**Mitigation** is what we do to decrease the potential of climate change itself.

**Adaptation** is how we prepare for and respond to the changes that we are already experiencing/expected to experience.
Third Response

KEEP CALM AND BURY YOUR HEAD IN THE SAND

LALALALALALA...I CAN'T HEAR YOU!
**Mission:** To create a robust future in the face of climate change

**How?** Providing support, training, and assistance to make planning and management less vulnerable.
Climate change is affecting all systems and will continue to do so for centuries to come, so...

We need to *incorporate climate change into long-term planning*  
- **Minimize** risk of wasting time, money, and effort  
- **Maximize** likelihood of success
State of Adaptation Program
finding out how people are fishing

Climate Adaptation Knowledge Exchange (CAKE; www.cakex.org)
connecting fishermen

Awareness to Action
teaching others to fish

Adaptation Consultation
fishing for you

National Adaptation Forum
gathering at fish market
State of Adaptation

- Survey practitioners and assess adaptation efforts
- Develop case studies
- Synthesize trends, opportunities, and challenges
- Connect people to case studies, synthesis reports, and other resources to share lessons learned and build the adaptation field

“[This effort] provides an opportunity to share local knowledge to address climate change.”
~ Gregory J. DuCote, Louisiana Department of Natural Resources

“The field is young. Case studies provide concrete examples of what works & doesn't.”
~ Noah Matson, Defenders of Wildlife
-State of Adaptation: 2009 – present

- 3500+ interviews and surveys
  - Marine/coastal North America (2009-2011)
  - Great Lakes (2011-2012)
  - Western U.S./Canada (2011-present)
  - Marine fisheries (2013 – present)
  - Southeast/Caribbean U.S. (2013 – present)

- 400+ case studies, cited by
  - U.S. Dept of State
  - NCA
  - NFWPAS
  - United Nations, etc.

Objective
Survey, catalog, and assess climate adaptation activities in the Southeastern United States & U.S. Caribbean, focusing on water resources

- How and where is adaptation happening?
- What adaptation tools are most useful?
  - What information is most needed?
- What adaptation strategies have worked and why?

- Impacts & Adaptation Analysis
- Interviews/Surveys & Case Study Examples
- Tools Analysis & Needs Assessment
- Synthesis Report & Guidance
- Dissemination & Outreach
The Life Aquatic in a Changing Climate

Air temperature
Water temperature
Precipitation
Sea/Lake level change
Water chemistry
Precipitation

1958-2012, USGCRP

Change (%)

-12% to 40+
Southeast & U.S. Caribbean: hurricanes, tornadoes, winter storms

Source: NOAA NCDC: http://www.ncdc.noaa.gov/billions/events
Sea Level Rise

1. Thermal expansion
2. Increases in freshwater input

Global average sea level rose roughly eight inches from 1880 – 2009.
Vulnerability to Sea Level Rise

Cascading Impacts

↑ Coastal/riverine flooding
↑ Effects of storms
↑ Drought
△ Coastal & riparian habitats
↑ Erosion
↑ Infrastructure damage
↓ Habitat availability
↓ Water quality
↓ Recreation/Tourism
Identifying Water-Specific Adaptation Options

**Water Supply:** *how much there is*

**Water Quality:** *how clean it is*

**Water Delivery (ecosystems & infrastructure):** *how it gets where it needs to go*

**Water Demand and Use:** *how much is used and why*
• Increase and/or diversify water supplies and/or storage capacity
  – Create new and protect existing reservoirs and retention ponds
  – Consider future conditions in water pricing and water trading (e.g., buying/selling water rights)
  – Increase capacity for/utilize desalinization to produce fresh water for human consumption and use

• Protect freshwater ecosystems
  – Enhance buffer zones for streams/rivers that feed aquifers

• Create drought mitigation plans
  – Conduct drought monitoring
  – Create early warning systems
Water Quality

• Integrate climate indicators into water quality monitoring

• Monitor surface water conditions and vegetation changes in watershed

• Protect resources from salinization

• Increase capacity for treatment of degraded water
  – Injection wells for wastewater treatment and/or aquifer recharge
• Limit development along riparian and coastal areas within vulnerable watersheds

• Improve flood protection measures (e.g., “soft” vs. “hard” measures)

• Implement green infrastructure (e.g., rain gardens, low impact development methods, pervious pavement, green roofs, swales, etc.)

• Implement watershed management (e.g., restoring vegetated land cover, managing runoff, mimicking natural features and hydrology)
Water Demand and Use

• Increase water conservation efforts
  – Educate water users (residents, agriculture) regarding water shortages and quality issues associated with climate change

• Increase water reuse and recycling (irrigation, urban/industrial)

• Promote use of alternative water sources for non-potable uses (e.g., rain barrels)

• Increase modeling to understand interactions between extreme precipitation events, sea level rise, storm surge, groundwater conditions, runoff, and future water supply
Needs Assessment Survey

Purpose:

- **Assess understanding and concerns** about the state of regional water resources (i.e. water supply and quality, existing strategies, challenges and opportunities)

- **Document activities** being employed in the region to prepare for and respond to present and future challenges

- **Compile needs, opportunities, and barriers** in planning for overarching threats to water resources, including changing climate conditions.

bitly.com/SoutheastWaterResources
Which of the following best describes the focus of your/your organization’s interest(s) in water resources?

Do you think climate variability/change has had, is having, or is likely to have a significant effect on water resources in the Southeast United States?
How well informed do you feel you are about climate change?

Sample Results to Date

Have you ever incorporated climate change into your water-related efforts?
Sample Results to Date

Specific challenges to integrating climate change?

- Lack of funding
- Insufficient capacity/staff
- Current, more pressing issues
- No legal mandate
- Lack of stakeholder demand
- Opposition from stakeholder groups
- Lack of downscaled climate data
- Scientific uncertainty
- Lack of leadership
- Lack of information on water-climate relationship
- Lack of options for management
- Lack of access to information and data
- Lack of technical assistance
- Lack of access to forecasting information
- Not enough time
- Other
What kind of information do you use to make decisions at work?

Sample Results to Date

- Best practices: 80%
- Scientific literature: 70%
- Case studies: 60%
- Gray literature: 50%
- Traditional knowledge: 40%
- Spatial data: 30%
- Ecosystem/species models: 20%
- Hydrologic forecasting: 10%
- Socioeconomic models: 10%
- Other: 0%
Top Needs Identified to Date:

– Best practices/lessons learned
– Case studies
– Guidance on integrating climate change into water resources activities
– Guidance on communicating climate issues to the public/stakeholders
– Example policies, ordinances, and model codes
– Webinars
Managing vulnerable lands at the Alligator River NWR

Sea Level Rise, $\Delta$ Hydrology

Actions

- Restoring oyster reefs
- Using water control structures
- Planting salt- and flood-tolerant vegetation
Prioritizing forest and water resources in plans

Runoff, Flooding, Water demand, Development

Actions

- Created the 2035 Climate Change Adaptation Plan, building upon the county’s 2035 Comprehensive Plan
- Examines effects of climate change & population growth
- Protecting headwater streams, rain water harvesting, zoning changes to reduce flood risk, green infrastructure, and establishing a river monitoring network
What tools/resources exist to support climate-informed water resources action?

- 50 tools/resources identified and catalogued
  - Examples:
    - OpenNSPECT
    - USGS National Water Information System
    - Coastal Resilience Index
    - Template for Assessing Climate Change Impacts and Management Options (TACCIMO)
    - Adaptation Strategies Guide for Water Utilities
    - U.S. Drought Portal

- Tool guide to be included in final report
- Tool profiles to be integrated with the Climate Adaptation Knowledge Exchange (www.cakex.org) and shared with other partners
A tool for every need...

Visualization

© NOAA Sea Level Rise Viewer

Decision Support

© Climate Wizard

Modeling

© NOAA Sea Level Rise Viewer

Monitoring

© Drought Risk Atlas

Communication/Outreach

© Drought Risk Atlas

Resource Portal

© Climate Wizard

Climate Adaptation Knowledge Exchange
A tool for every phase of adaptation...
A tool for every water subsector...

Water Quality  Water Supply & Storage

Water Demand & Use  Water Delivery (ecosystems/infrastructure)

... and every interest in-between

**Audience:**
- Land managers
- Natural resource managers
- Water utility managers
- Local/state/regional authorities
- Engineers
- Scientists
- Public

**Societal sector:**
- Agriculture
- Conservation
- Emergency management
- Environmental justice
- Public health
- Tourism/Recreation
- Water utilities

**Water resources of interest:**
- Drinking water
- Stormwater
- Wastewater
- Rivers & streams
- Lakes & reservoirs
- Estuaries
- Wetlands
OpenNSPECT: [http://coast.noaa.gov/digitalcoast/tools/opennspect](http://coast.noaa.gov/digitalcoast/tools/opennspect)

Developed by: National Oceanic and Atmospheric Administration (NOAA)

Contact Information: coastal.info@noaa.gov

Tool Type: Visualization

Phase of Adaptation: Awareness, Assessment, Planning

Water Resource Types: Drinking water, stormwater, watersheds, rivers and streams, lakes and reservoirs, wetlands, estuaries, marine

Sectors: conservation/restoration, land use planning, agriculture, water resources, public health, wildlife, policy, environmental justice, rural/indigenous livelihoods

Audience: Land managers, water utility managers, natural resource managers, local authorities, planners, policy makers

Description: OpenNSPECT is an open-source tool that estimates and maps how water quality (i.e., surface water runoff volume, pollutant loads and concentrations, and total sediment loads) may vary as a result of climate change, development, and other land use changes. OpenNSPECT analyses integrate several different data types to generate maps of overland flow, pollutants, and erosion, including land use/land cover, elevation, soil types, rainfall factor, and precipitation....

Example in Use: Weeks Bay National Estuarine Research Reserve, Alabama Weeks Bay National Estuarine Research Reserve (NERR) used the private version of OpenNSPECT (N-SPECT) to analyze water quality issues and assist with achieving water quality objectives outlined in its Watershed Management Plan. Staff used N-SPECT to identify potential sources of fecal coliform contamination within the watersheds draining to Weeks Bay and to test how hypothetical management and land use changes would affect future fecal coliform levels.)
Learning from our Peers: 
Climate-Informed Water Resources Management Case Studies

Andrea M. Webster, Project Manager
Office of Sustainability, Develop Louisville-Louisville Forward, Louisville Metro Government

“A hot city in a coal state: mitigating and adapting to the effects of climate change”

Chris Burkett, Wildlife Action Plan Coordinator
Virginia Department of Game and Inland Fisheries

“Incorporating climate change into Virginia’s Wildlife Action Plan”
Why Make a CAKE?
• Everything we do is vulnerable to climate change but few people know what to do about it
• Adaptation is a rapidly developing field
• We are spending more time *reinventing*, not enough *innovating*

Why Join CAKE?
• **Explore** projects, people, and resources on the map
  ➢ Map, text, and keyword searches
• **Publish and promote** your work on climate adaptation
• **Get advice** from adaptation experts
• **Request information** from your colleagues (advice, connections, training)

Sponsors, Partners, and Contributors: Kresge Foundation, Wilburforce Foundation, Data Basin, EBM Tools Network, Model Forest Policy Program, Northern Institute of Applied Climate Science, NCAnet, Integrated Data Management Network, USGS, and many more!
Opportunities for Engagement

Submit a project! bit.ly/AdaptationProject

Take the survey! bitly.com/SoutheastWaterResources

Read/Request State of Adaptation surveys and synthesis products!

Join CAKE and submit your content! CAKEx.org

Join us at the 2017 National Adaptation Forum!

Contact me!
Rachel M. Gregg, Rachel@EcoAdapt.org
The cycle of life is intricately joined with the cycle of water.

Jacques Cousteau

EcoAdapt.org