USGS National Water Census

Coastal Carolinas Focus Area Study

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USGS South Atlantic Water Science Center

North Carolina - South Carolina - Georgia

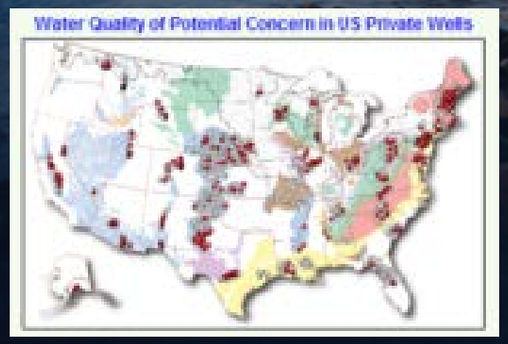
Our objective for the National Water Census

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?

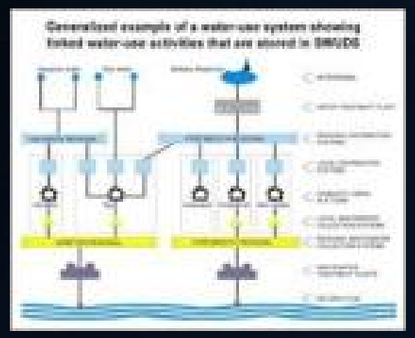
SECURE Water Act
Public Law 111-11, § 9507 and 9508

Focused Water Availability Assessments

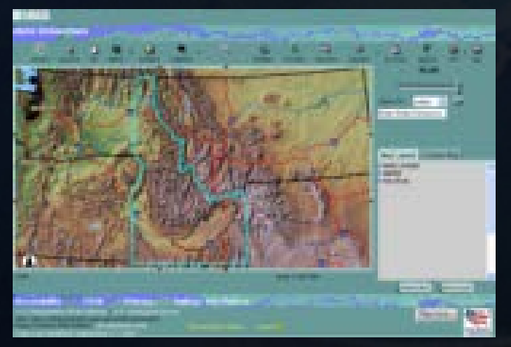


Water Quality

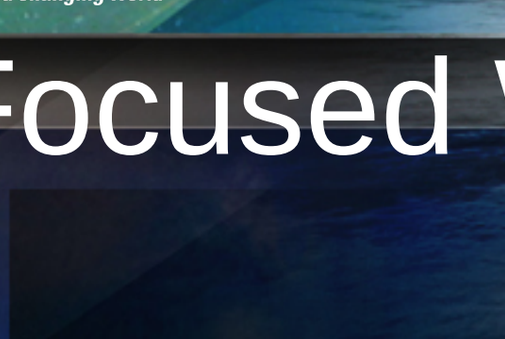
Groundwater Resources



Water Use



Surface Water Trends, Precipitation, etc



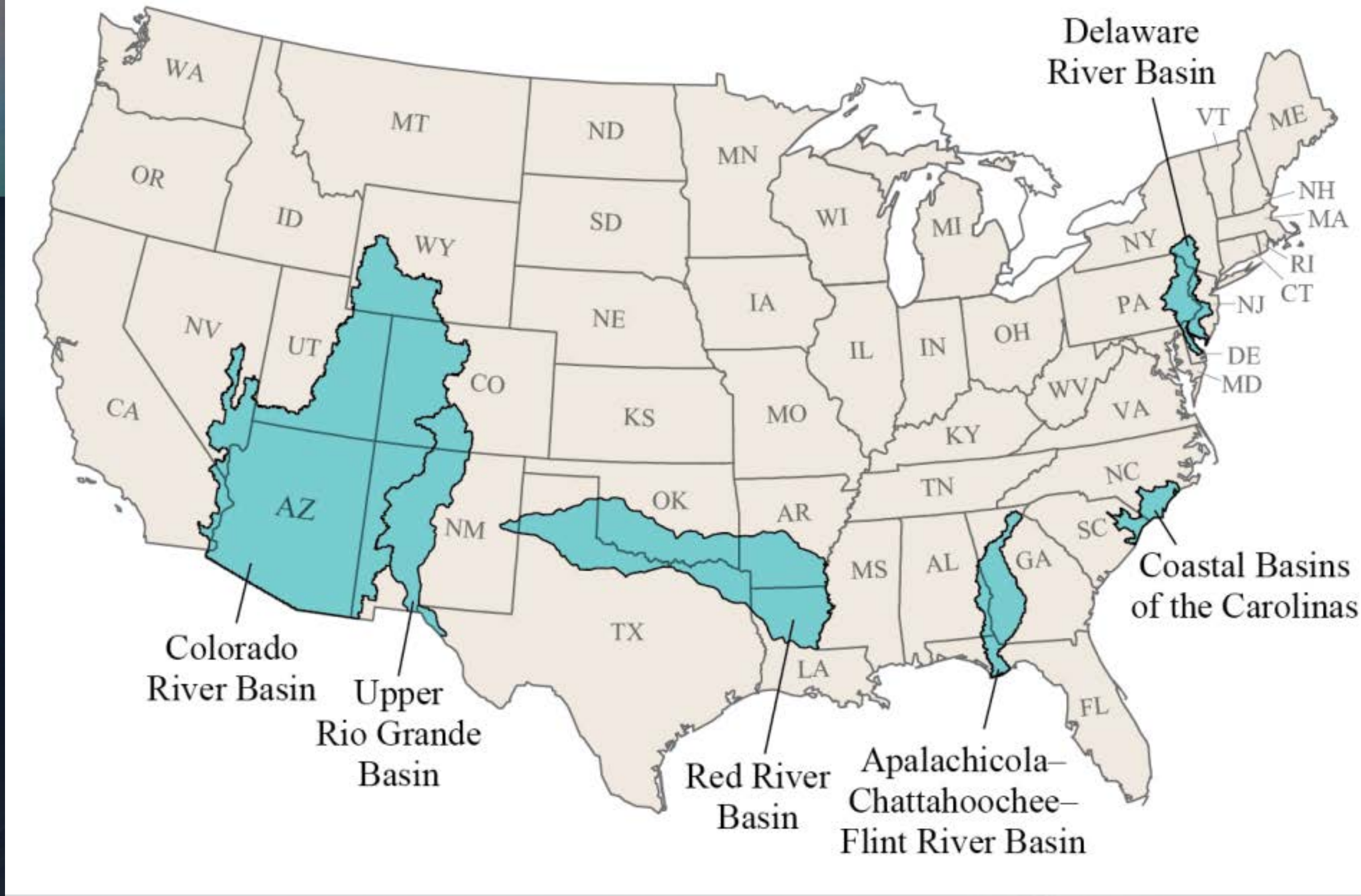
Eco Flows

Global Change

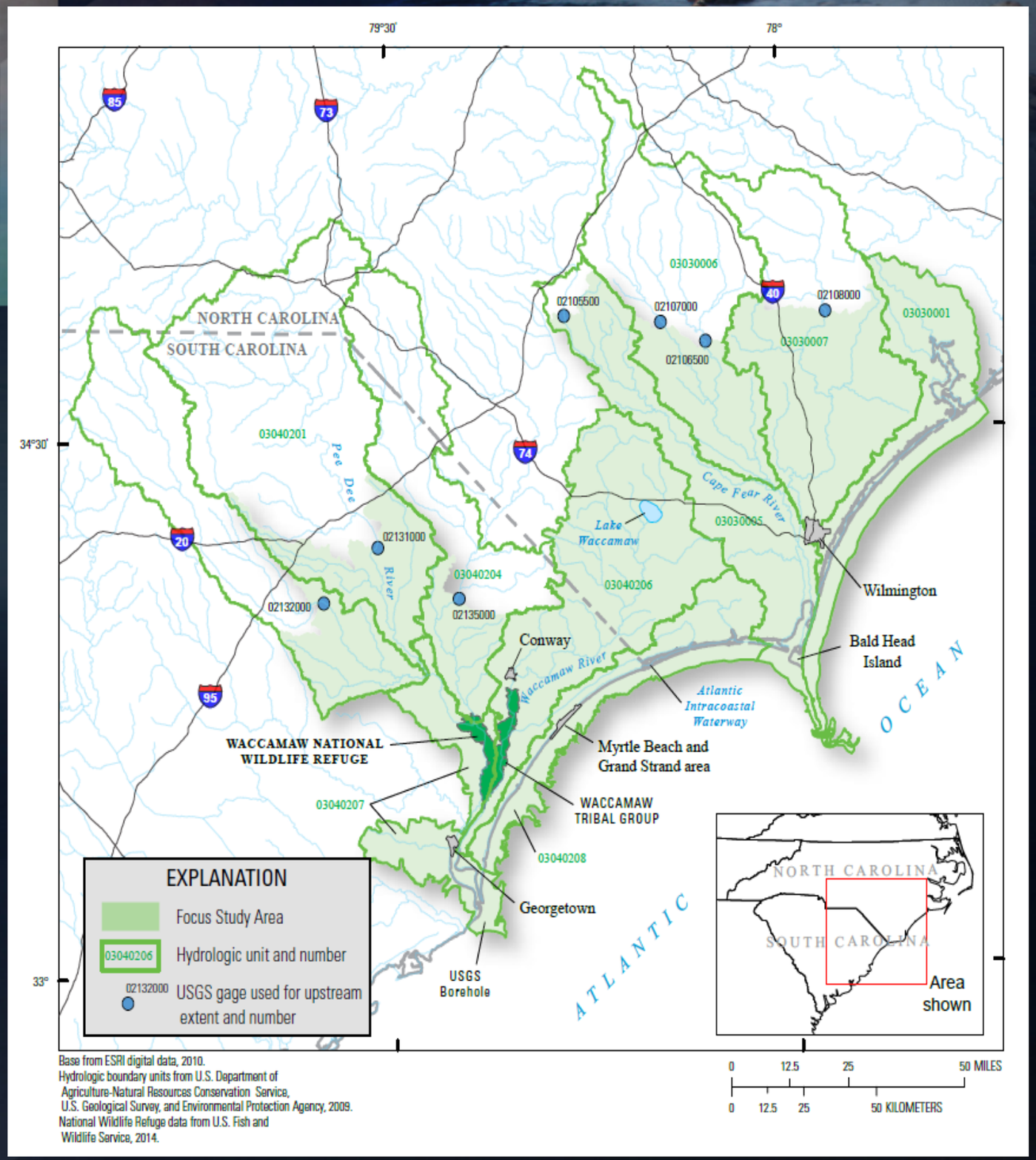
Defined Technical Questions to be Answered

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-8 watershed scale and refine estimates for golf courses, public supply, thermoelectric and industrial sectors.

- Develop models of land-use, population and water-demand change

- Surface-water models to evaluate potential changes in water availability 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 water-use and climate-change scenarios and localized susceptibility of saltwater encroachment and leakage from pumping

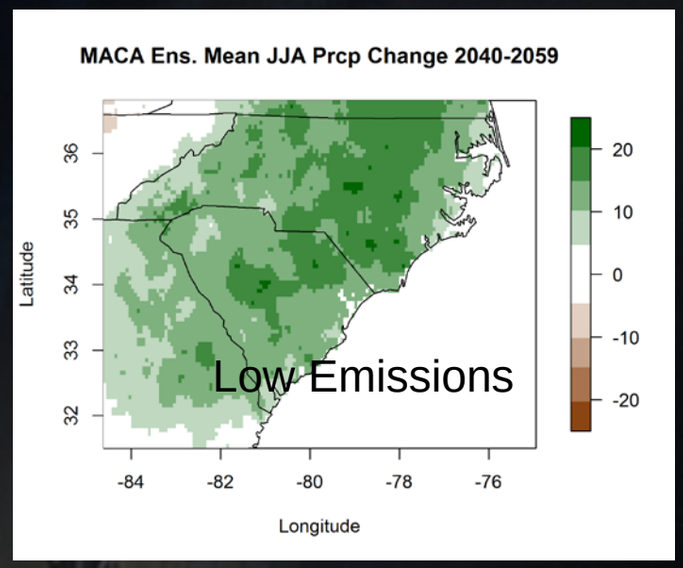
Water-Use Data Compilation

1. Develop refined site-specific and HUC-8 water-use estimates related to public supply, irrigation, thermoelectric, industrial, golf courses for 2000 – 2015 for the study area.

2. The 2000-2015 county-wide aggregated estimates for these categories of water usage will be disaggregated so that all water-use estimates will be reported to the watershed HUC-8 area.

Land-use, Population, Water-use and Climate-Change Scenarios

- Simulate future urbanization based on various scenarios using the Future Urban-Regional Environment Simulation (FUTURES) model.
- Simulate future water-demand based on urban growth/form and socio-economic conditions.
- Will employ the most current and applicable downscaled global climate models (CMIP5) to project a range of regional precipitation and temperature change -- necessary input to the groundwater, surface-water and ecological response models.



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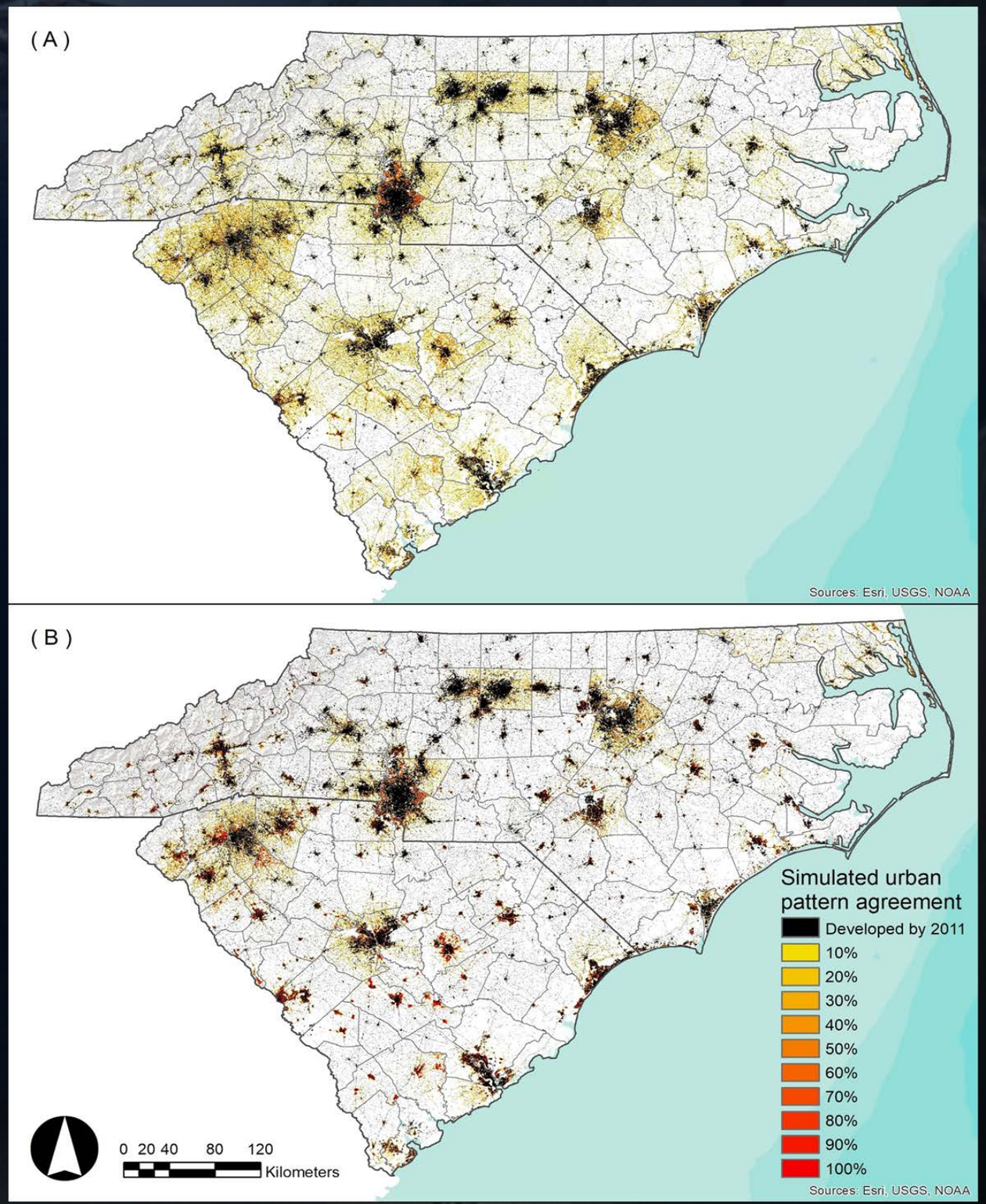
Center for **Geospatial** Analytics

Urbanization Probability by 2065

Status-Quo

WaterSmart



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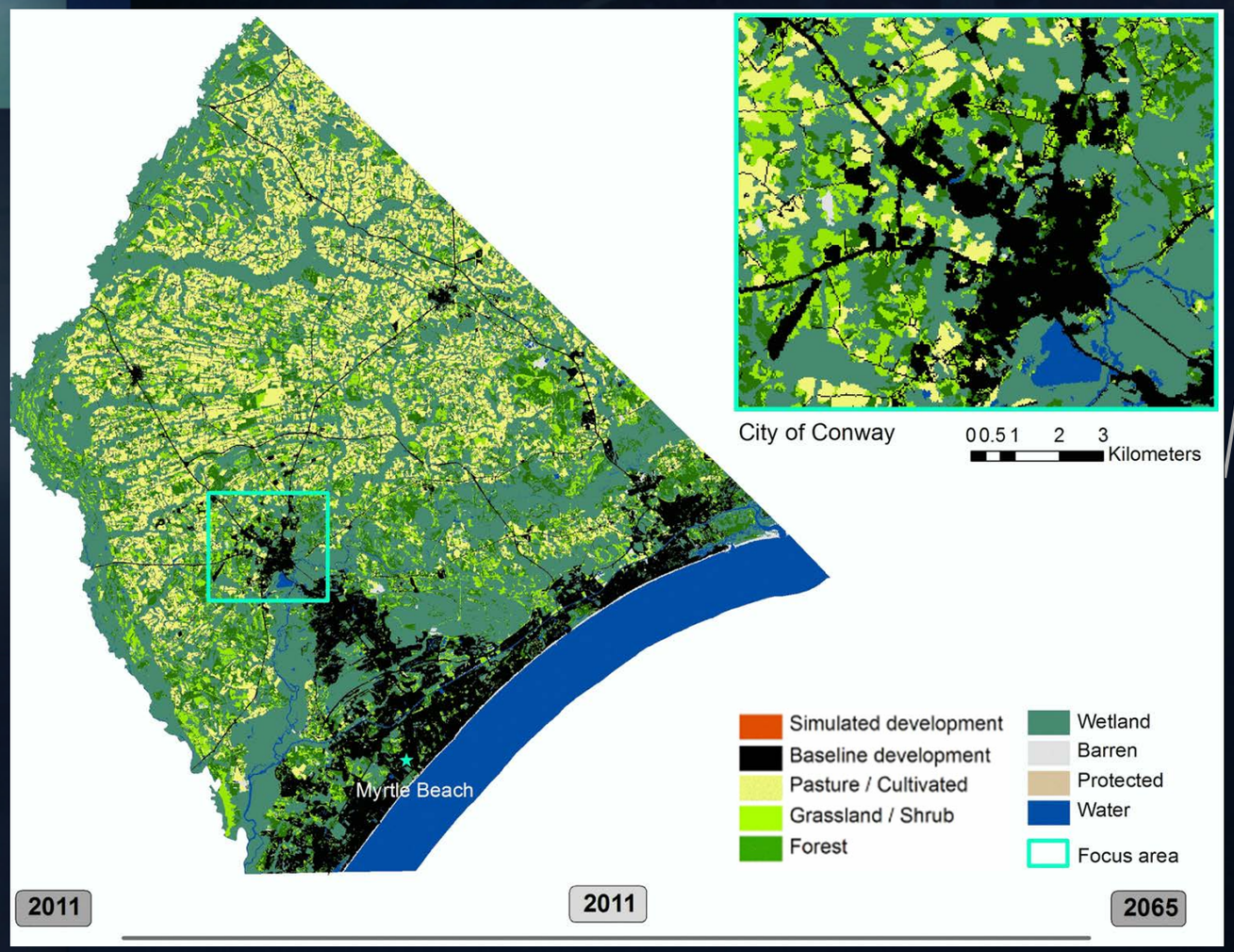
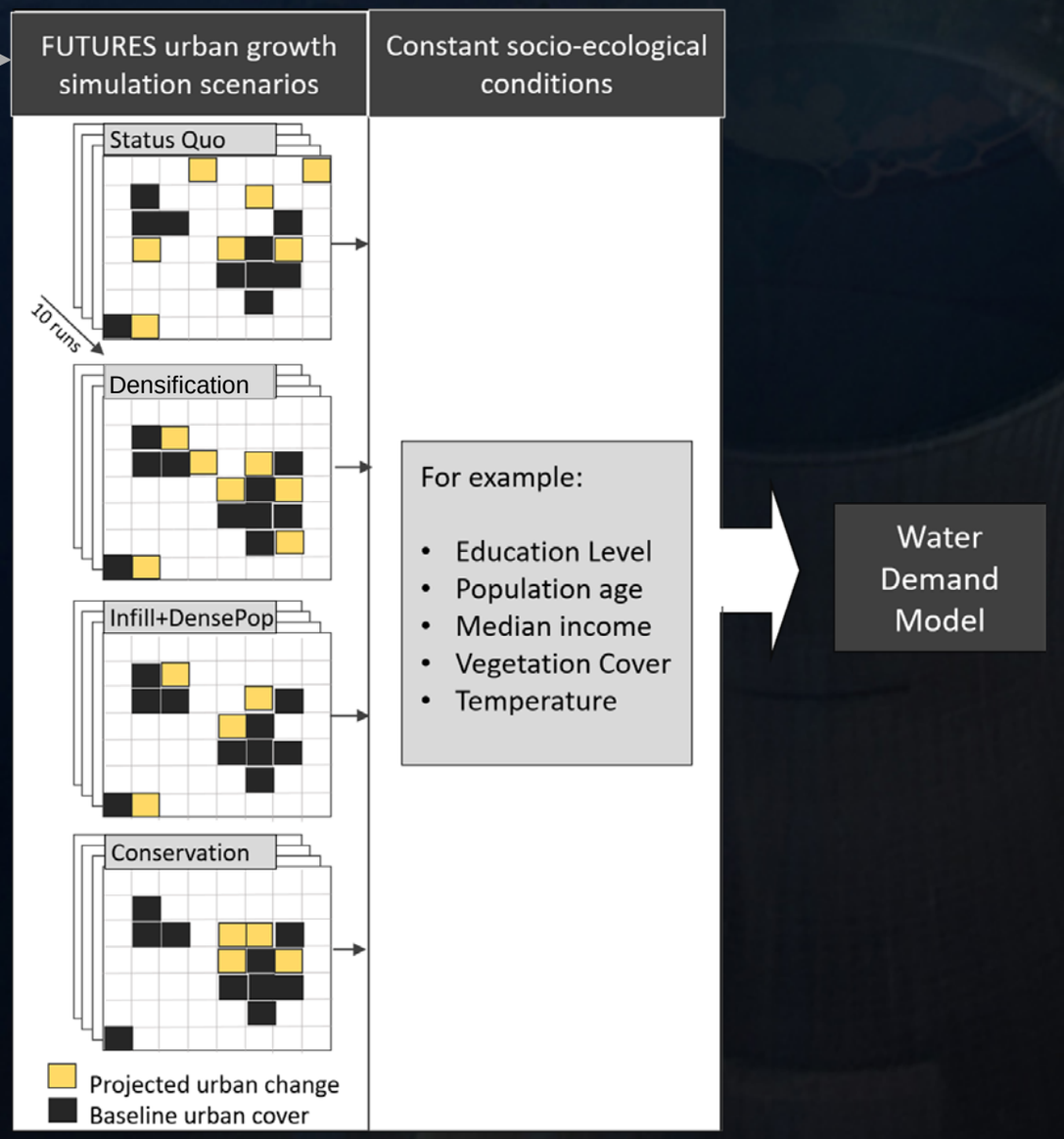
Coupling urban growth and water demand models





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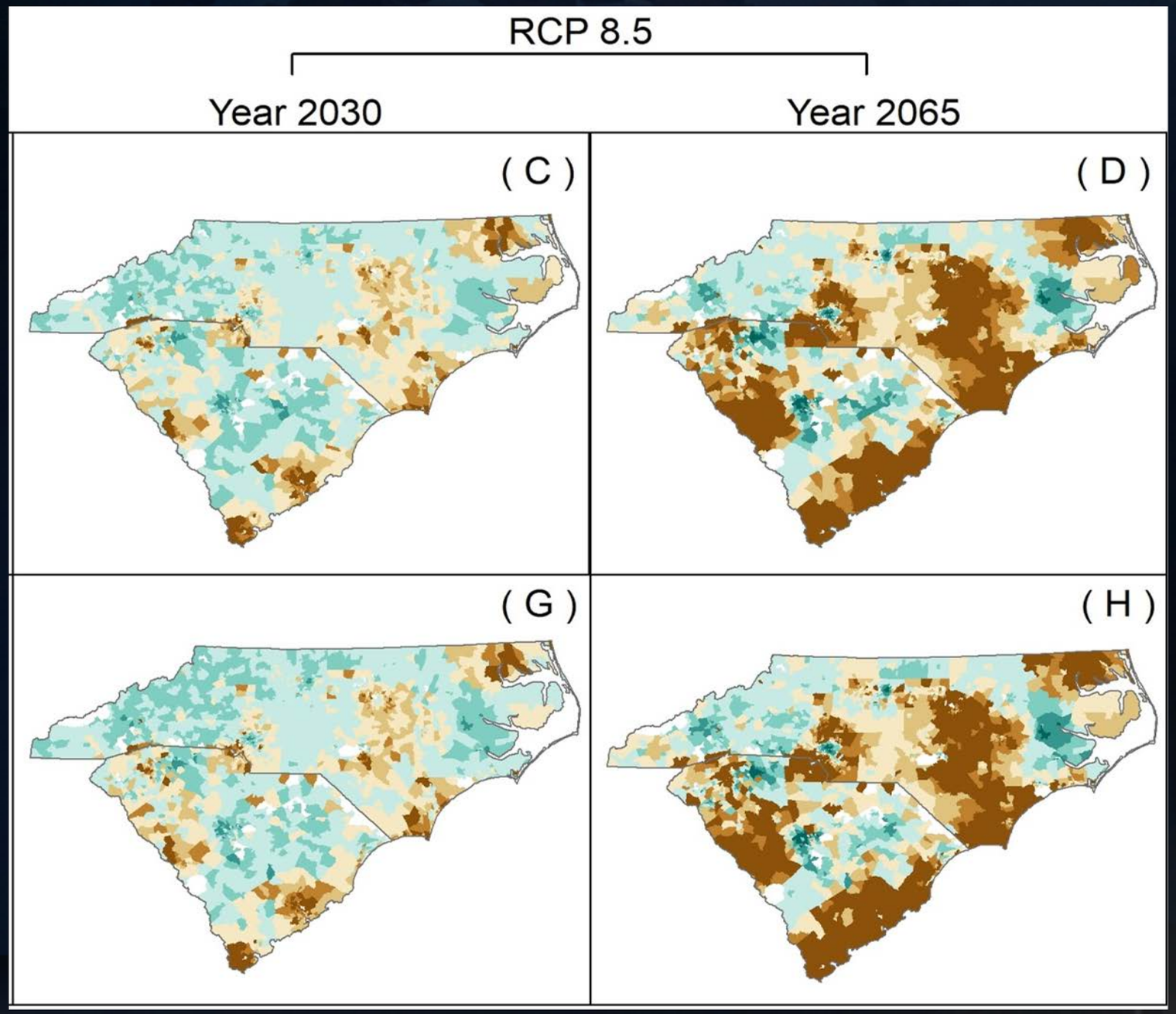
Spatial Distribution of Projected Change in Water Demand

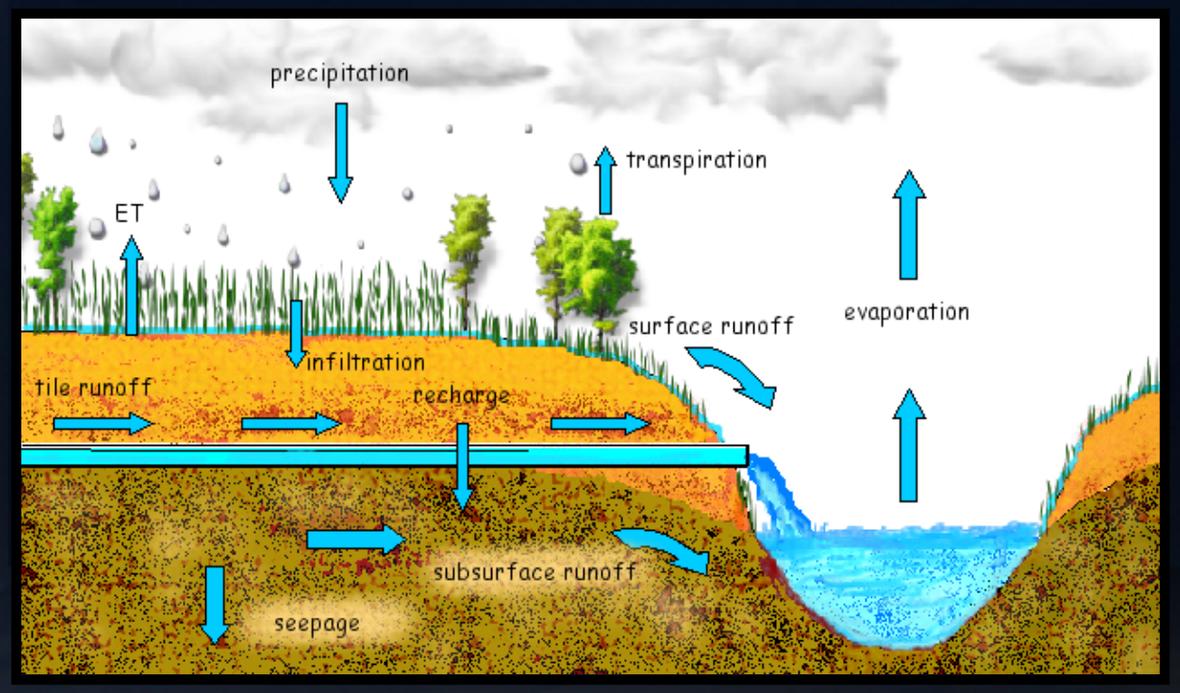


Estimates at census tract spatial unit by 2030 and 2065.

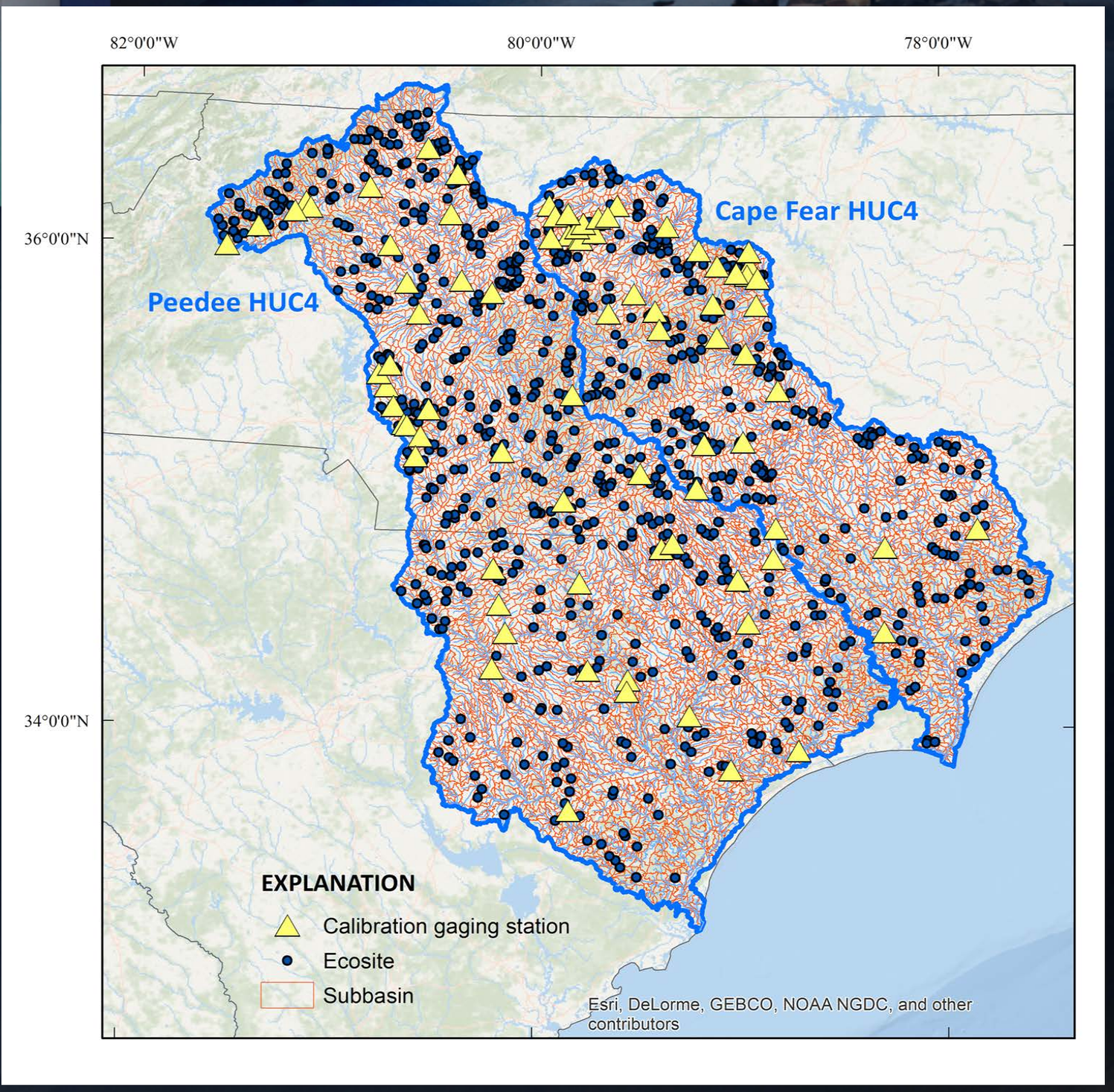
Surface-water Modeling

- Surface-water models (SWAT) of the Cape Fear River basin and Yadkin/PeeDee/Waccamaw River basin will be developed to simulate:
  - Streamflow at ecological sampling sites
  - Watershed response to various scenarios of extreme climate events (droughts, hurricanes, etc.), climate and land-use changes and water-use.

- The Yadkin/PD/Waccamaw modeled streamflow will be used in conjunction with PRISM-DSS (Conrads and others, 2013) to simulate instream salinity responses to projected water-use and climate change in the study area.



Cape Fear and Pee Dee River Basin SWAT Models

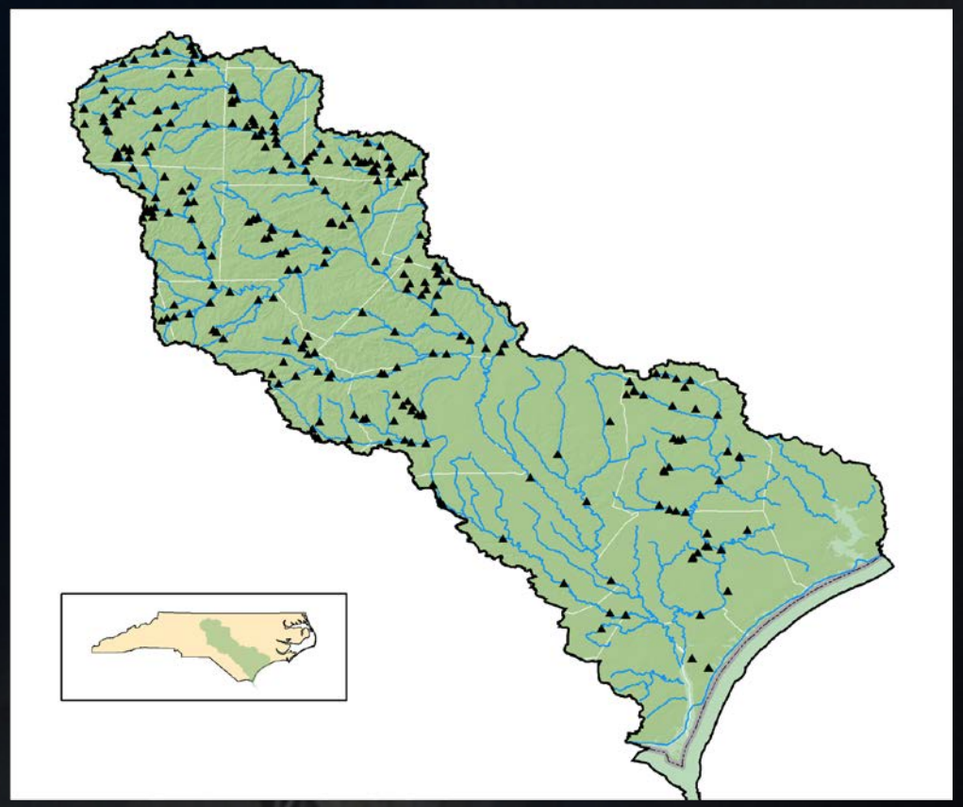


- Two HUC4 models
- With 2 sq mile subbasins
  - Cape Fear River basin
    - 2928 subbasins
    - 352 ecosite locations
    - 37 calibration stations
  - Pee Dee River Basin
    - 5678 subbasins
    - 599 ecosite locations
    - 44 calibration stations

Ecological Response Modeling

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

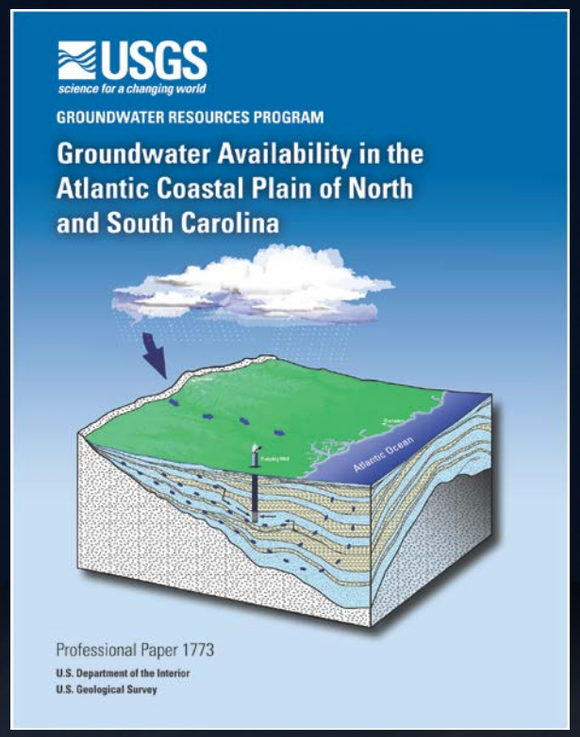
2. Investigate the effects that implementing differing ecological flow standards (7Q10 and 80% flow-by) would have on water availability for societal purposes and on the protection of fish and invertebrates during drought.

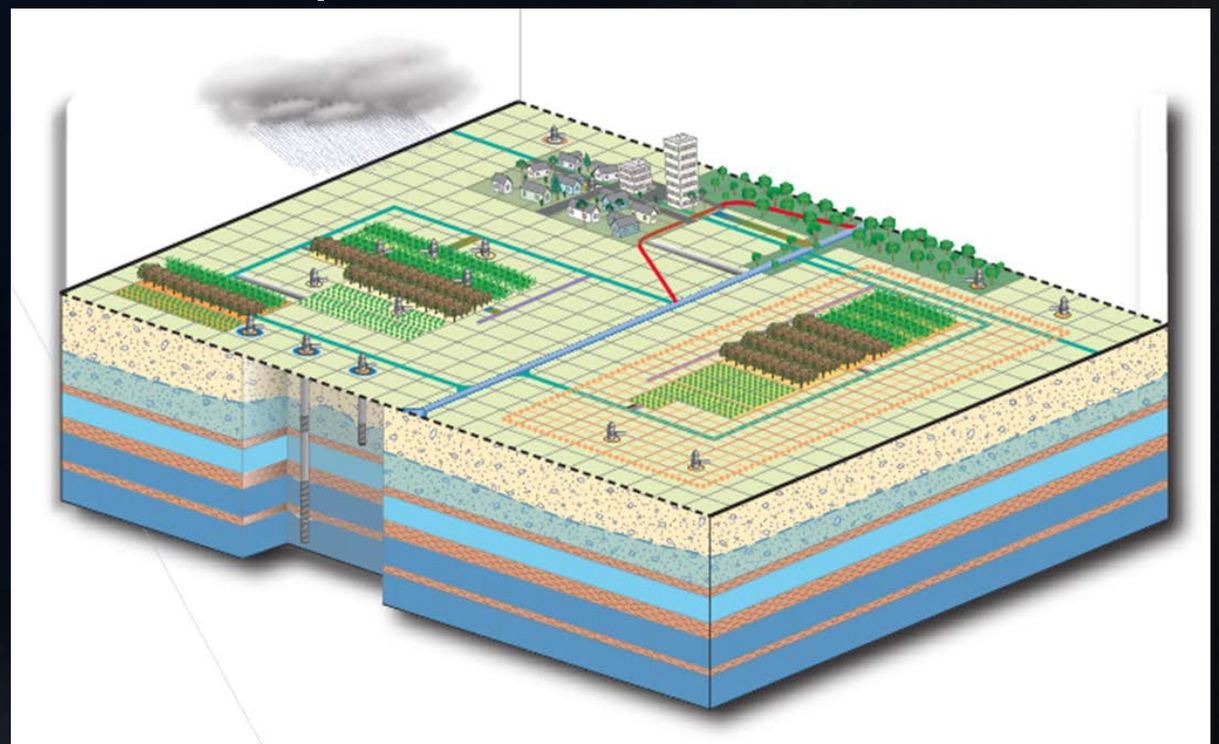


Groundwater Flow Modeling

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 saltwater movement (localized SEAWAT model), and various water-use scenarios in the study area on groundwater availability
- Create hypothetical scenarios that will predict future water-level and salinity conditions in the aquifers.





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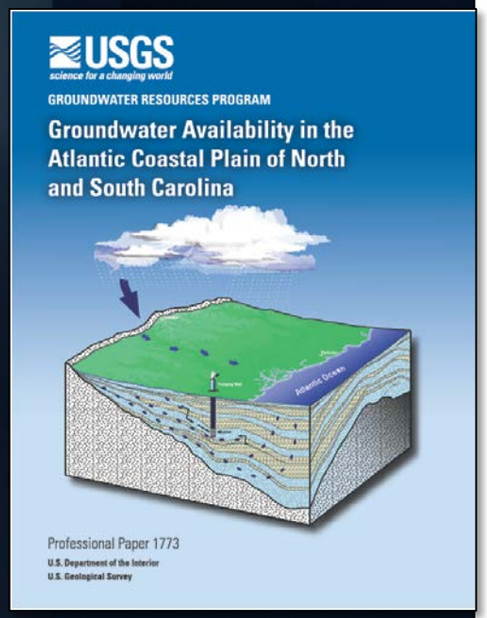
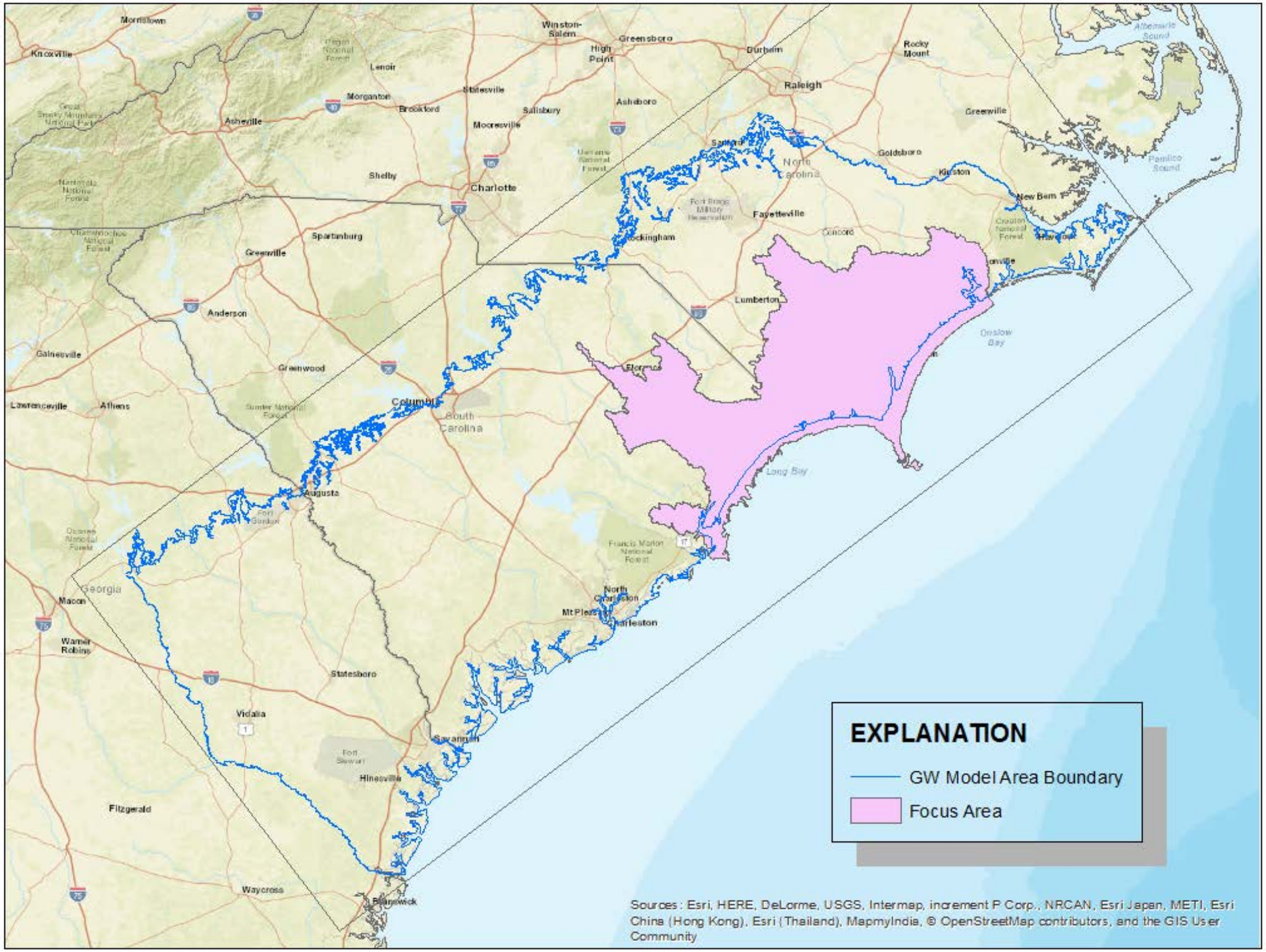
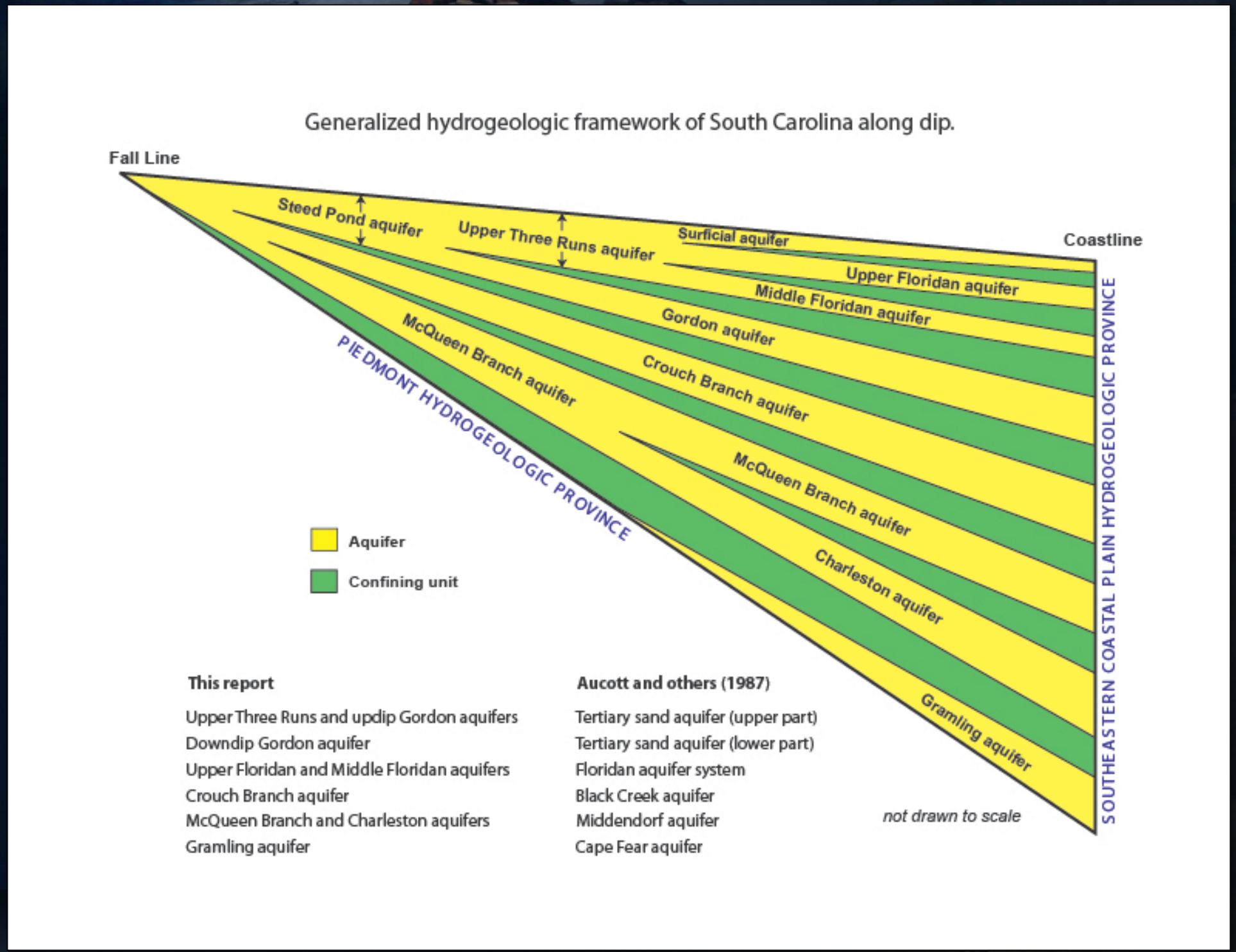
Groundwater Model Area





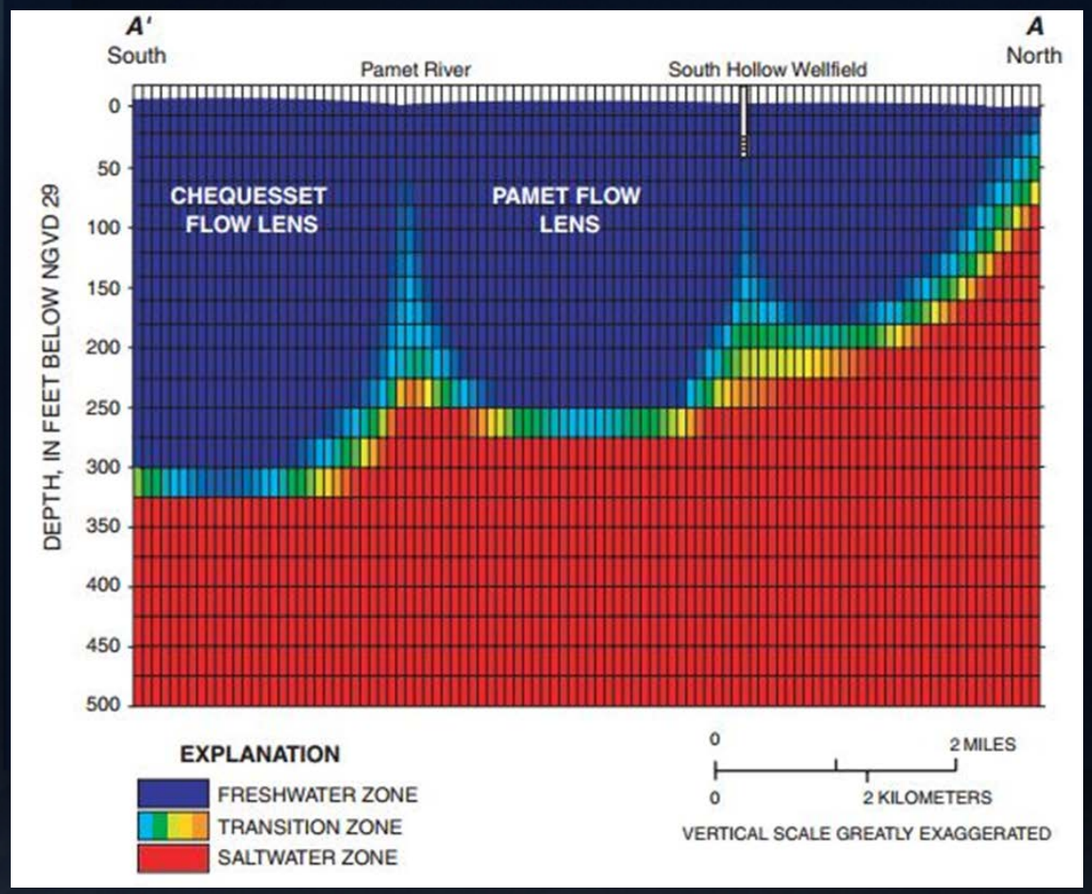
Coastal Plain Hydrogeologic Framework



Saltwater Intrusion Groundwater Modeling

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

- Planning to develop localized SEAWAT models for 1 – 2 areas (i.e. areas around Wilmington, NC and(or) Georgetown, SC).

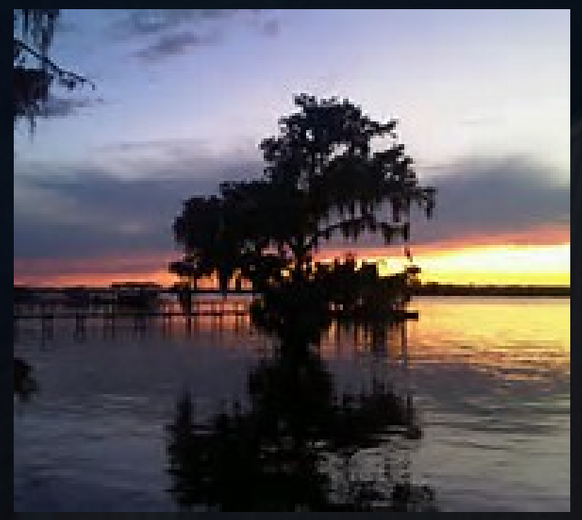


Proposed Decision Support System

- Develop DSS/user interface to allow users to retrieve a predefined library of modeled in-stream, aquifer, and ecological response to a range of population, land-use, water-demand and climate-change scenarios.

Expected Results/Deliverables of the CC FAS:

- More refined and representative water-use estimates at the HUC-8 levels from pts of diversion or withdrawal
- Future land-use change (urbanization) and water-demand predictions
- Modeling tools and water-availability predictions based on alternative land-use, water-use, and climate-change scenarios
  - Surface-water models;
  - Ecological response models; and
  - Groundwater flow and saltwater intrusion models;



- Decisions support system (DSS) for users to view surface-water, aquifer, and ecological response to various water-demand, land-use and climate-change scenarios.

Questions/Discussion

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