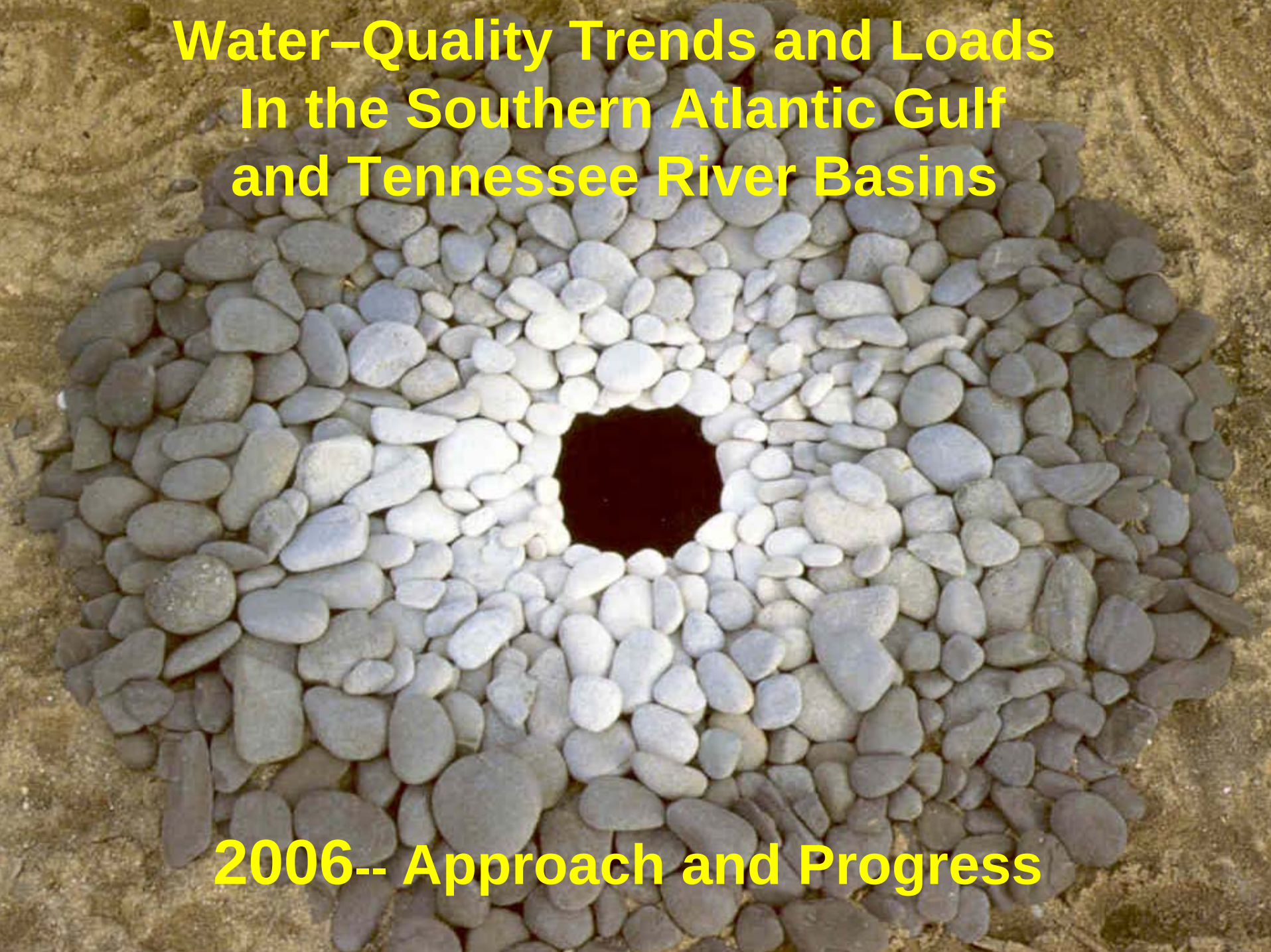


# **MRB2-- Southern Atlantic Gulf and Tennessee River Basins (SAGT)**

- 1. Trends- Douglas Harned**
- 2. Point Sources- Jerry McMahon**
- 3. SPARROW- Anne Hoos**

# Water–Quality Trends and Loads In the Southern Atlantic Gulf and Tennessee River Basins

A circular structure made of smooth, greyish-blue stones is set into a sandy ground. The stones are arranged in concentric circles, with a central opening that is dark and shadowed. The overall appearance is that of a well or a decorative stone feature in a natural setting.

2006-- Approach and Progress

# SAGT 2006



**Kelly Peak**



**Aaron Bunch**

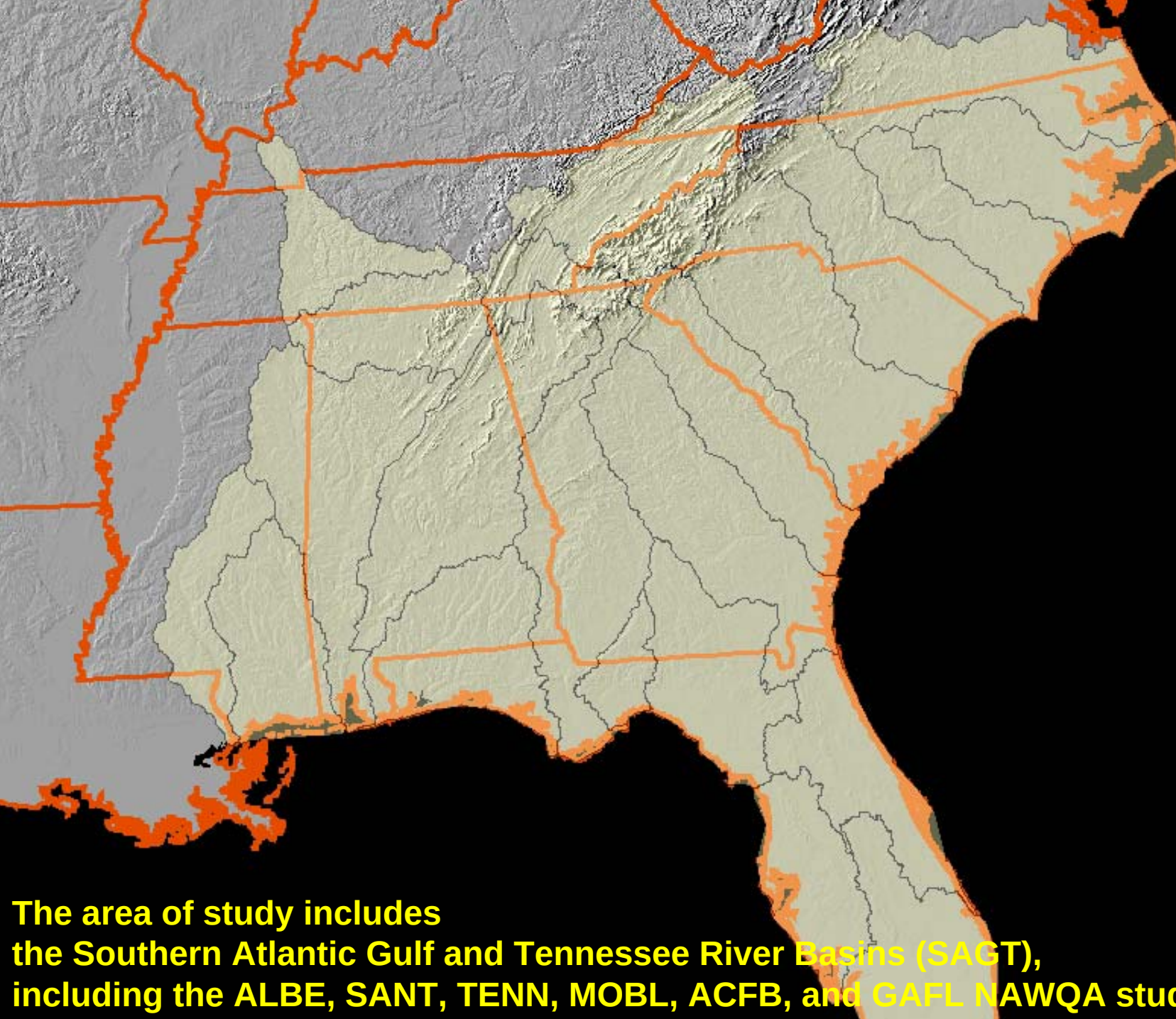


**Eric Sadorf**

Ruth Alkons-Wolinsky, Tom Cuffney,  
**Kirsten Cassingham**, Elise Giddings, Michelle Moorman,  
Jim Tesoriero, **Silvia Terziotti**,  
**Jerry McMahon**,

**Phil Jen**, Douglas Harned, and Erik Staub

Missing: **Anne Hoos**, Mike Woodside, Rodney Knight and **Connor Haugh (TENN)**



**The area of study includes the Southern Atlantic Gulf and Tennessee River Basins (SAGT), including the ALBE, SANT, TENN, MOBL, ACFB, and GAFL NAWQA study areas.**

# What is new about the SAGT trends study?

Previous trends studies were limited to a description of monotonic trends for set time periods.

This study will examine:

- **Regional trend patterns, and**
- **Association of source and landscape variables with water quality trends.**

# Objectives

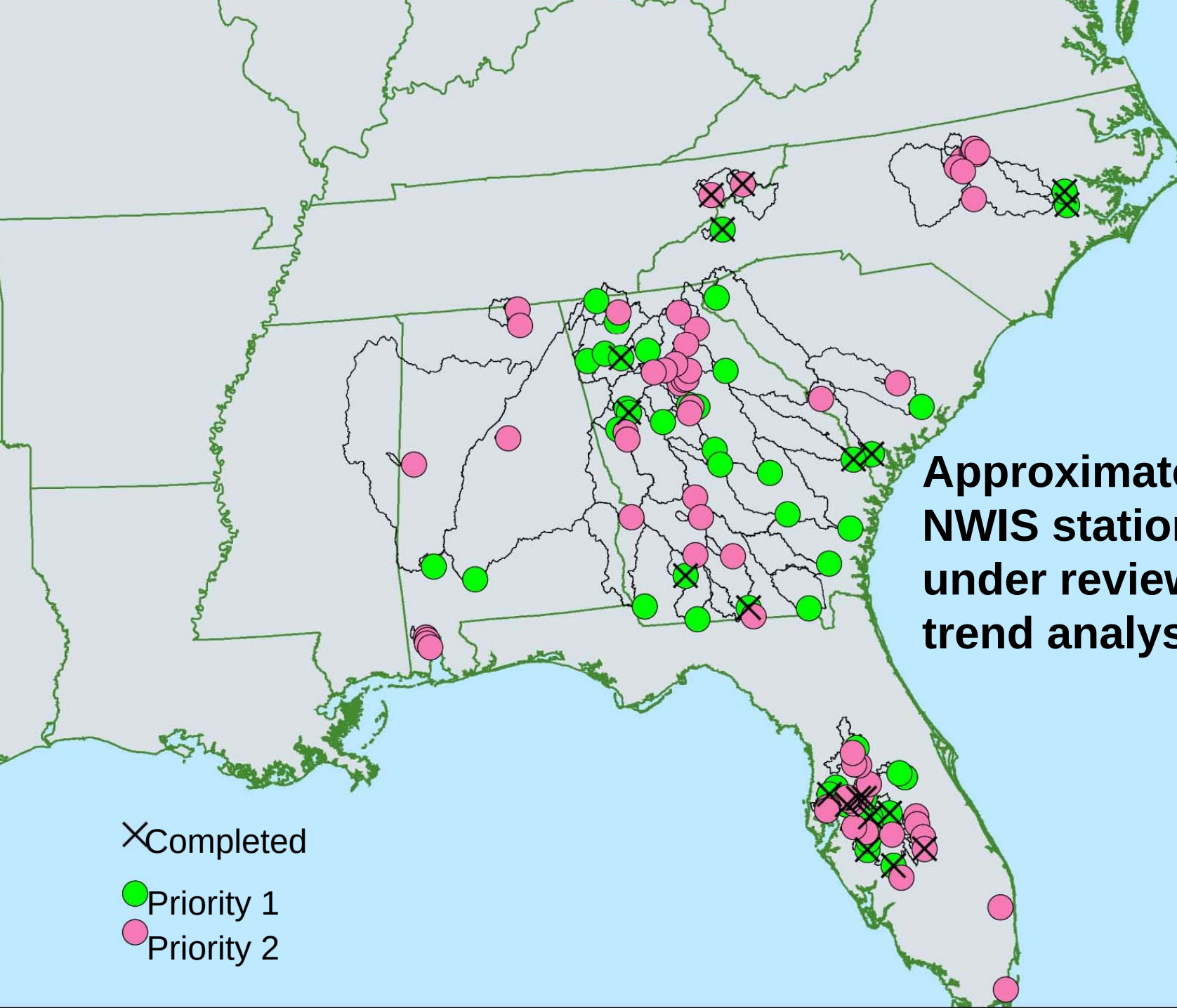
1. **Select USGS stations suitable for trend analysis to give a spatial representation of the Southeast, and which represent a gradient of source and landscape variation.**
2. **Identify all significant water-quality concentration trends over the last 35 years for the stations.**
3. **Assess trends for 1993-2004 for all suitable stations (National time period).**
4. **Identify regional or landscape-related patterns in the trends.**
5. **Calculate loads and yields for the selected stations.**
6. **Compare trend-detection results of the load analysis to the trend analysis.**
7. **Identify associations of concentration trends and yields with trends in source and landscape variables.**

# Approach

1. Water-quality data retrieval and review,
2. Ancillary data compilation,
3. Trend analysis,
4. Trend pattern identification,
5. Calculation of loads,
6. Assessment of associations of concentration trends with trends in landscape variables,
7. Report writing.

# Water-Quality Data Retrieval and Review

- Stations were identified through a review of available NWIS sites, using Fluxmaster site statistics and time plots of nutrient data.
- 111 potential stations with long-term data encompassing the 1993-2004 time period.
- The data was retrieved by state for the period 1973-2005. Data conversions, re-censoring, and calculation of synthetic variables preceded trend analysis.
- **Progress-** Data compilation and review has been completed.



**Approximately 111  
NWIS stations are  
under review for  
trend analysis.**

X Completed

● Priority 1

● Priority 2

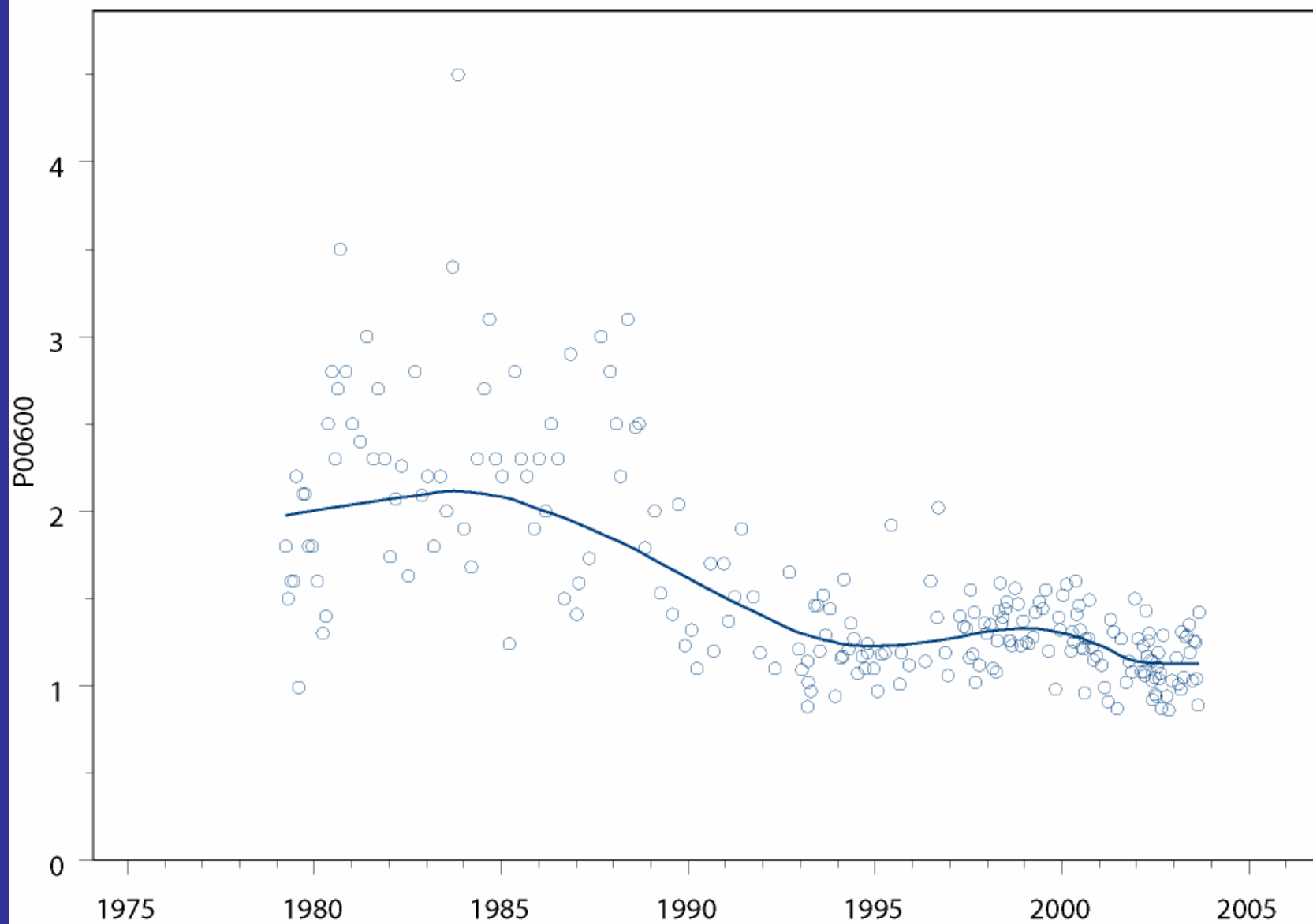
# Ancillary Data Compilation

- Drainage basins were defined for each potential trend station.
- Ancillary data were compiled nationally using GIS (B. Ruddy, D. Lorenz, D. Mueller).
- Fertilizer is being recompiled by SAGT. Annual data is preferred for the trends correlation analysis
- The source variables include: fertilizer sales, atmospheric inputs, animal waste, and point source discharges
- Landscape variables include: land use, population, census variables, road density, the ULUG Urban index, physiographic province and other regional variables, and row crops.
- Progress- National ancillary data sets have been compiled. Crop data for SAGT basins has been compiled.

# Trend Analysis

- Specific conductance, dissolved oxygen, pH, major ion, nutrient, and suspended-sediment concentration data assessed.
- Identify potential trends from scatter plots and LOWESS curves.
- Test for trends with the seasonal Kendall-tau test (S-ESTREND).
- Archive results in paper and electronic files and summary tables.
- Determine trends for all stations for 1993-2004.
- **Progress**—Trend analysis is complete for the 35 highest-priority sites that provide regional coverage of the Southeast. A second selection has been made of 30 sites to optimize ancillary-variable gradients of non-farm nitrogen, agricultural land cover, developed land cover, road density, and 2000 population density.

# Station 02091500



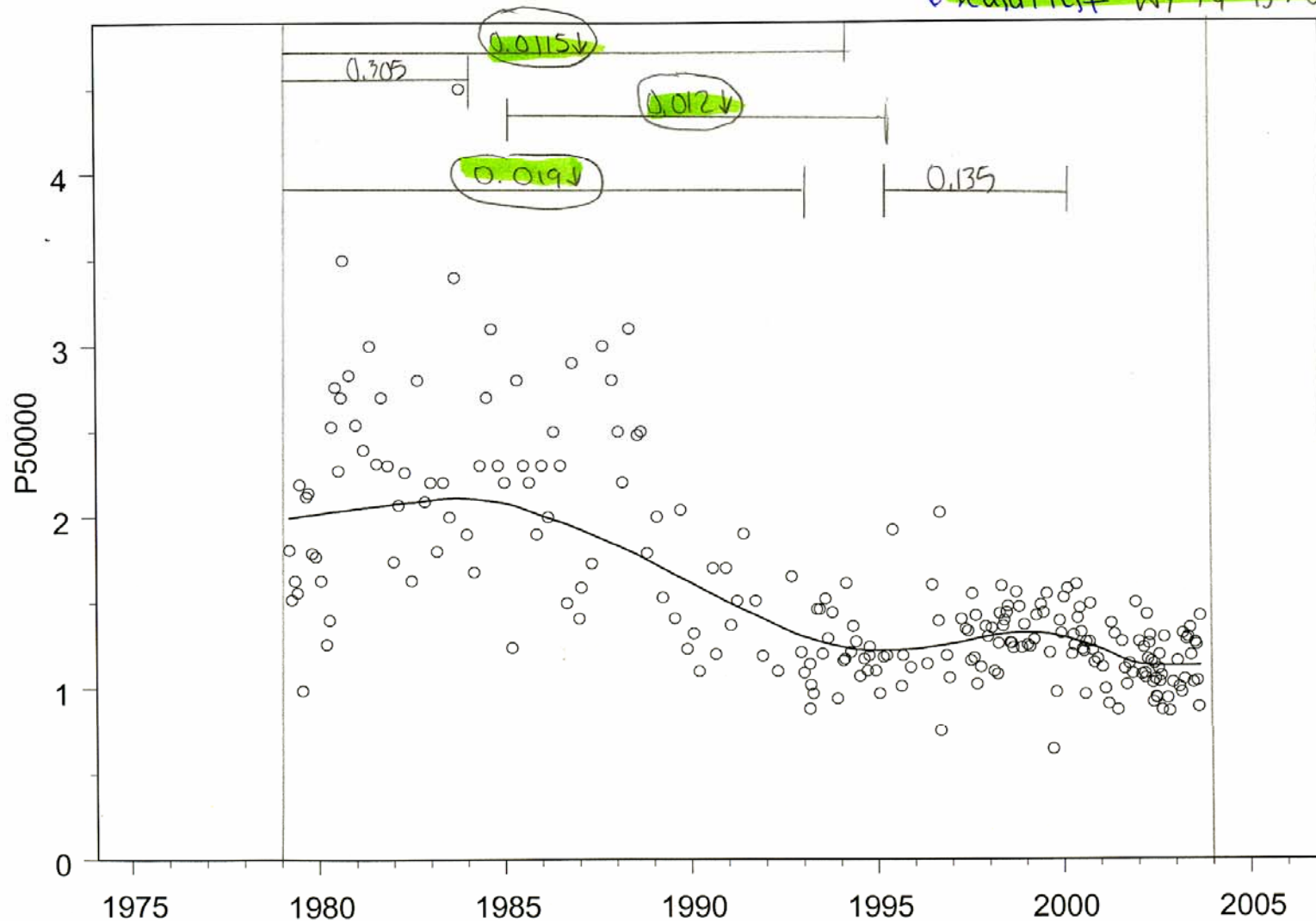
WY 79-93 X 79-94  $\rightarrow 0.0115 \downarrow$   
79-84  $\rightarrow 0.305 \times$

Station 02091500

WY 85-95  $\rightarrow 0.012 \downarrow$

95-00  $\rightarrow 0.135 \times$

6 season test WY 79-93  $\rightarrow 0.019 \downarrow$



# Trend-Pattern Identification

- Use the summary tables, and stacked time-series graphs to identify stations with similar trend patterns.
- Associate observed trend patterns with ancillary data variables.
- Map patterns by ancillary variable.
- **Progress**—Trend pattern identification and analysis is ongoing as trend analysis for additional sites are completed.

# Calculation of Loads

- Use S-LOADEST to calculate loads for the high priority stations.
- Compare the trend results from regression models to the Seasonal Kendall results.
- Map nutrient yields.
- Compare load results to Fluxmaster loads (SPARROW).
- **Progress**—Load data sets have been compiled. Load estimation is ongoing. Data is being provided to Greg Schwarz for Fluxmaster processing.

# Associations of Concentration Trends with Trends in Source and Landscape Variables

- Use principal components to obtain synthetic variables that combine variance of the ancillary variables.
- Use correlation analysis to assess association of basin characteristics with basin water-quality.
- Use multiple regression to test association of annual variation in concentration, with annual variation in ancillary variables and synthetic variables for the priority stations.
- **Progress**—This step will be executed in March/April 2006 after trend analysis of a complete set of (~50) sites has been completed.

# Report Writing

- The trends and loads article for the SAGT summarizing the results of the analysis:  
**“Water-Quality Trends and Loads in the Southeastern U.S.A., 1975-2004”** will be submitted to Water Resources Research (16 Pages).
- **Progress**—Writing is planned for April/May 2006 after completion of the ancillary data correlation and multiple regression.

# Summary

## Water-Quality Trends in the Southeastern USA

**Douglas Harned, Erik Staub, Kelly Peak,  
Kirsten Cassingham, Silvia Terziotti, Eric Sadorf,  
Jerry McMahon, Anne Hoos, Mike Woodside,  
Aaron Bunch, Rodney Knight, and Connor Haugh**

- Graphic trend evaluation.
- Seasonal Kendall-Tau trend testing.
- Identification of regional patterns.
- Nutrient and sediment loads and yields.
- Trend testing of set periods.
- Source and landscape trend correlation with trends in concentrations.

# Timeline 2006

# Water-Quality Trends in the Southeastern U.S.A.

|                                 | J | F | M | A | M | J | J | A | S | O |
|---------------------------------|---|---|---|---|---|---|---|---|---|---|
| 1. Water-quality data retrieval |   |   |   |   |   |   |   |   |   |   |
| 2. Ancillary data compilation   |   |   |   |   |   |   |   |   |   |   |
| 3. Trend analysis               |   |   |   |   |   |   |   |   |   |   |
| 4. Trend Pattern Identification |   |   |   |   |   |   |   |   |   |   |
| 5- Calculation of loads         |   |   |   |   |   |   |   |   |   |   |
| 6. Conc. trends vs. landscape   |   |   |   |   |   |   |   |   |   |   |
| 7. Report writing               |   |   |   |   |   |   |   |   |   |   |

