



# Community Interactions: Effects of Environmental Change

**Patuxent Wildlife Research Center**

**Biennial Science Meeting**

**11-13 October 2006**

# Outline of Discussion

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- Overview of relevant issues
- Management and research questions
- PWRC multidisciplinary approaches to understanding community responses to environmental change - *examples*

# Major issues facing DOI agencies

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Effects of human-caused environmental changes on community dynamics, species persistence, ecosystem function

- Land use changes, e.g., urban and sub-urban growth, silviculture, agriculture
- Altered stream hydrology from water diversions, impoundments, flow-regulation
- Climate change, altered fire regimes
- others

# ***A lot of PWRC Research on Communities & Environmental Change***

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- **Amphibians**
- **Migratory birds**
- **Mammals**
- **Waterfowl**
- **Stream fishes**
- **Vegetation**
- **Invertebrates**

# Management & Research Questions

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- Approaches for measuring community change
- Development of predictive understanding of community responses
  - Innovative tools, field approaches
  - Use of remote sensing data
  - Quantitative models

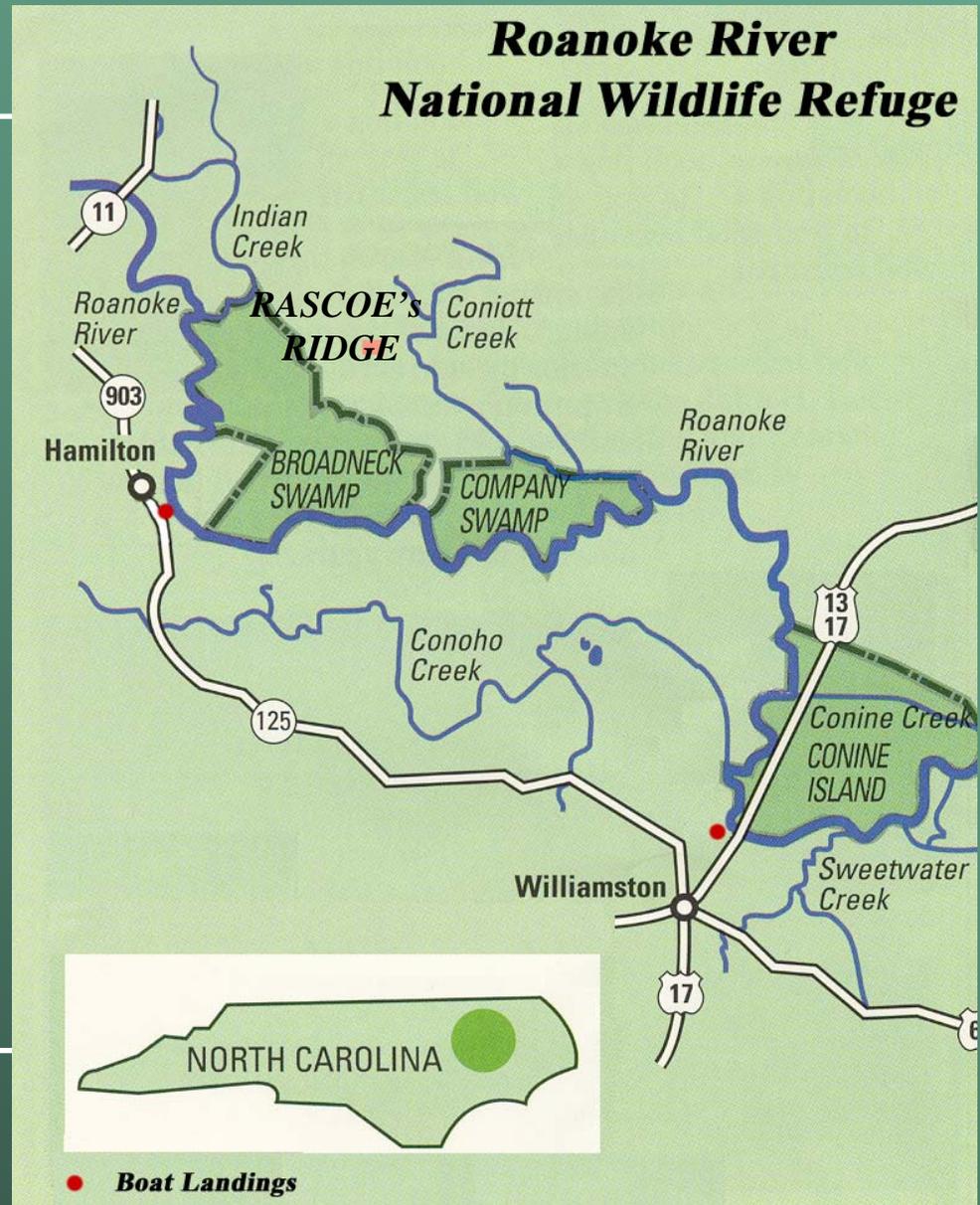
# Research examples

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- Effects of extended flooding on forest communities
  - *Roanoke River Wildlife Refuge, Perry et al.*
- Stable isotopes in food-web analyses
  - *Prairie Potholes, Guntenspergen et al.*
- Conservation planning for landbirds
  - *West Gulf /Central Hardwoods, Twedt et al.*
- Hydrologic alteration effects on stream communities
  - *Flint River, Freeman, Hughes, Peterson et al.*

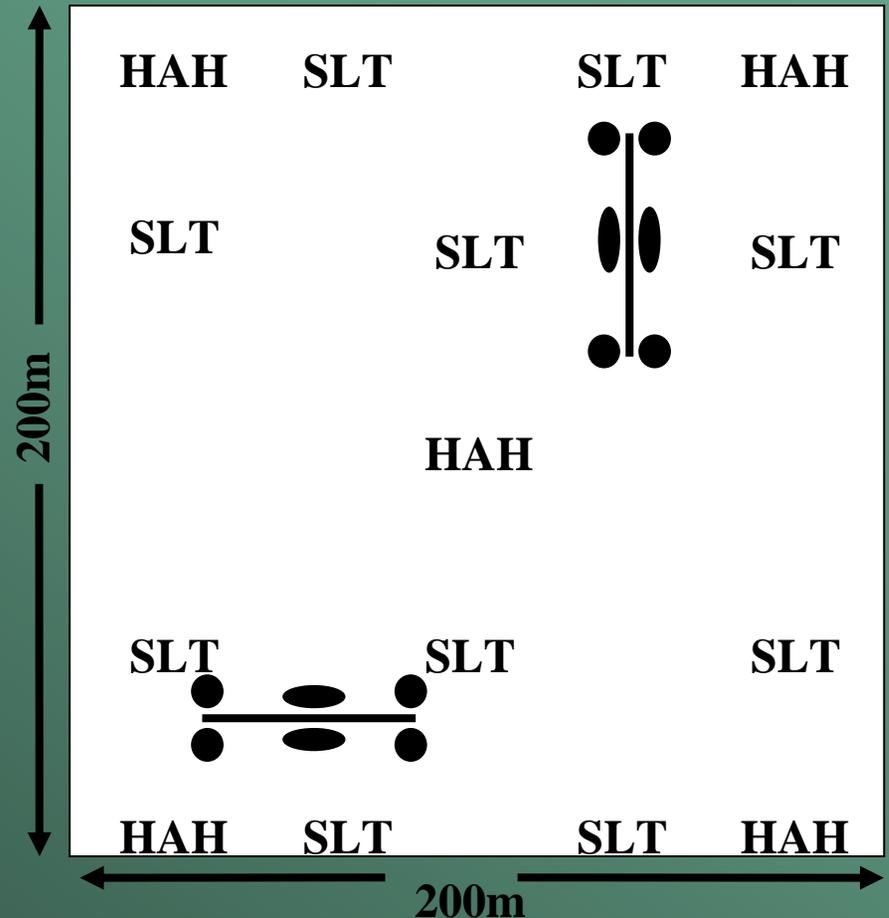
# Extended flooding effects in bottomland forest

Objective:  
Design and test a protocol for assessing effects of extended flooding on vertebrate, invertebrate and vegetative communities



# Extended flooding effects in bottomland forest

Approximate location of traps used to capture vertebrates in study sites on the Roanoke River National Wildlife Refuge.



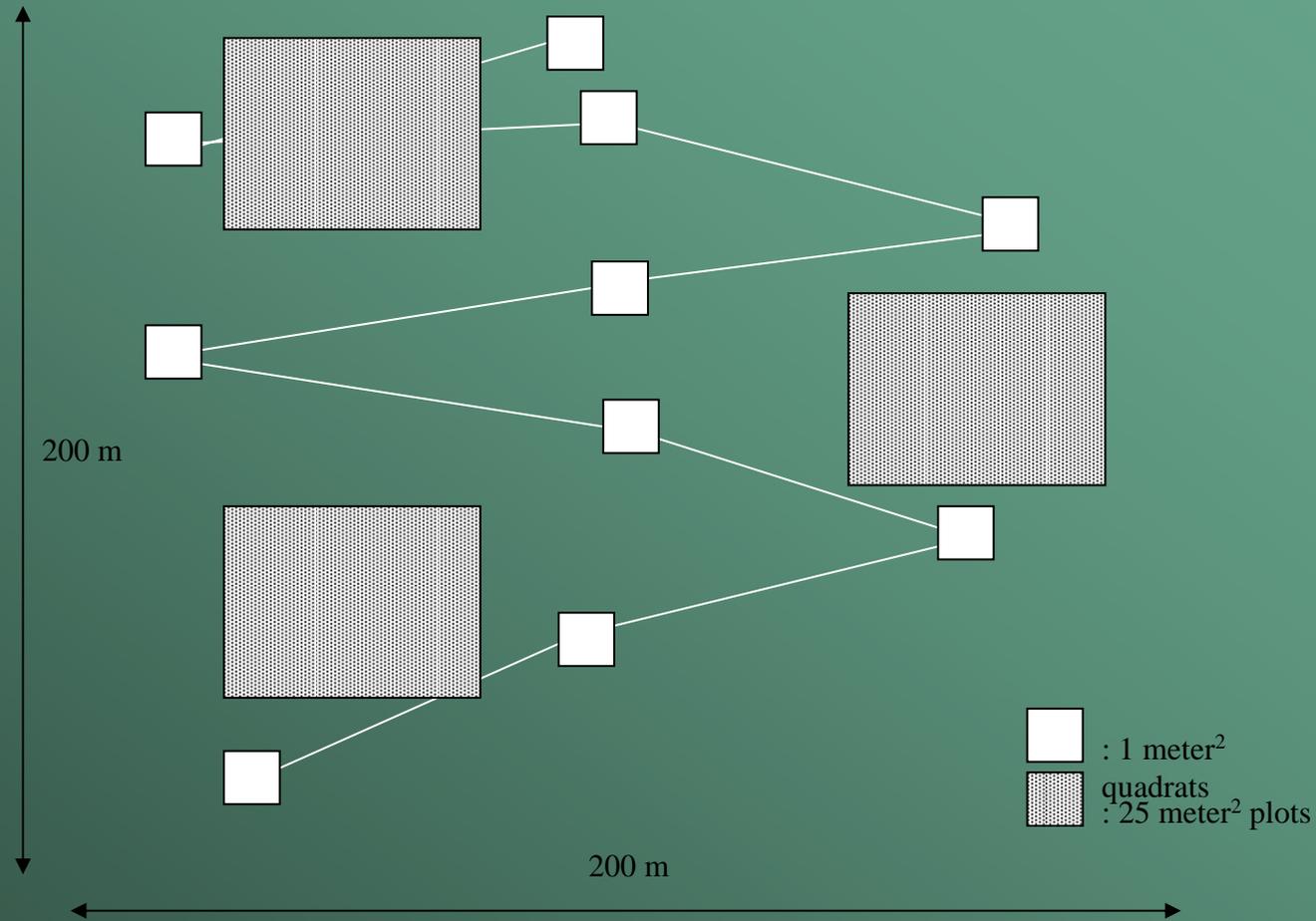
HAH – HAV-A-HART Medium size mammal box trap.

SLT – Sherman Live Trap for small mammals.

Drift fence with two pitfall traps at each end, and funnel trap on each side.

# Extended flooding effects in bottomland forest

General diagram of location of 10m<sup>2</sup> quadrats and three 25 x 25m<sup>2</sup> sections used for *vegetation sampling* at study sites for Roanoke River NWR.



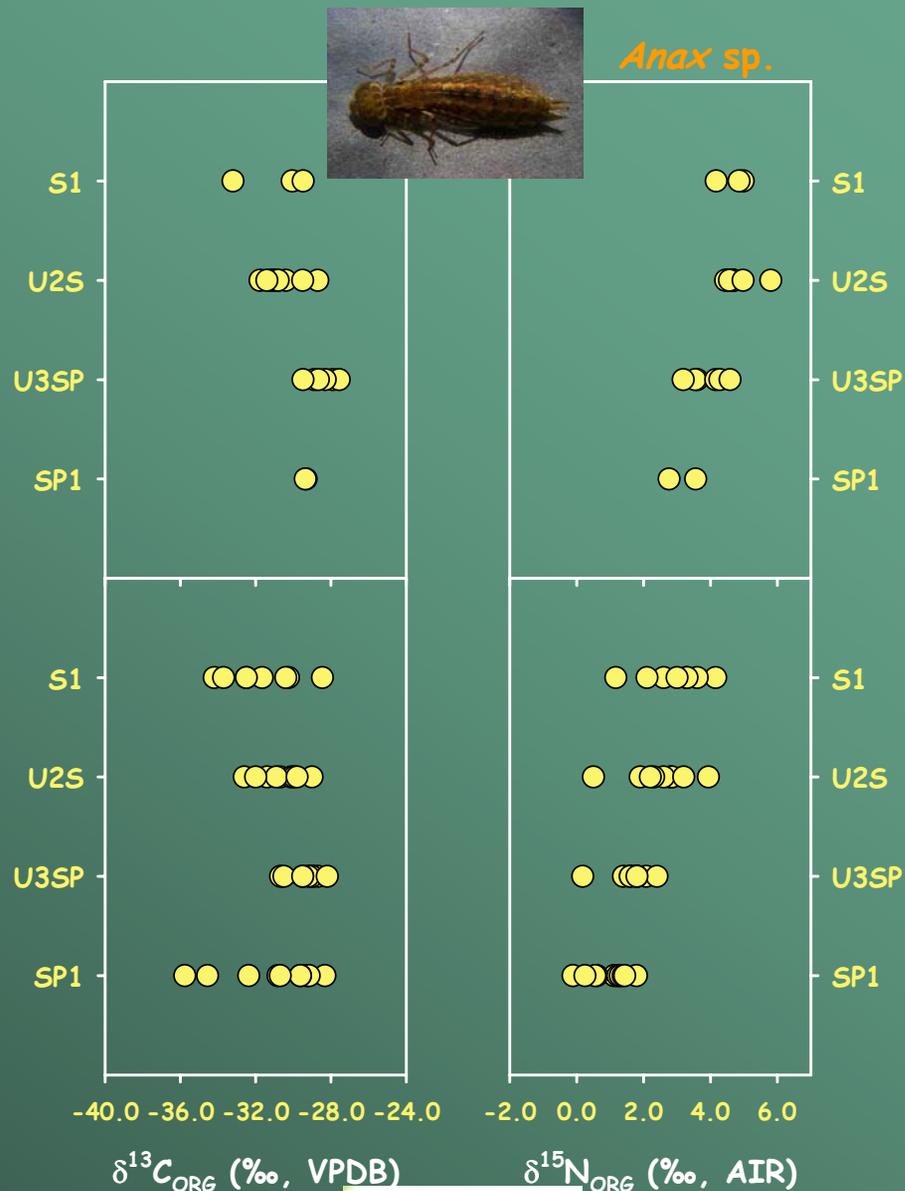
# Food web relationships using stable isotopes

## C isotopes...

- Provides less source info
- Big range for 1° consumers
- Reflects local habitat

## N isotopes...

- Systematic enrichment
- N cycling info
- Wetlands differ



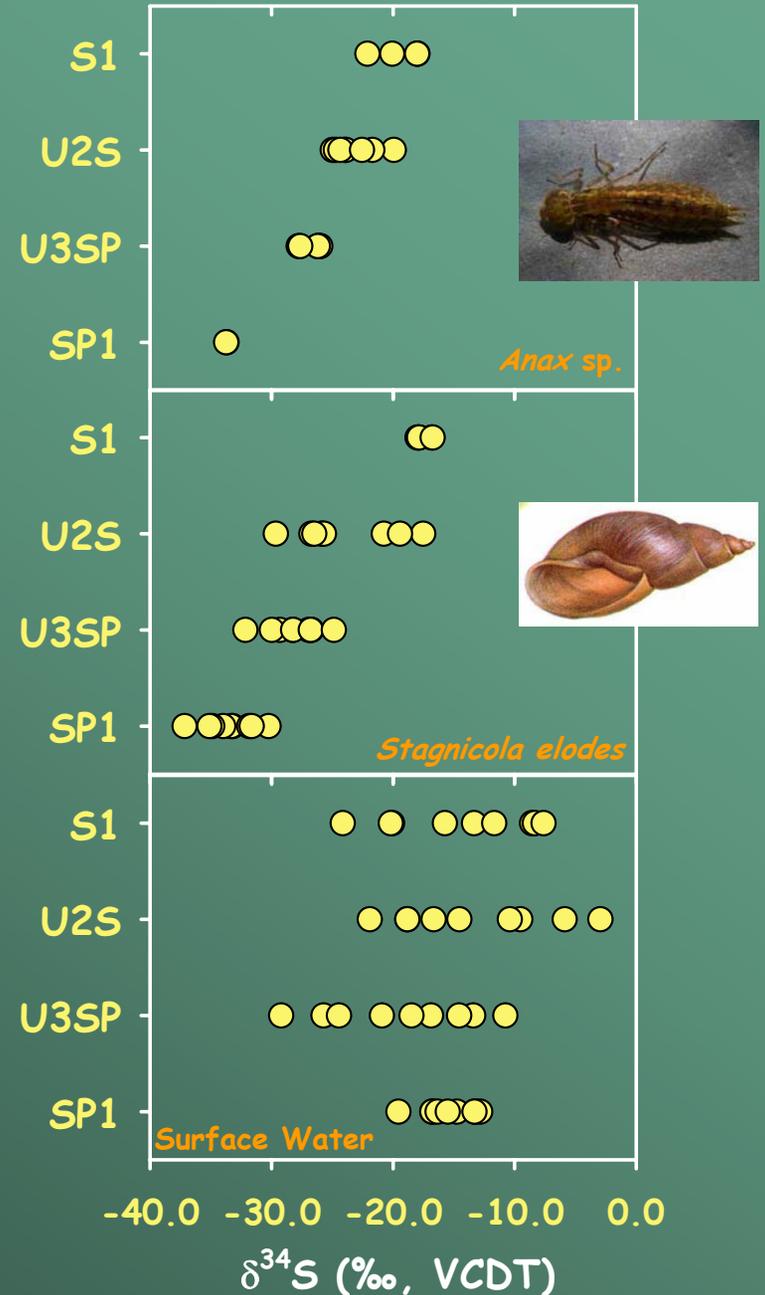
*S. elodes*

# $\delta^{34}\text{S}$ Variability...

- SW had biggest range
- Lighter lower in the catchment
- 1° consumer more variable than 2° consumer
- $\Delta\delta^{34}\text{S}_{\text{SO4-ORG}} \sim 6$  to  $23\text{‰}$

# Implications...

- $\delta^{34}\text{S}_{\text{ORG}}$  signature set early
- Life history, diet switching
- Noise dampening



# Implications

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- **S isotopes...provide better insights into nutrient-food web relationships that would not be available from C and N isotopes**
- **Interdisciplinary research with geochemists - understand S biogeochemistry to better interpret food web relationships**

# Ecoregional Scale Landbird Conservation Planning

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Joint USGS, Fish & Wildlife, Forest Service Project

**North American Landbird Conservation Plan goal:**

**Create landscapes capable of sustaining bird populations at prescribed levels**

**Project objective:**

**Develop population objectives based on and linked to habitat conditions**

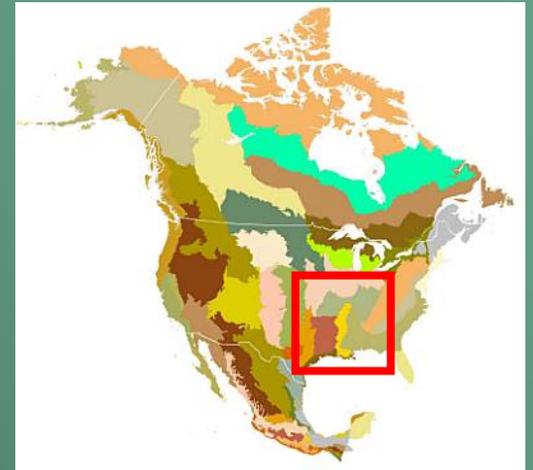
# West Gulf Coastal Plain & Central Hardwoods Regions

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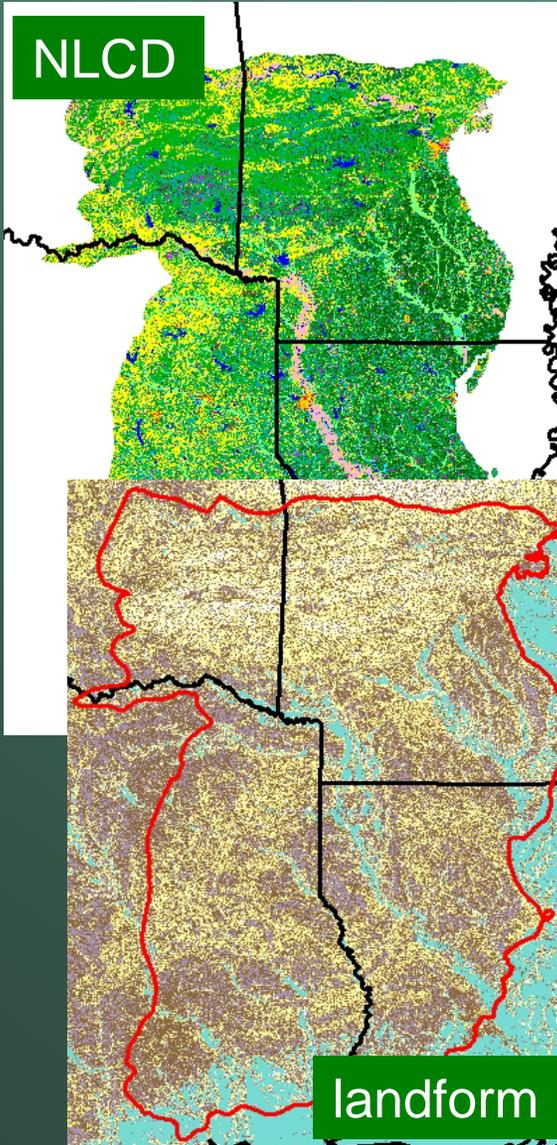
**Model population response to habitat for 43 priority bird species**

**Use density and productivity as metrics**

**Assess current and future ability of landscapes to support bird populations**

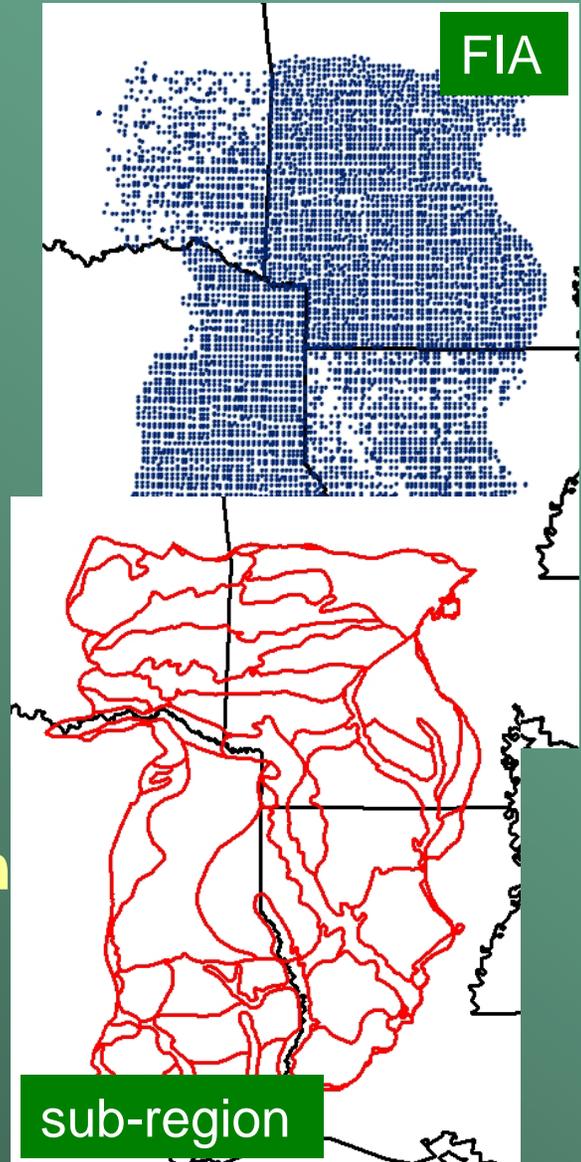


# Use National Datasets



Link  
National Land Cover  
&  
Forest Inventory  
Data

Extrapolate habitat  
to  
landform class  
&  
ecological subregion



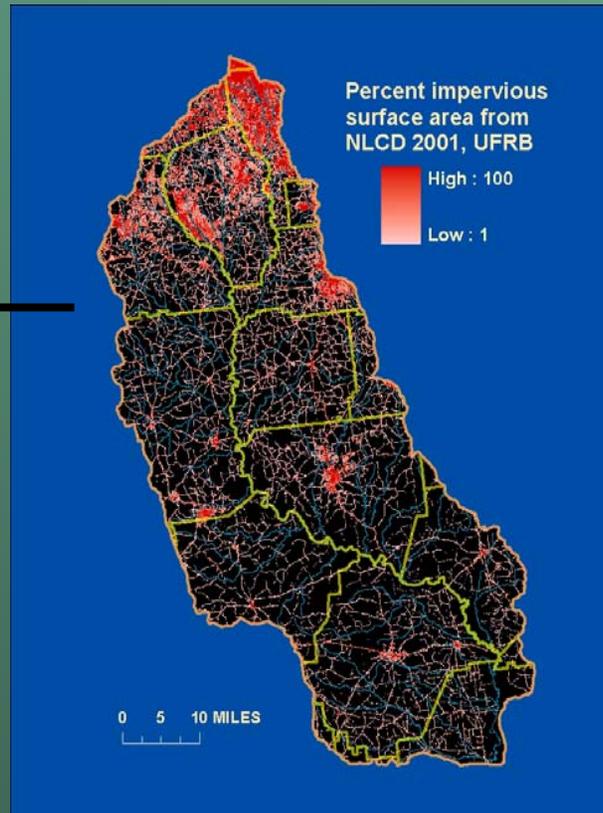
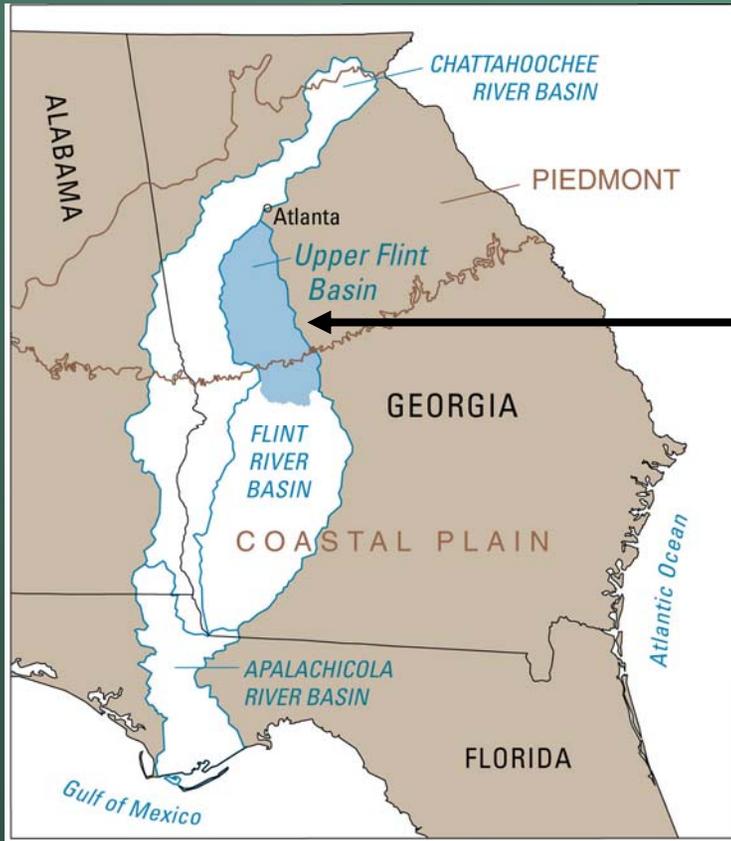
# Water availability for ecological needs: Flint River, GA

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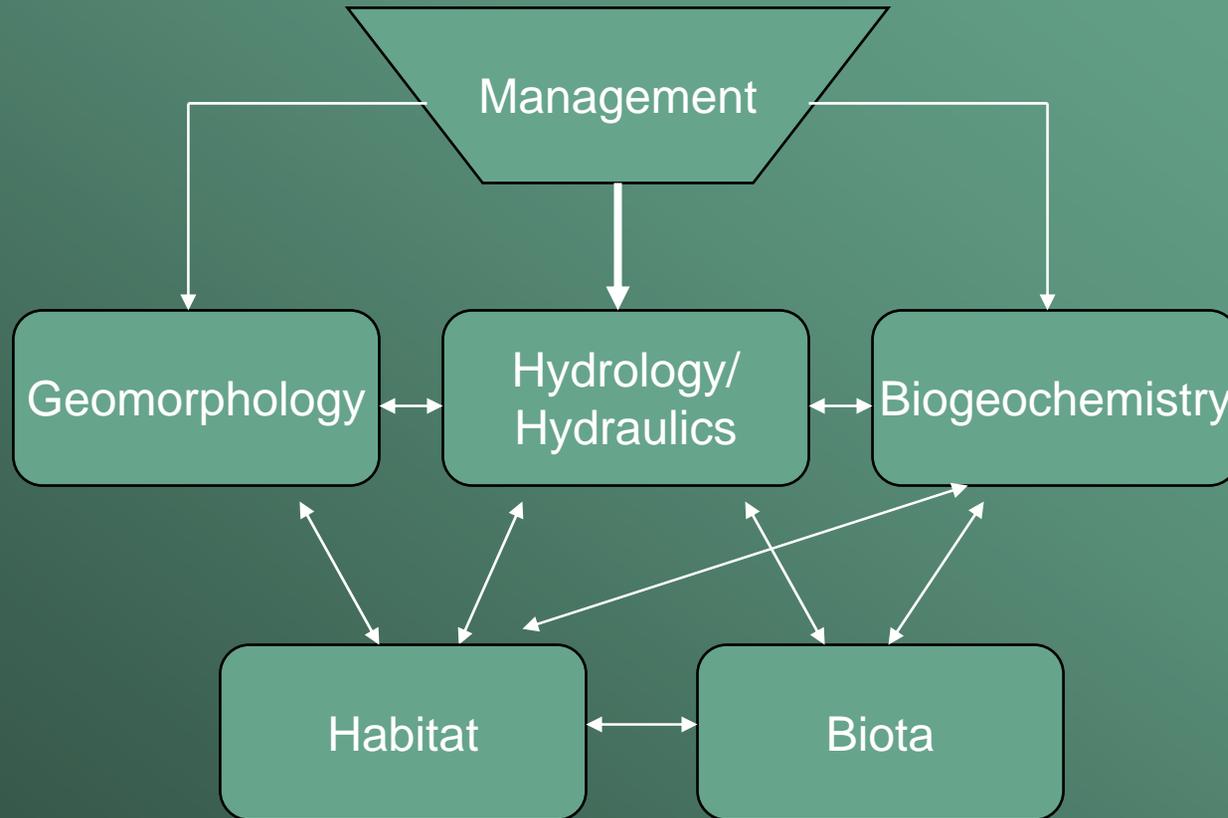
Goal: develop a scientific basis for predicting ecological consequences of water-supply development in a river system



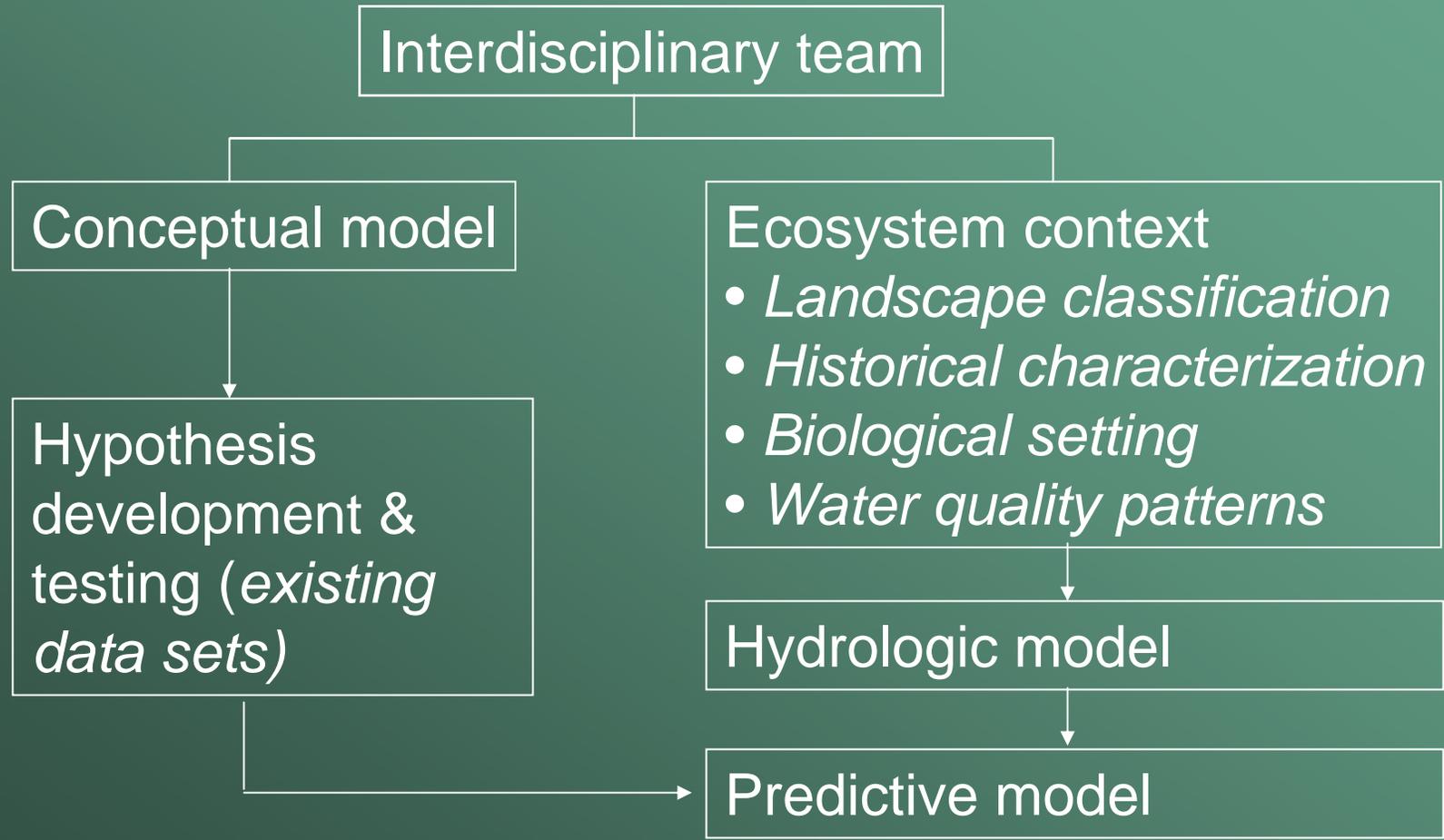
# Water availability for ecological needs: Flint River, GA



# Management & flow linkages to biota are complex, indirect



# Approach



# Hypothesis Construction and Evaluation

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## ■ Evaluate support for alternative hypotheses:

*Alternative characterization of species and flow components:*

### *Species:*

- *Life history strategies*
- *Habitat affinities*
- *Reproductive characteristics*

### *Flow components, by season:*

- *Short-term low-flows (e.g., 5 d)*
- *Average flows*
- *Flow stability*

*Models: What variables best predict occurrence of adults, juveniles, or juvenile to adult transition?*

- *Infer most influential flow-biota linkages*

# Summary

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- Many diverse issues requiring approaches for *understanding and predicting* community responses to environmental change
- PWRC active in this area now
- Future opportunities are large, e.g. -
  - Climate change
  - Invasive spp
  - Water for ecological needs