drought plan – is that idea dead yet?

- **Research needs**
  - 3-month forecast of water budget components (e.g., streamflows, inflows, storage, releases, withdrawals, returns, evaporation, etc.) for reservoirs and stream flows, 7Q10, etc.
  - Forecast probabilities of drought development and recovery − increase reliability

- Drought is like a recession: When did it start? When will it end?

- **Implementing a Drought Early Warning System**
  - We should implement a drought early warning system (DEWS) based on the current La Nina forecast
    - Meet in October and look at the next 6 months
    - Look at real data, climatology, present the information again in 6 weeks
    - In December assess if things are playing out as expected
      - Did you use the information?
      - Was it helpful?
      - Did the La Nina develop? Was it weak, moderate or strong? It makes a difference for some parts of Georgia.
      - Distribute products beforehand
      - Create products by watershed
      - In December invite new governors-elect

Develop a plan of action and timeline: Developing and implementing a drought early warning formation system for the ACF Basin – needs of the Middle Chattahoochee & Flint River Basins
Keith Ingram (Univ. of Florida)

Recommended Actions
- Observation gaps
- Make effort to get real-time data on soil moisture, stream flows, GW water table depths, reservoir levels, and water withdrawals
- ACF basin discussion group for inputs to national drought monitor, ACE, state officials – similar to what North Carolina does.
- Use DM D1, D2, D3…levels as triggers to initiate timely and effective communication.
- Develop and provide general public with drought information – data visualizations, historical comparisons, educational materials
- Research needs
- Forecast probabilities of drought development and recovery – increase reliability
- 3-month forecast of water budget components (e.g., inflows, storage, releases,
  - Withdrawals, returns, evaporation, etc.) for reservoirs and stream flows, 7Q10, etc.