



# Predictions of biotic health in urban streams with reduced flow

Jessica Sterling<sup>1</sup>, Brenda Rashleigh<sup>2</sup>, and Amy Rosemond<sup>1</sup>

<sup>1</sup>Odum School of Ecology, University of Georgia, Athens, GA

<sup>2</sup>United States Environmental Protection Agency, Athens, GA

# Upper Oconee Watershed Network (UOWN)

Volunteer monitoring (biology and chemistry) in streams in the Upper Oconee basin since 2000.





# Drought in the Southeast

- The past 15 winters have been drier than the long-term average in Georgia (*D. E. Stooksbury*)
- The Intergovernmental Panel on Climate Change (IPCC) predicts that the likelihood of droughts will increase in the Southeastern U.S.



# Macroinvertebrates as bioindicators

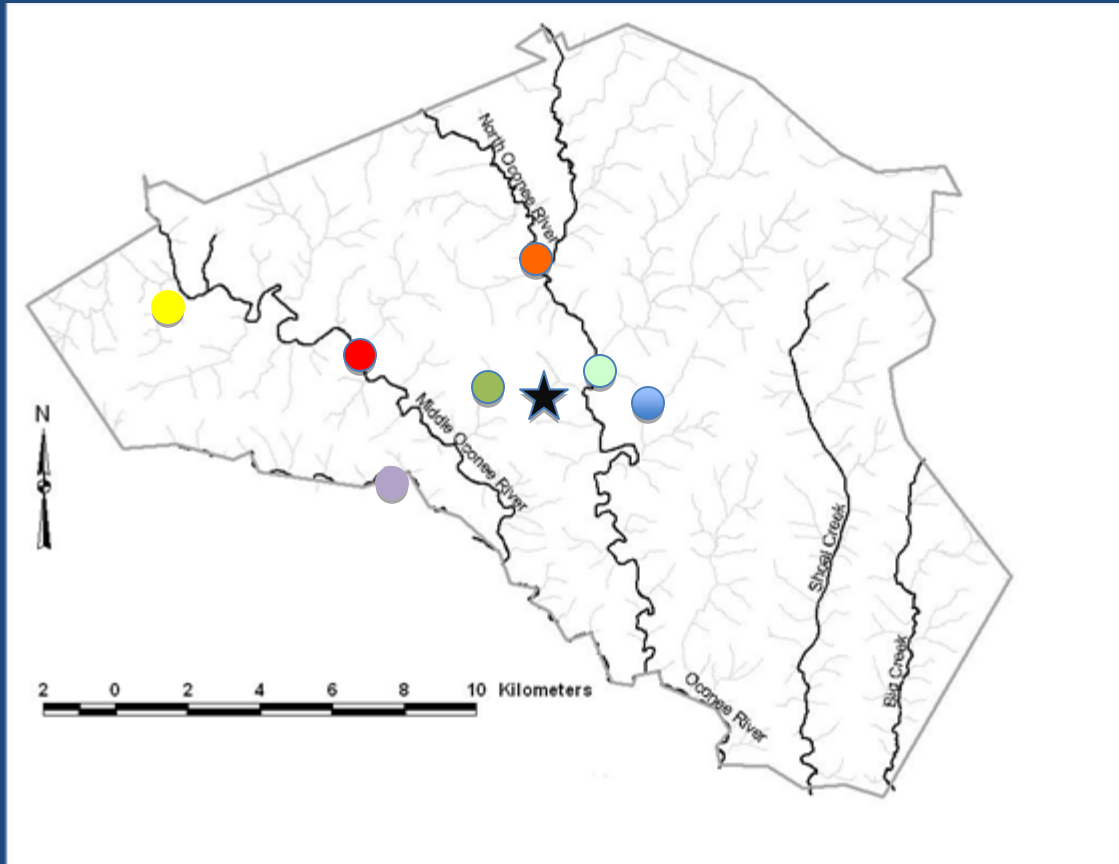


- Macroinvertebrates are relatively long lived, integrating the effects of local disturbance and pollution.
- Easy to collect and identify
- A cost effective way to measure water quality

# How might drought affect stream invertebrate communities?

- Increases in stream temperature
- Decreases in dissolved oxygen
- Changes in chemical and nutrient concentrations
- Reductions in habitat volume

# Study Sites – Upper Oconee river basin Clarke County, GA, USA



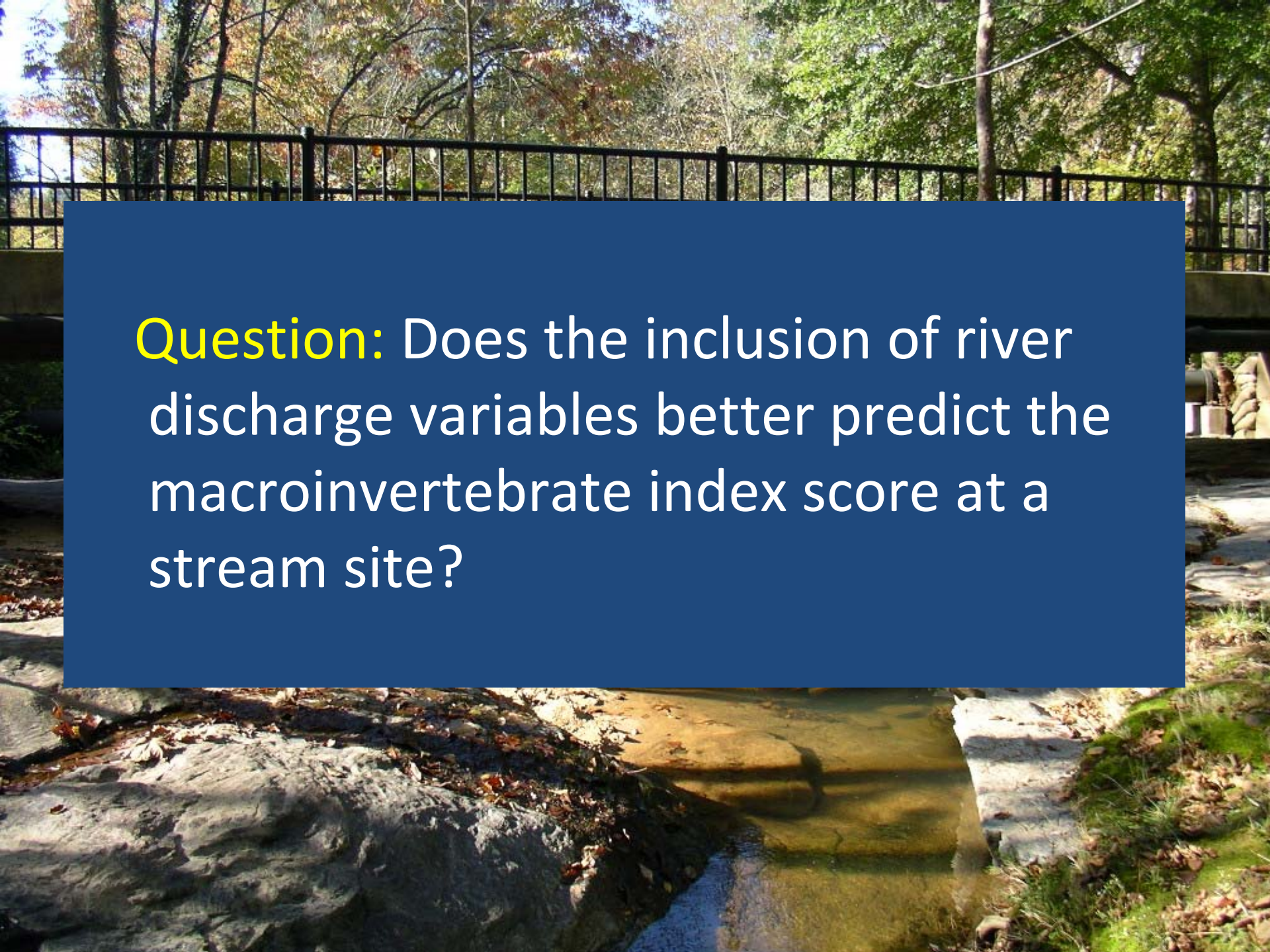
## North Oconee

- Trail Creek
- Carr Creek
- Sandy Creek

## Middle Oconee

- Hunnicutt Creek
- Brooklyn Creek
- Bear Creek
- McNutt Creek



A photograph of a stream flowing over large, flat rocks. The water is clear and reflects the surrounding greenery. In the background, a black metal fence runs across the frame, and beyond that, a dense forest of trees with green and some autumn-colored leaves is visible. The scene is brightly lit, suggesting a sunny day.

**Question:** Does the inclusion of river discharge variables better predict the macroinvertebrate index score at a stream site?



# Methods



## Biological

- Macroinvertebrates collected 4X per year
- Scored using the “Save our Streams” biotic index

## Chemical

- Conductivity collected at each sampling event



# Previous UOWN study

- Conductivity is a measure of dissolved ions in water and is indicative of pollution from chemicals and nutrients.
- Kominoski et al. (2007) showed conductivity to be a significant predictor of biotic index scores in streams in the upper Oconee basin.

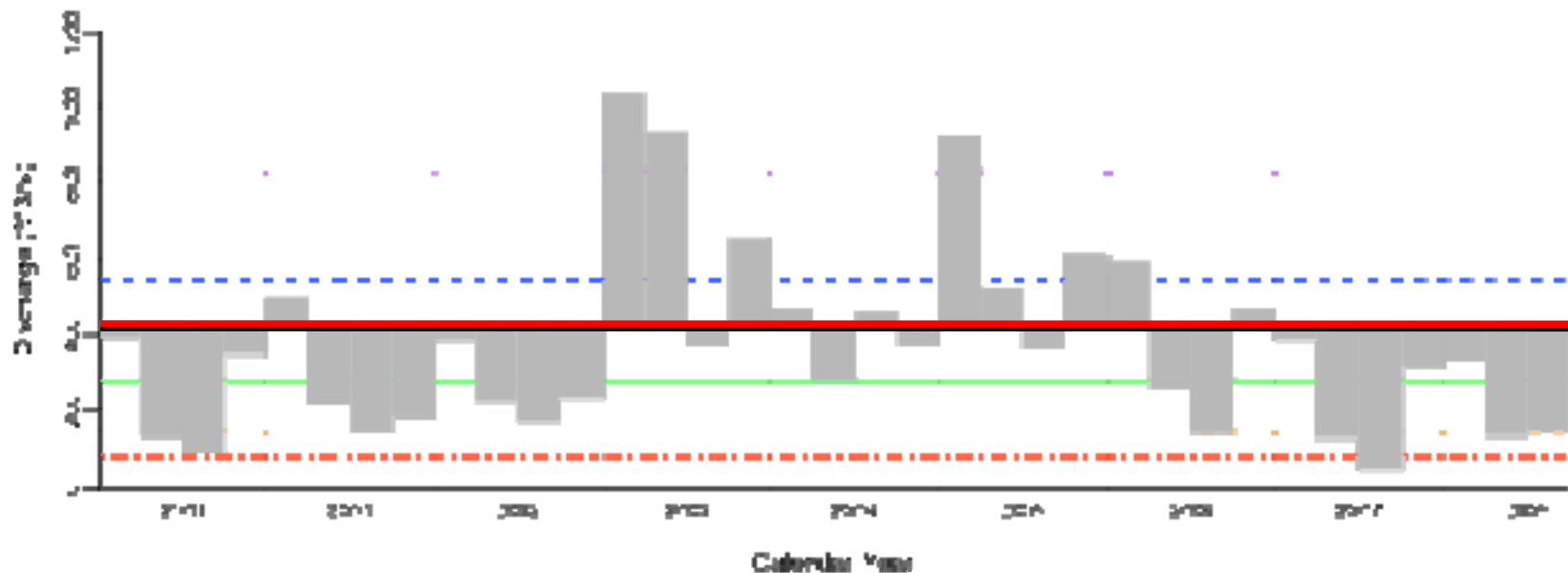
# Methods

## Flow

- Downloaded long-term discharge data from [www.usgs.gov](http://www.usgs.gov) - Middle Oconee in Jackson County, GA
- Downloaded flow mean, minimum, and maximum
- Calculated flow coefficient of variation (Flow CV) and # low flow days



# Middle Oconee River 2000 – 2008



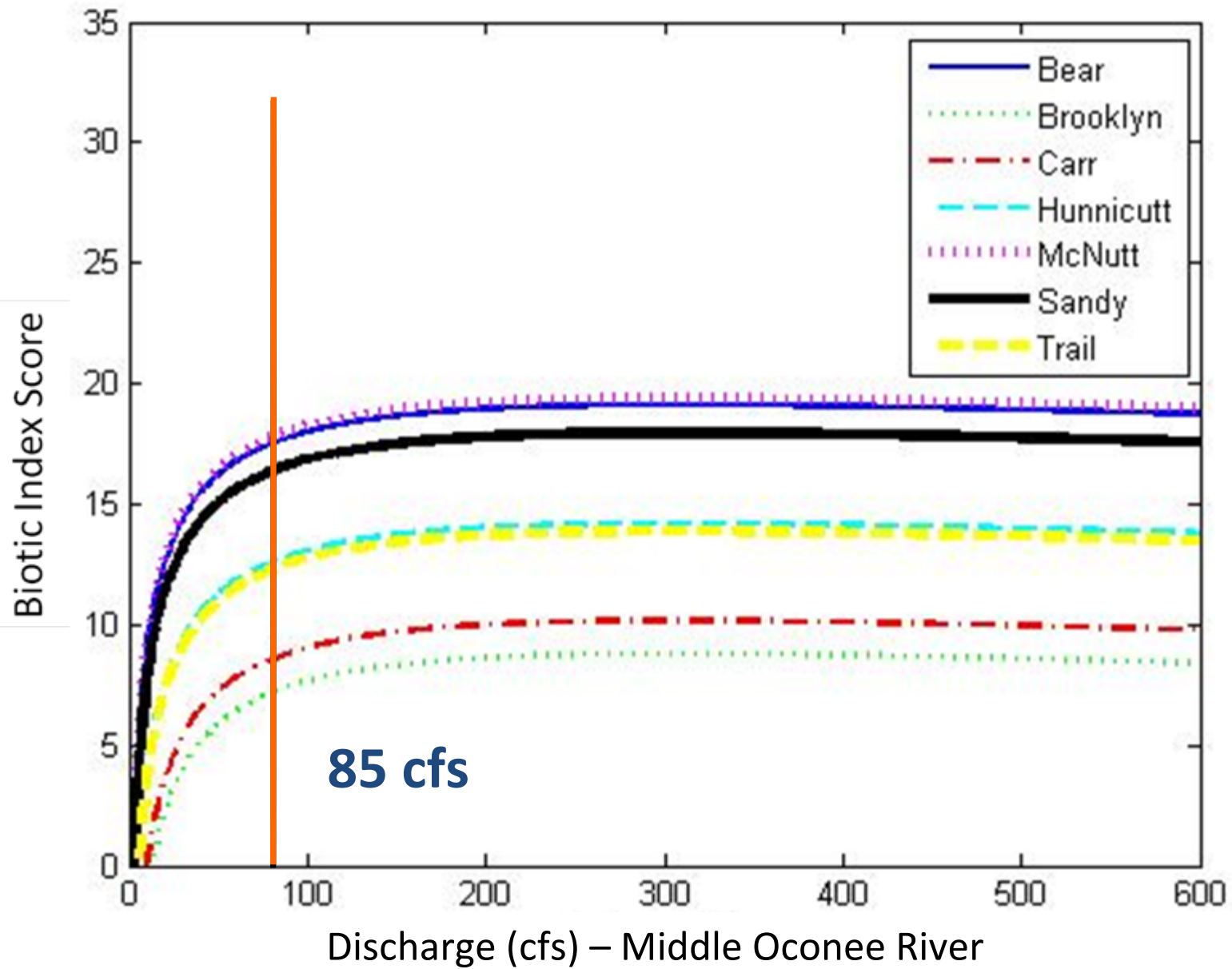


# Model Building

- Multiple linear regression used to relate biotic index scores to predictor variables
  - Final set of variables: mean, flow CV, conductivity, # low flow days, and their squared values
- Best fit model selected using Akaike's Information Criterion corrected for small sample sizes (AICc)

# Results – best fit model

Variable	Coefficient	SE	Lower CI	Upper CI
Conductivity	-3.76	1.28	-6.28	-1.24
Flow	10.08	2.26	5.61	14.55
Flow*Flow	-0.88	0.22	-1.31	-0.45
CV	6.24	5.78	-5.17	17.65
CV*CV	-3.43	2.83	-9.03	2.16





# Results

- The steep response of the biotic index at low flows indicates that macroinvertebrates are sensitive to extremely low flows.
- The negative response of macroinvertebrates to conductivity indicates that macroinvertebrates are sensitive to pollution – consistent with studies by Kominoski et al. (2007) and Roy et al. (2003).

# Conclusions

- As we begin to experience longer, more frequent droughts in the Southeast, it is important to consider the effects of extreme low flows on stream biota.
- It is important to continue monitoring these streams in order to assess the long-term effects of drought on stream invertebrates.

# Future analyses and data collection

- Incorporate flow monitoring into UOWN's quarterly sampling of the sites used in this study.
- Test whether urbanized sites have a different response to reduced flows than forested sites.



# Acknowledgements

Bryan Nuse

Rachel Katz

Amy Trice

Rosemond Lab

UOWN board and volunteers

