

Eastern Region Initiative on the Clinch

A USGS Partnership to Investigate Effects of Water Quality on Freshwater Mussel Health in the Clinch River Basin in Virginia and Tennessee

<http://va.water.usgs.gov/projects/clinch.htm>

Eastern Region Initiative on the Clinch

USGS Collaborators:

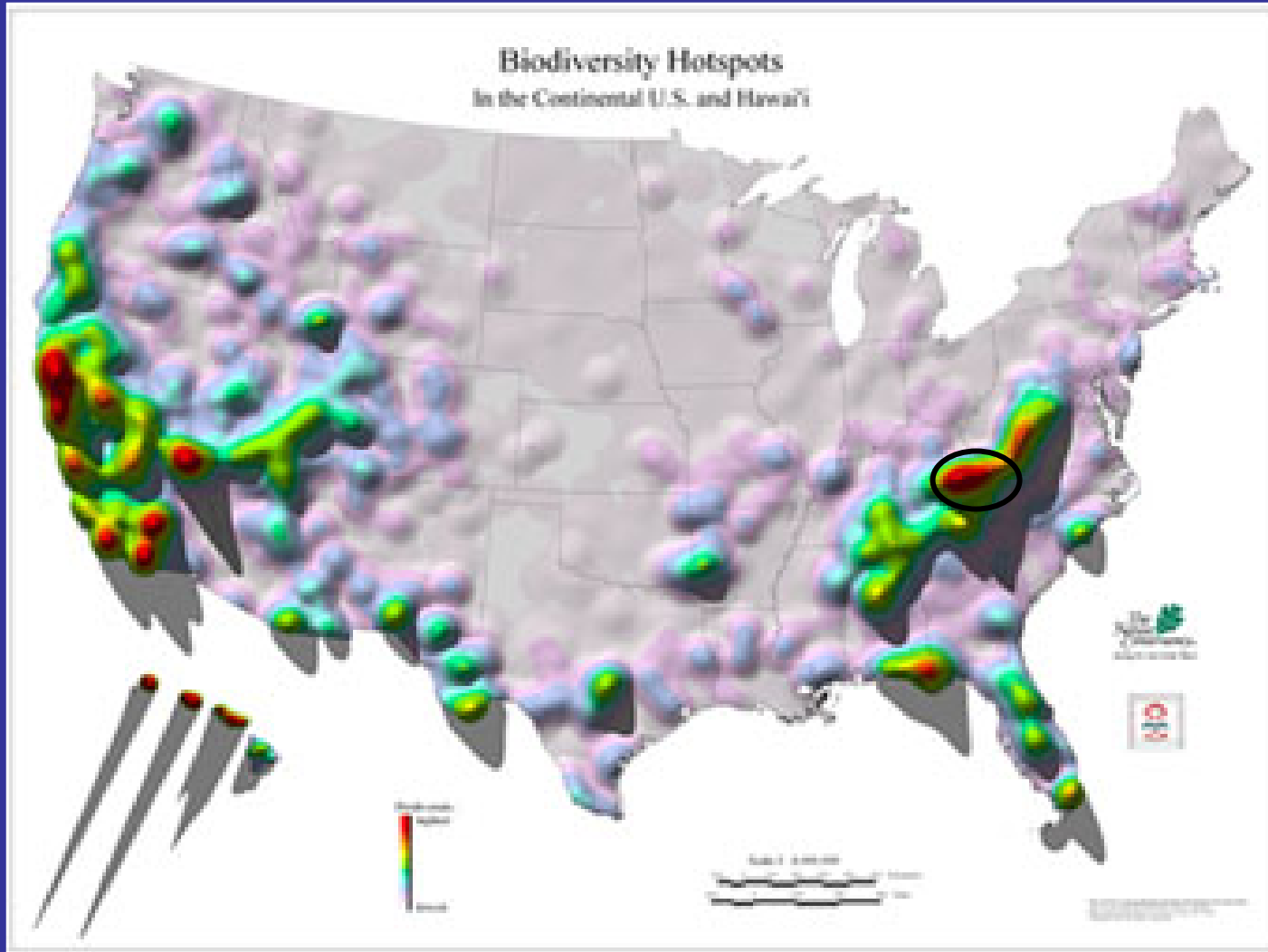
- Mark R. Bennett VA Water
- Kenneth E. Hyer VA Water
- Jennifer L. Krstolic VA Water
- W. Scott Gain TN Water
- Greg C. Johnson TN Water
- Brett Otsby Biology
- David A Kirtland Geography
- William H. Orem Geology



Clinch Powell Clean Rivers Initiative Collaborators:

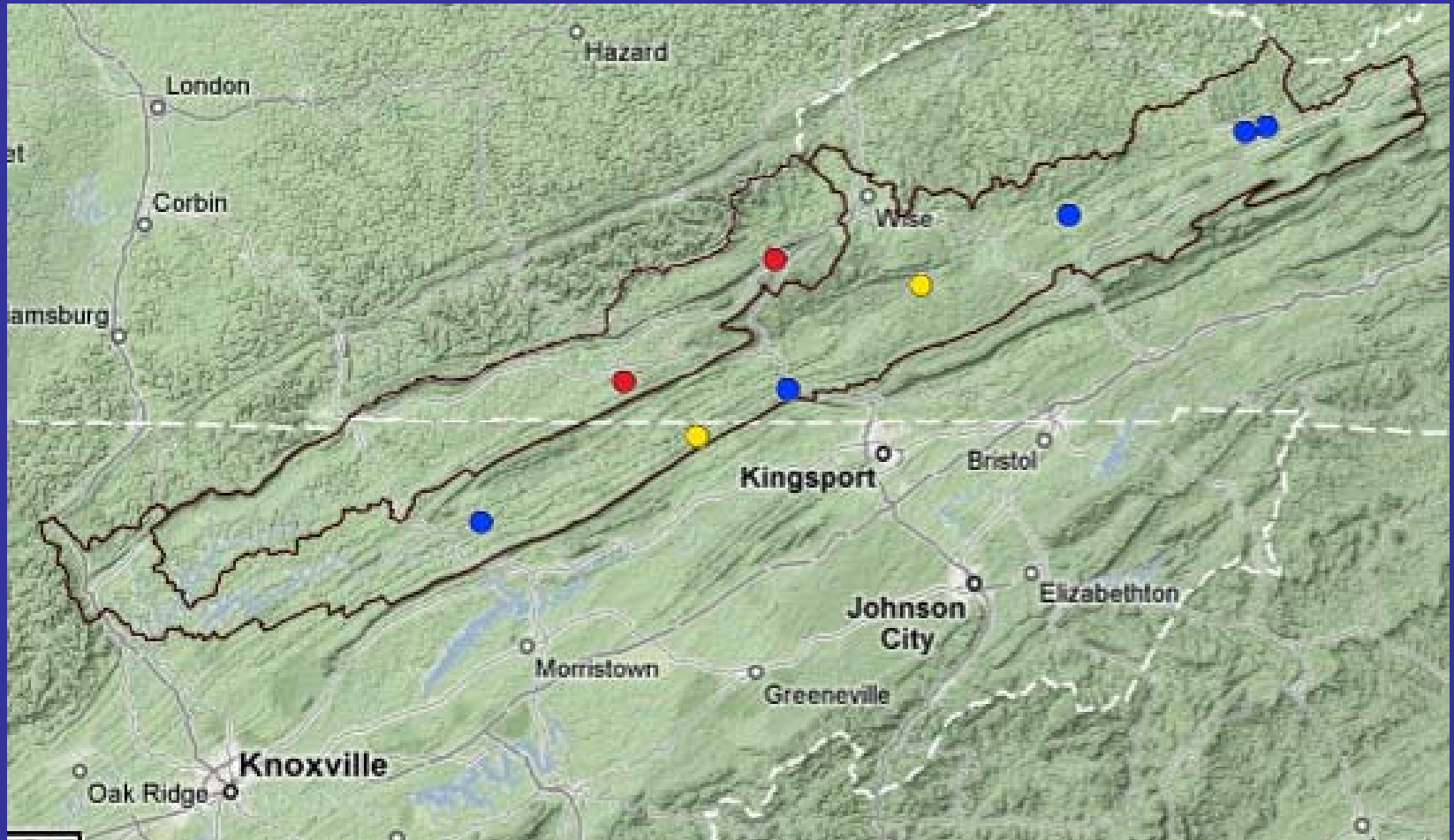


Biodiversity Hot Spot



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Biodiversity Hot Spot



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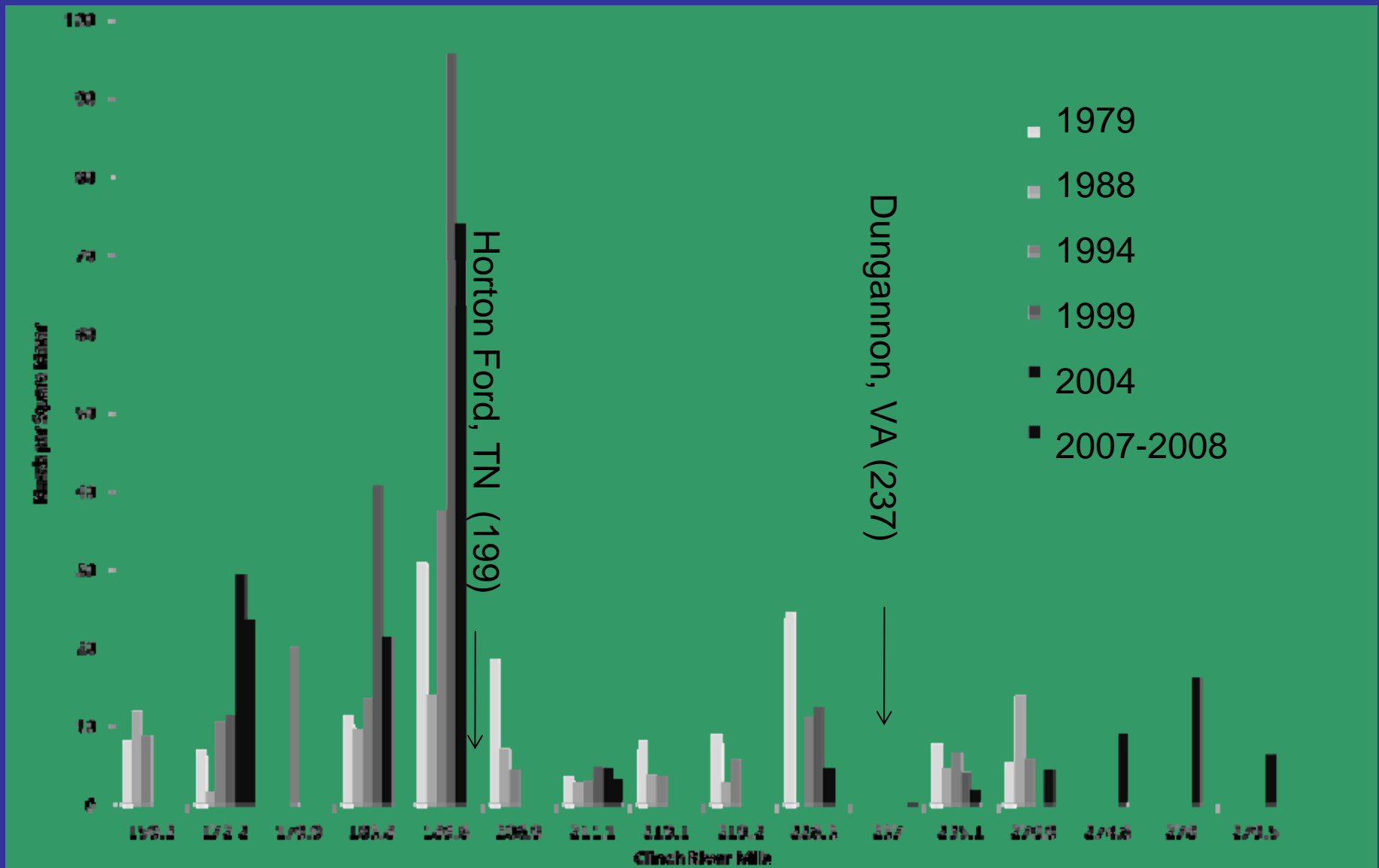
Ecosystem Change Drives the Problem Definition

- Historic Mussel Data Trends Show Decline
 - Loss of species diversity
 - Shift in age structure (lack of recruitment)
 - Declining densities
- 1979 – Present



Photo: Brett Otsby 2008

Changes in Mussels Density (mussels/m²) 1979 - 2008



Data from various studies: Ahlstedt and Otsby 1979 - 2008

What Ecosystem Services are Available?

- Stable streams
- Consistent streamflow
- Habitat and food are available
- Fish hosts present



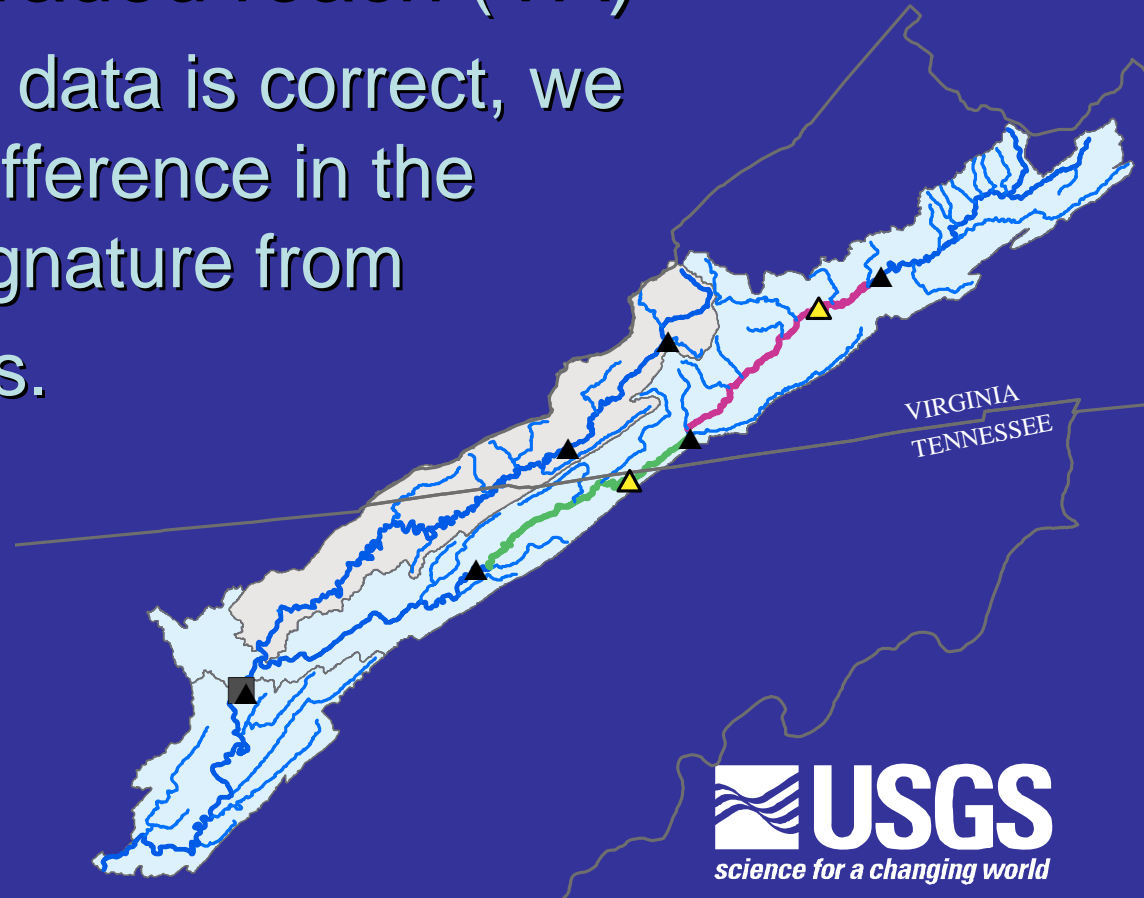
What are Causes for Decline?

Given available ecosystem services, water quality and sediment quality appear to be the most important factors effecting mussel health.

- Contaminants in the Water Column
- Contaminants in Bed Sediments
 - Chronic stressors?
 - Acute stressors?

Study Approach

- Comparison of water quality and sediment quality with a healthy reach (TN) and a degraded reach (VA)
 - If the biological data is correct, we should see a difference in the contaminant signature from the two reaches.



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Horton Ford



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Water Quality and Suspended Sediment

- Real-time Continuous QW at 2 Sites:
 - Temp, pH, SC, Turbidity
- Manual Storm Water & Suspended Sediment and Base flow Sampling
- Laboratory Analysis for Metals, Nutrients, Organics



Photo: VA WSC hydrologists

Bed Sediment Quality



- Organic analysis
- Substrate size distribution
- Percent coal
- Fine sediment toxicity analysis (Ingersoll*)



Mussel Health Assessment



Goals

- Detect the dominant species present and relative abundance
- Quantify density of mussels and snails at the central riffle
- Sample reaches in a uniform manner for comparisons among reaches



Photos: Brett Otsby 2008

Mussel Habitat Assessment

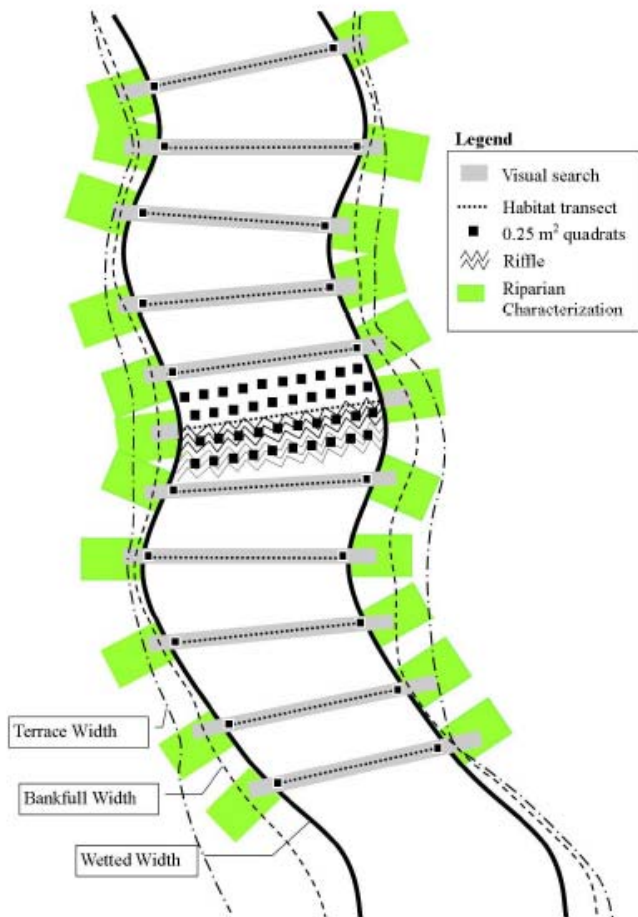


Figure 3. Mollusk and habitat assessment sampling design. All measurements within a 10x width reach.

Physical Habitat Assessment

(10x stream width in total)

Measure depth, substrate roughness, and substrate particle size.

Visually estimate silt depth and embeddedness.

Measure bank slope, bankfull height, terrace height, and riparian and instream cover, and reach slope.

Mussel Survival and Growth Experiments

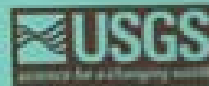
- Silos for growth and survival instream experiment (2-3 sites)
 - Additional sites monitored by VA DGIF*

Mussel silos: Bernoulli flow devices for caging juvenile mussels in streams.



Missouri State
UNIVERSITY

Chris Barnhart,
Todd Fobian, Dave Whites,
and Chris Ingersoll



FMCS 2007,
Little Rock, AR



Mussel Survival and Growth Experiments

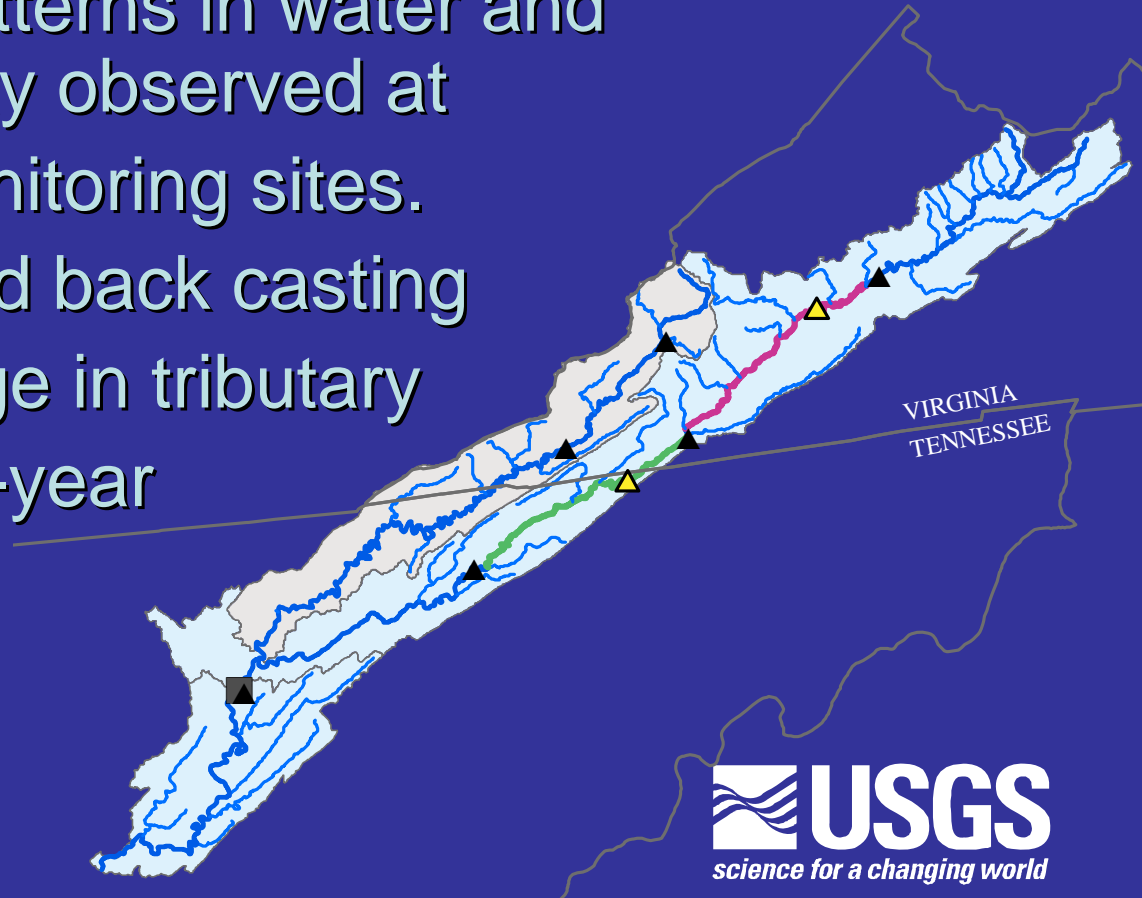
- Silos for growth and survival instream experiment (2-3 sites)
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Integrating Land Use and Water Quality

Land Use Change

- Fine scale land-use analyses to relate riparian buffer-zone land-use practices to observed patterns in water and sediment quality observed at continuous monitoring sites.
- Forecasting and back casting land-use change in tributary systems for 10-year increments.



Acknowledgements

The ERIC would not have been possible without USGS support through the following groups or individuals:

- Eastern Region Ecosystem Change Funds
- Dave Russ, REX Funds
- Jess Weaver, REX Funds

----Now to the video!



Photo: Brett Otsby 2008

http://mdc4.mdc.mo.gov/tv/video.asp?mediaID=i__19984392_1000