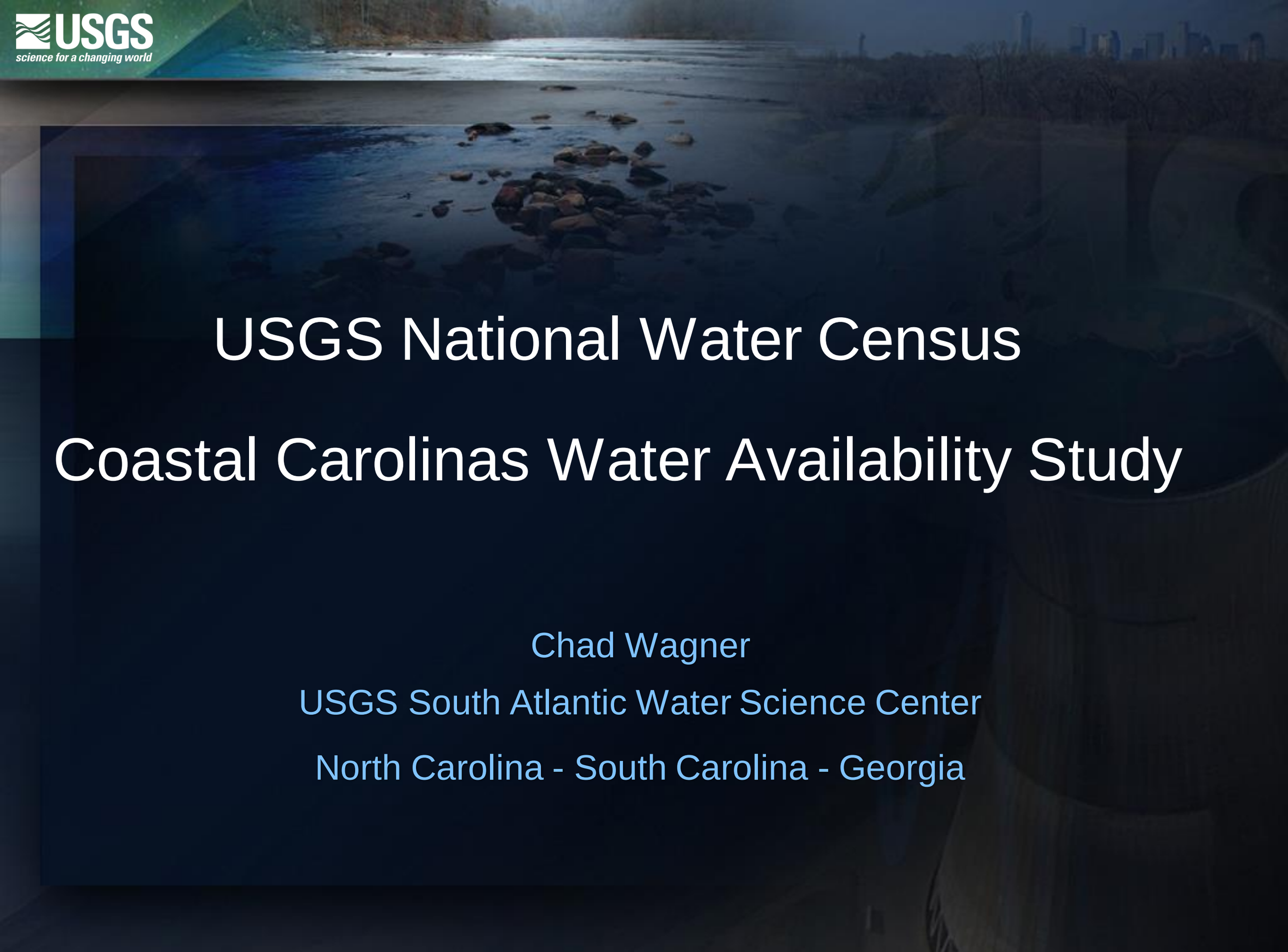


USGS National Water Census

Coastal Carolinas Water Availability Study

Chad Wagner

USGS South Atlantic Water Science Center

North Carolina - South Carolina - Georgia

USGS
science for a changing world

What is the USGS National Water Census?

Part of the WaterSMART Initiative

Our objective for the National Water Census

To place technical information and tools in the hands of stakeholders, allowing them to answer questions they face about water availability:

- Does the Nation have enough freshwater to meet both human and ecological needs?
- Will this water be present to meet future needs?

SECURE Water Act
Public Law 111-11, § 9507 and 9508

Water Withdrawals by Category, 2010

Livestock

1 percent

Self-Supplied Domestic

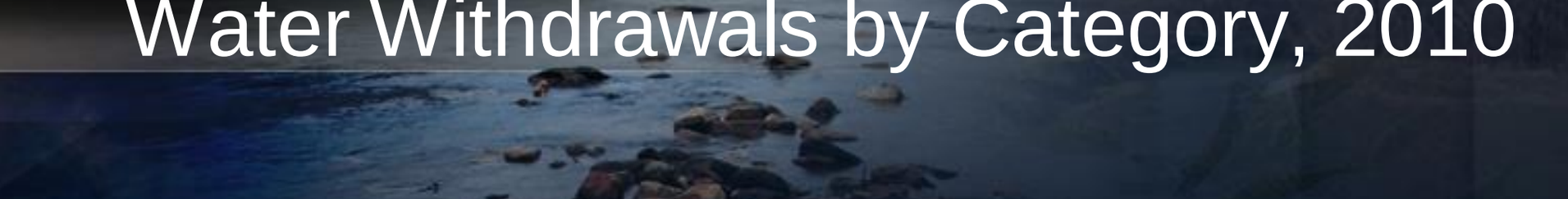
1 percent

Public Supply

12 percent

Thermoelectric Power

45 percent



1 percent

Mining

3 percent

Aquaculture

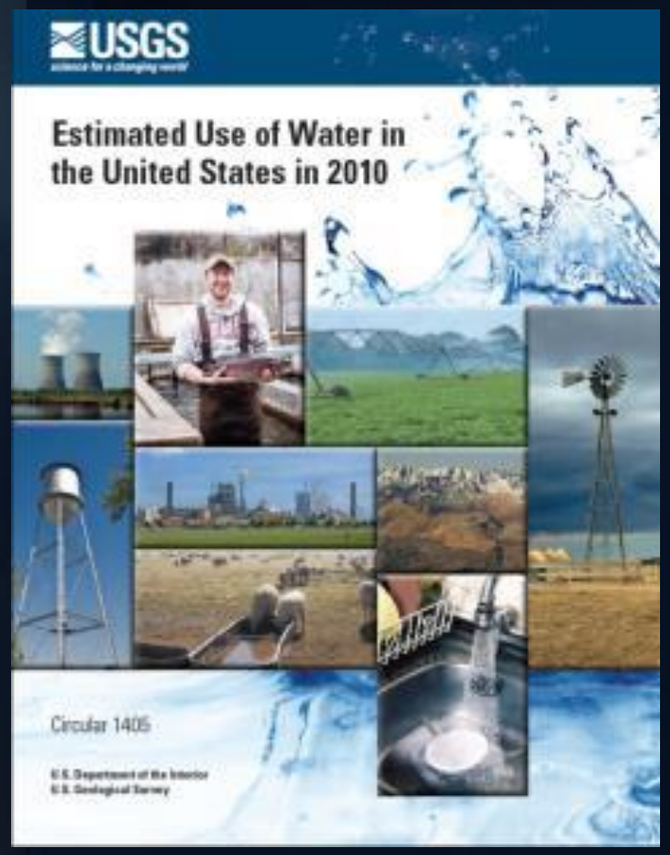
4 percent

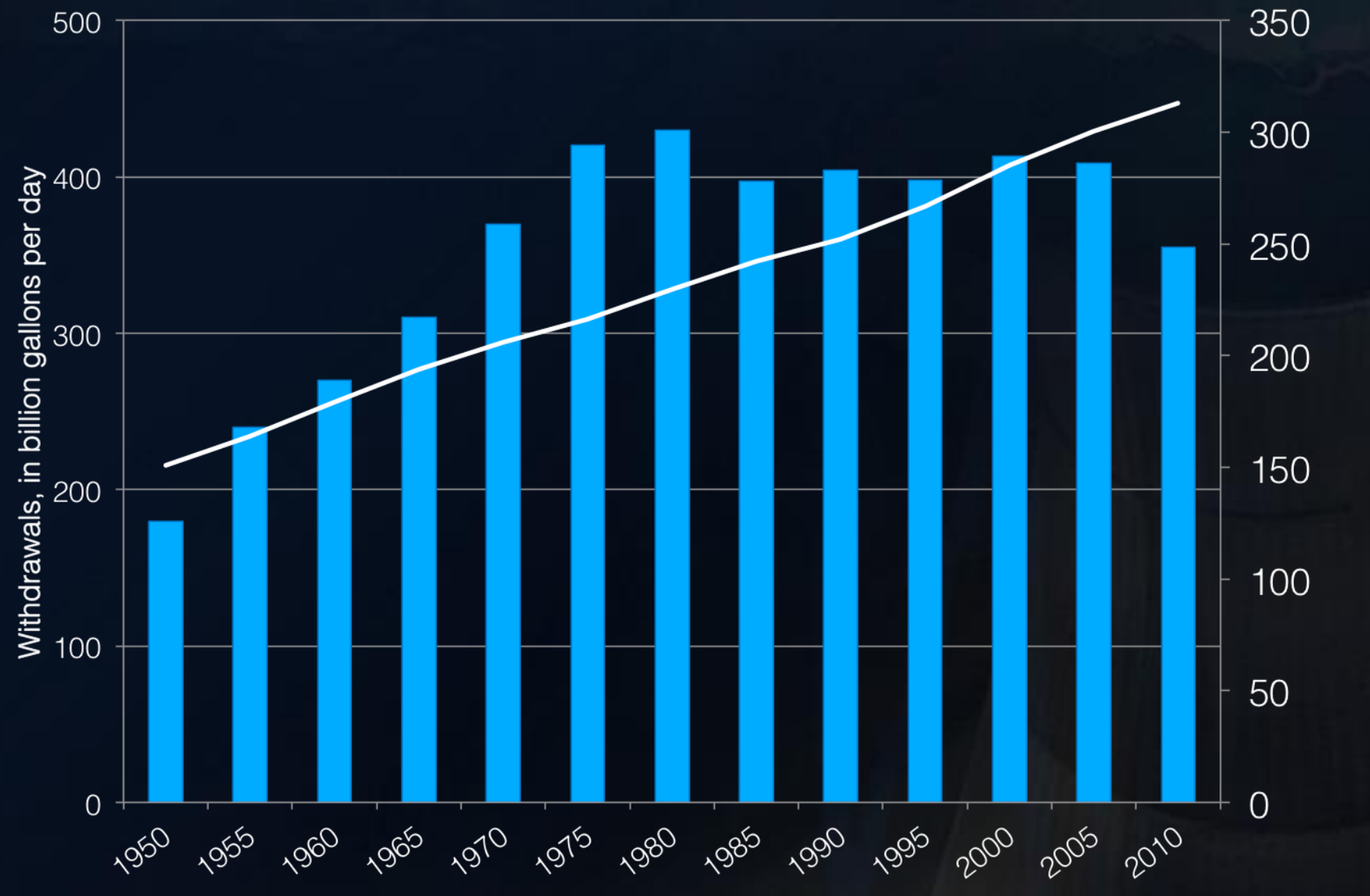
Self-Supplied Industrial

33 percent

Irrigation

Population and Total Withdrawals 1950-2010





Billion gallons per day, BGD

Water Use Trends

- Total water withdrawals in 2010 were 355 billion gallons per day or 13% less than in 2005.

- Total population in 2010 was 313 million or 4% more than in 2005.

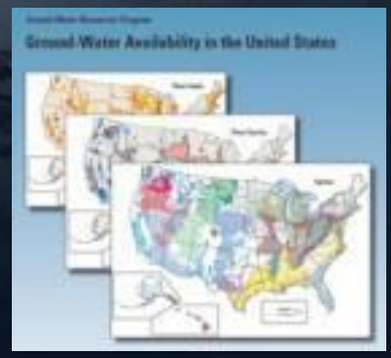
- This is the largest percent decline in water withdrawals nationally since we have maintained records.

- In 2010, water withdrawals reached a level not previously seen since 1970.

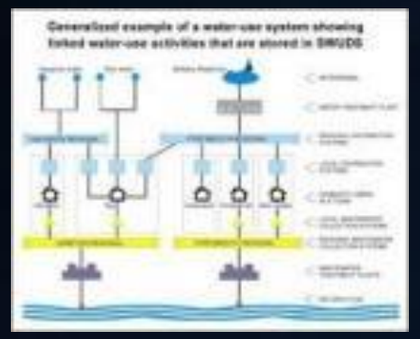
- All categories of use declined in water withdrawals, except for mining and aquaculture, which saw increases of 40% and 7%, respectively.

Focused Water Availability Assessments

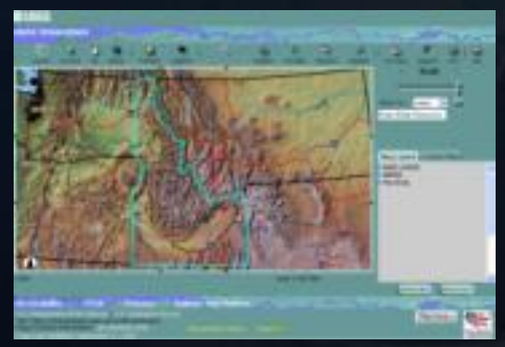
Water Quality



Groundwater Resources



Water Use



Surface Water Trends, Precipitation, etc

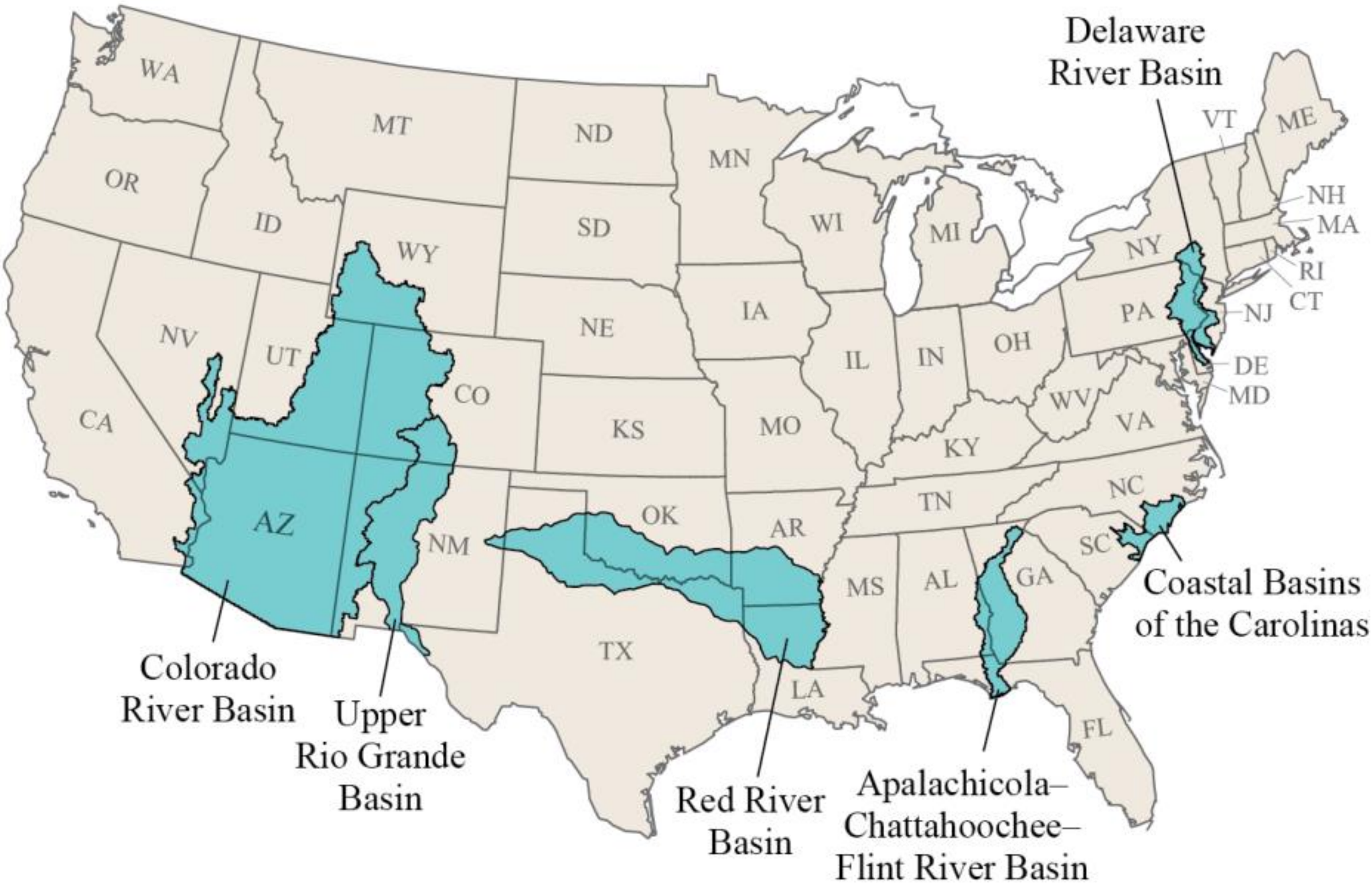
Eco Flows

Global Change

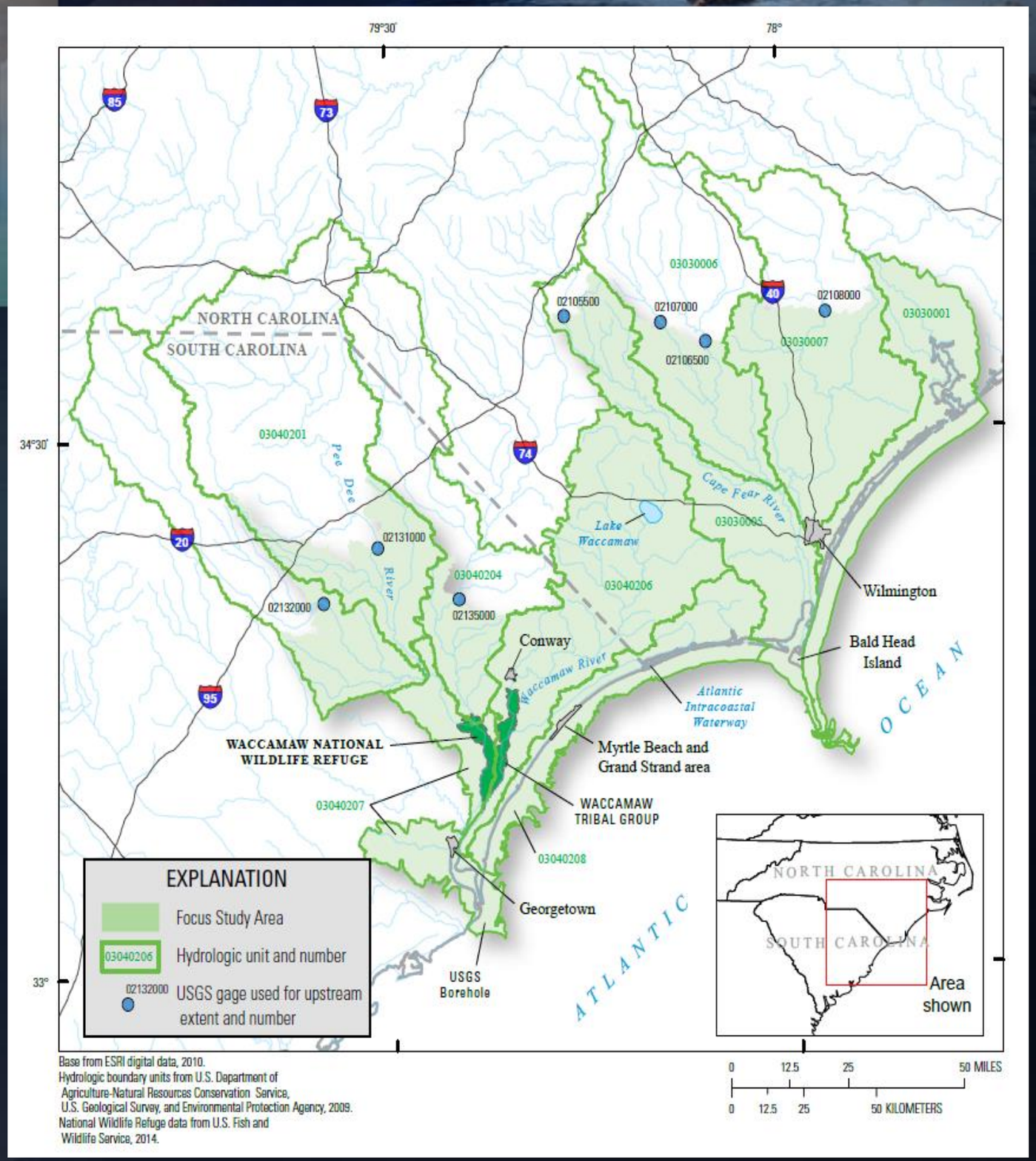
Defined Technical Questions to be Answered

State, Local, Regional Stakeholder Involvement

New (in 2016) and Existing Focus Area Studies



Coastal Carolinas Focus Area Study



- ✓ Ongoing/projected population increases in this land limited coastal region = higher population density and sharper interface between fresh and saltwater ecosystems.
- ✓ Frequent Droughts/Hurricanes
- ✓ Groundwater Capacity-use Area
- ✓ Sea-level rise, land-use change and climate change will impact aquifer water levels and frequency, duration and magnitude of streamflow and salinity intrusion near water-supply intakes.

Why Coastal Carolinas?

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2015

H.B. 186
Mar 10, 2015
HOUSE PRINCIPAL CLERK

H **D**

HOUSE DRH20059-MH-78 (03/09)

Short Title:	Cape Fear Water Resources Availability Study.	(Public)
Sponsors:	Representatives Catlin, Szoka, and Glazier (Primary Sponsors).	
Referred to:		

A BILL TO BE ENTITLED

AN ACT TO REQUIRE THE ENVIRONMENTAL RESOURCES COMMISSION TO CONDUCT A STUDY OF WATER RESOURCES AVAILABILITY IN THE CAPE FEAR RIVER BASIN.

The General Assembly of North Carolina enacts:

SECTION 1. The Environmental Review Commission, with the assistance of the Department of Environment and Natural Resources, shall study the aggregate uses of groundwater and surface water in or affecting the Cape Fear River Basin by all users, including, but not limited to, public water systems, industrial facilities, and agricultural operations. The study will include all of the following elements: (i) a summary of the current and 50-year projected water-use demands along with the available water supplies for those portions of Alamance, Bladen, Brunswick, Caswell, Chatham, Columbus, Cumberland, Duplin, Durham, Guilford, Harnett, Hoke, Lee, Moore, New Hanover, Onslow, Orange, Pender, Randolph, Richmond, Robeson, Rockingham, Sampson, Scotland, and Wake counties within the Cape Fear River Basin; (ii) an evaluation of the adequacy of currently available supplies to meet the expected long-range needs for all water demands, including the identification of those areas of the basin that do not have a sustainable long-term water supply for the anticipated growth of that area; (iii) the identification of potential conflicts among the various users and recommendations for developing and enhancing coordination among users and groups of users in order to avoid or minimize those conflicts; and (iv) an enhanced review of the portions of the Cape Fear River Basin within Brunswick, New Hanover, and Pender Counties addressing the increased demands on groundwater and limited surface water options in that area.

The findings of the study will be included within the Department's Cape Fear River Basin Plan. All the information and any analytical tools, such as models, employed in the conduct of the study will be made available electronically for public review and use from the Web site of the Department's Division of Water Resources.

The Environmental Review Commission may submit an interim report to the 2016 Regular Session of the 2015 General Assembly and shall submit a final report of its findings and recommendations, including any legislative proposals, to the 2017 General Assembly.

SECTION 2. This act is effective when it becomes law.

Objectives and Scope

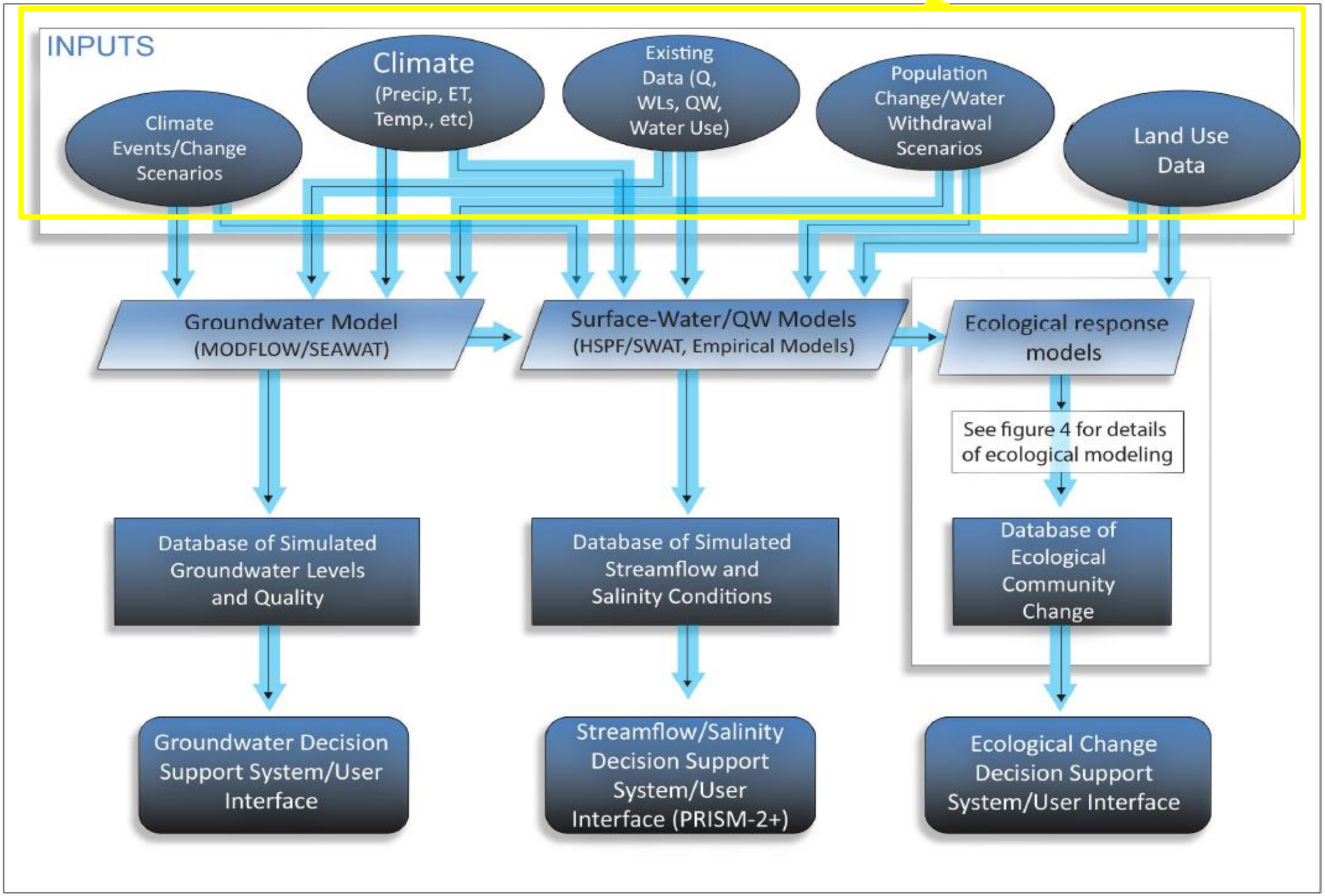
- Develop water-use estimates at HUC-10 scale and refine estimates for agriculture, public supply and industrial sectors.
    - Build site-specific water-use data in SWUDS to support the tracking of water from source, to user, to disposal, both within and out of the study area

- Surface-water models to evaluate potential changes in water availability and salinity in response to various water-use and climate change scenarios

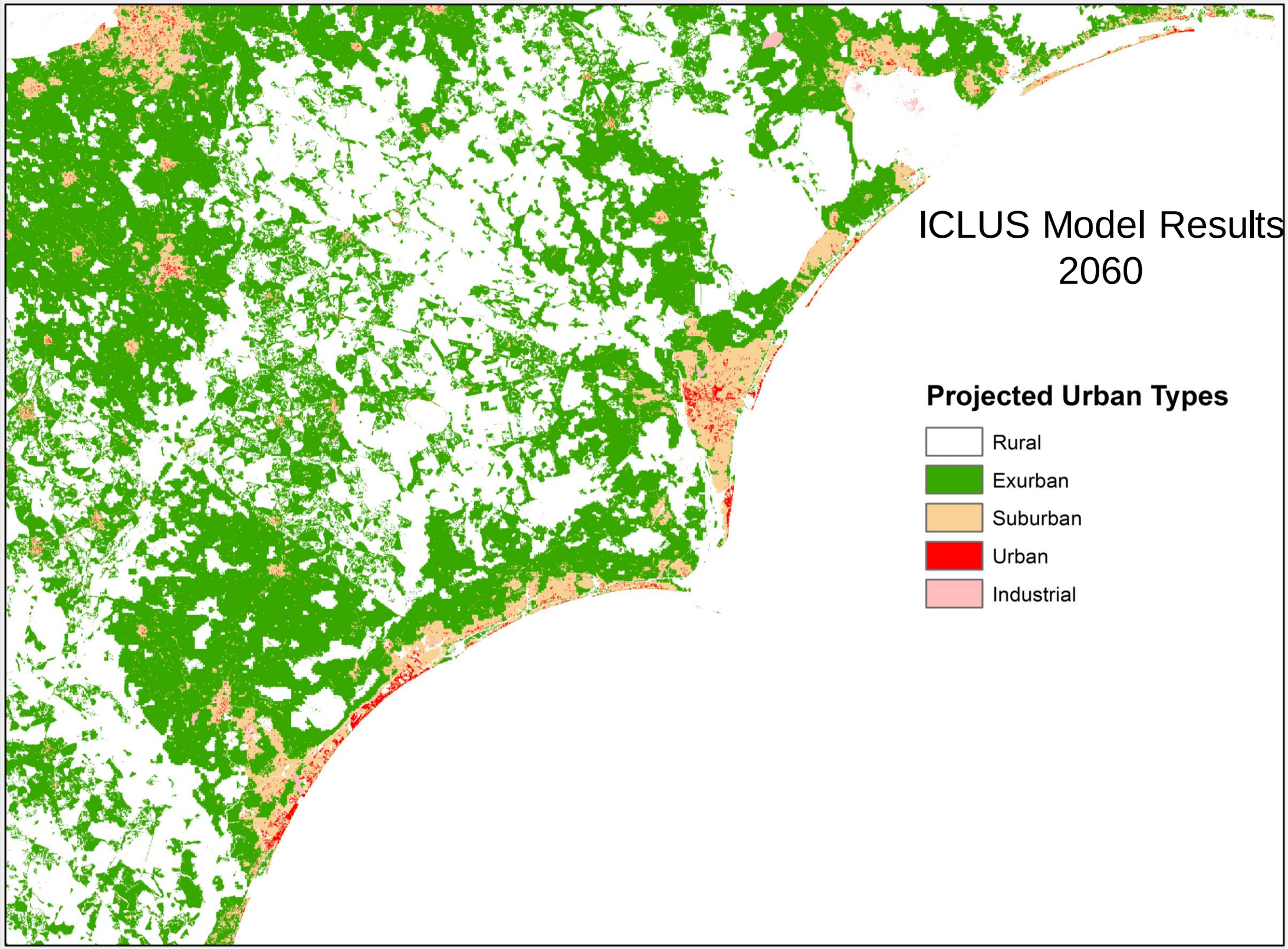
- Ecological (fish and invertebrate) response models to alterations in flow

- Groundwater flow model of surficial and deeper water-supply aquifers to simulate impacts of ET and water-use scenarios and susceptibility of saltwater encroachment and leakage from pumping

Conceptual Design



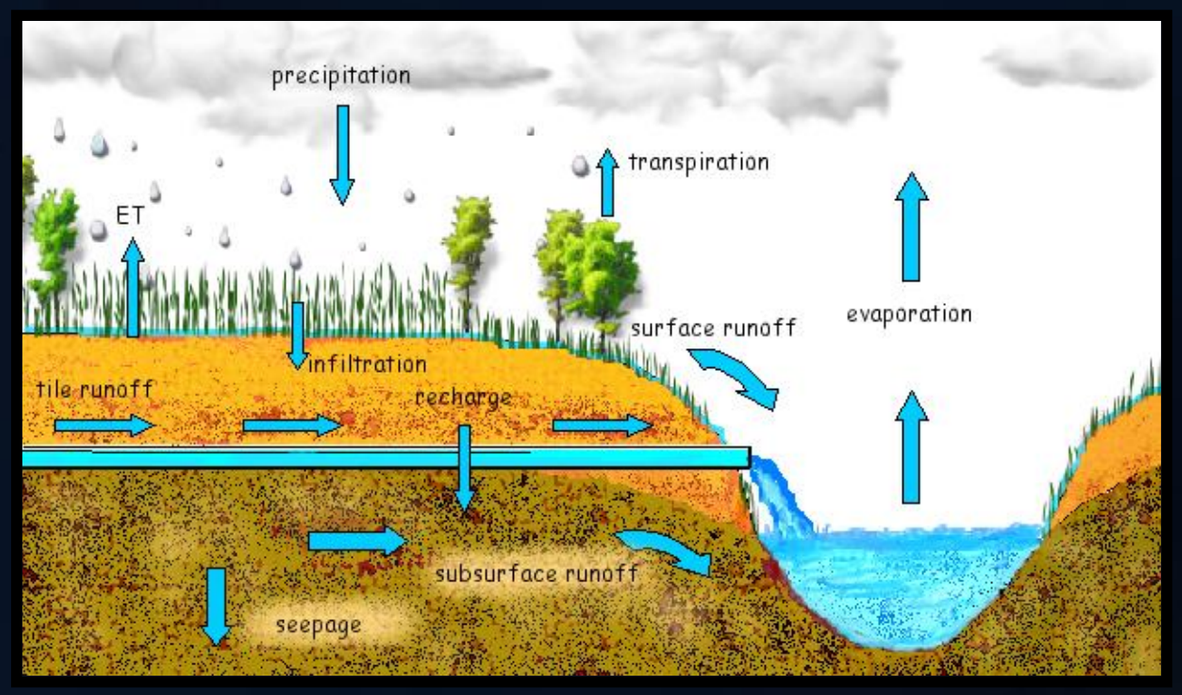
Population and Land-use Change Modeling



Surface-water Modeling

- A surface-water model of the Cape Fear River basin will be developed to simulate watershed response to various scenarios of extreme climate events (droughts, hurricanes, etc.), climate and land-use changes and water-use.

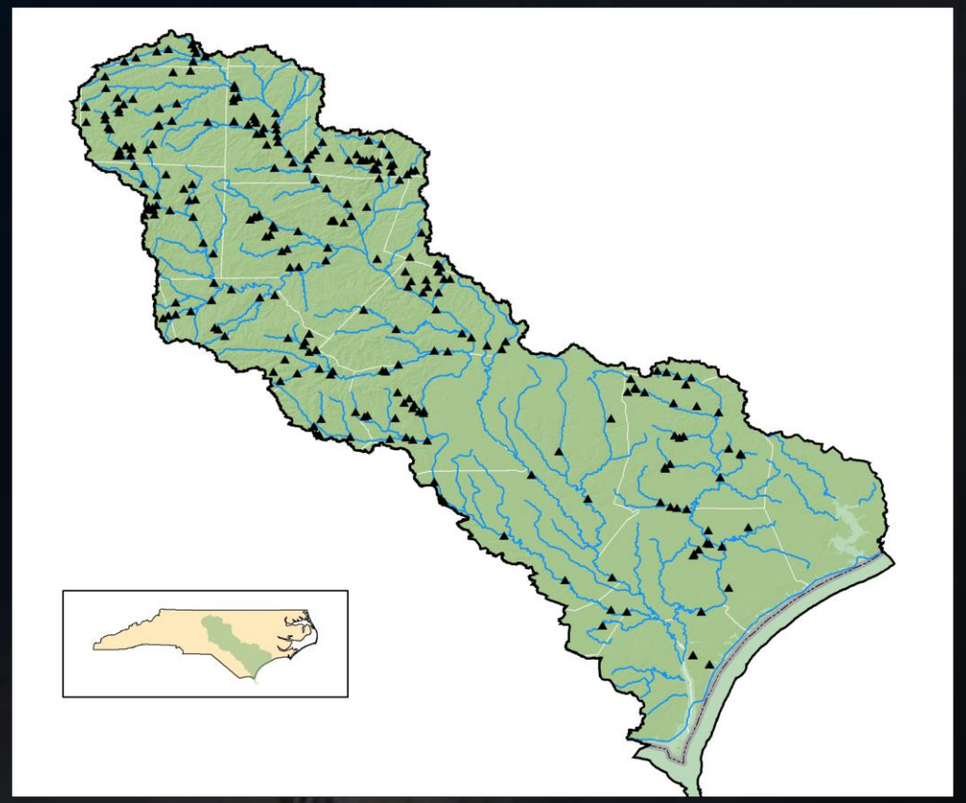
- The surface-water model will be used to simulate water level, streamflows and salinity, including potential effects of projected water-use and climate change in the study area.



Ecological Response Modeling

1. Existing fish (TN and ACF River basins) and invertebrate (Delaware and NC) response models will be applied using community data obtained from NC and SC State biomonitoring programs to forecast community change associated with the various surface-water model scenarios.

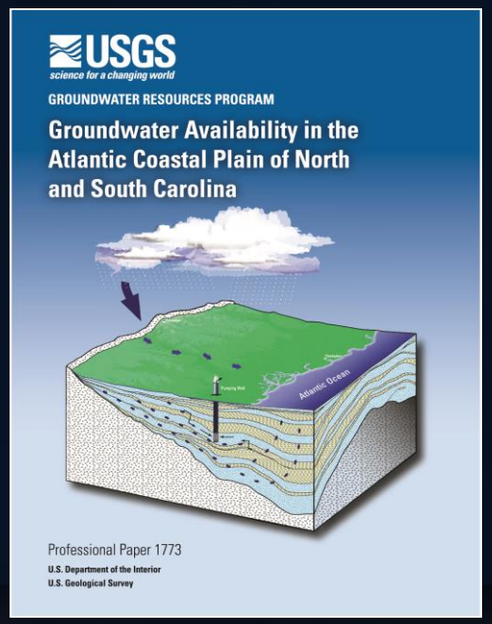
2. Investigate the effects that implementing differing ecological flow standards (7Q10 and 80% flow-by) would have on water availability for societal purposes and on the protection of fish and invertebrates during drought.

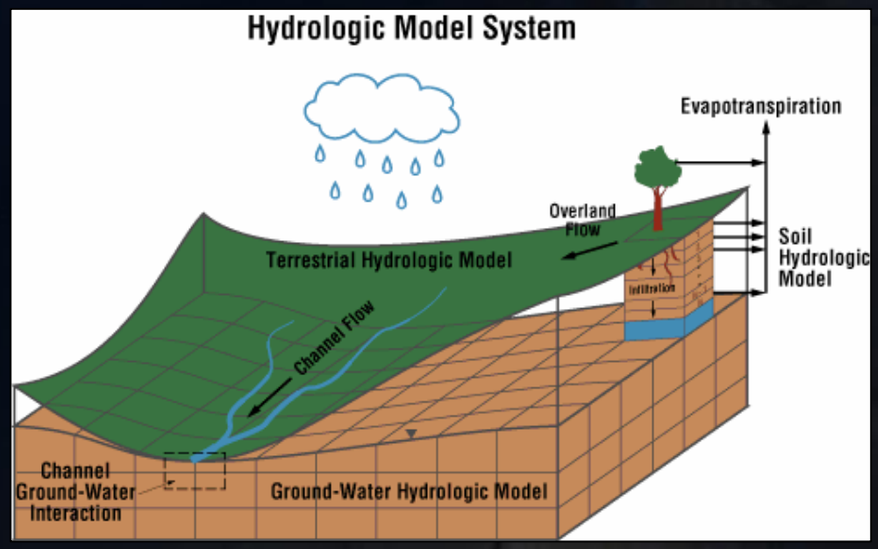


Groundwater Flow Modeling

The groundwater flow model will be developed to:

- Simulate results of historic and future stresses on the groundwater system in the coastal areas;
- Simulate and evaluate impacts of ET and various water-use scenarios in the study area on groundwater/surface-water interactions
- Create hypothetical scenarios that will predict future water-level and salinity conditions in the aquifers.





Potential Saltwater Intrusion Groundwater Modeling Effort

- Could add the ability to simulate saltwater movement into the groundwater flow model.

- Localized saltwater intrusion models would be extracted from the larger groundwater flow model and focus on coastal areas with existing or potential saltwater intrusion and upconing issues.

- Although the saltwater modeling effort does not fall within the current project scope, due to limited time and funding, the work being done creates an opportunity to find additional funding partners to study the saltwater issues of the region at significantly reduced costs.

Groundwater Modeling Benefits

- The models will be a tool that can be used to manage the groundwater resources of the region.

- The model can be used optimize well fields pumping to potentially minimize water level drawdowns and saltwater movement.

- Allow water suppliers to be proactive to potential problems that may arise with the future development of new supply wells or alternative well pumping schedules.

Proposed Decision Support Systems

- DSSs for Streamflow, Ecological and Aquifer response to water- and land-use scenarios from a range of population growth projections and climate/sea-level rise scenarios:

- DSSs and user interfaces could allow users to retrieve predictions based on a predefined library of modeled water-use, ecological-flow requirement, and(or) climate change/sea-level rise scenarios.

Expected Results of the FAS:

- More refined and representative water-use estimates at the HUC-10 or -12 levels from pts of diversion or withdrawal

- More accurate assessment of effect of consumptive water demands (ET) on water availability, leveraging remote-sensing work of Water Census topical study

- Modeling Tools and Alternative Water-Use Scenarios
  - Surface-water and Salinity models;
  - Ecological response models; and
  - Groundwater flow and salt-water intrusion models;

Questions/Discussion