Synthesis of brook trout data for range-wide conservation planning in a changing climate

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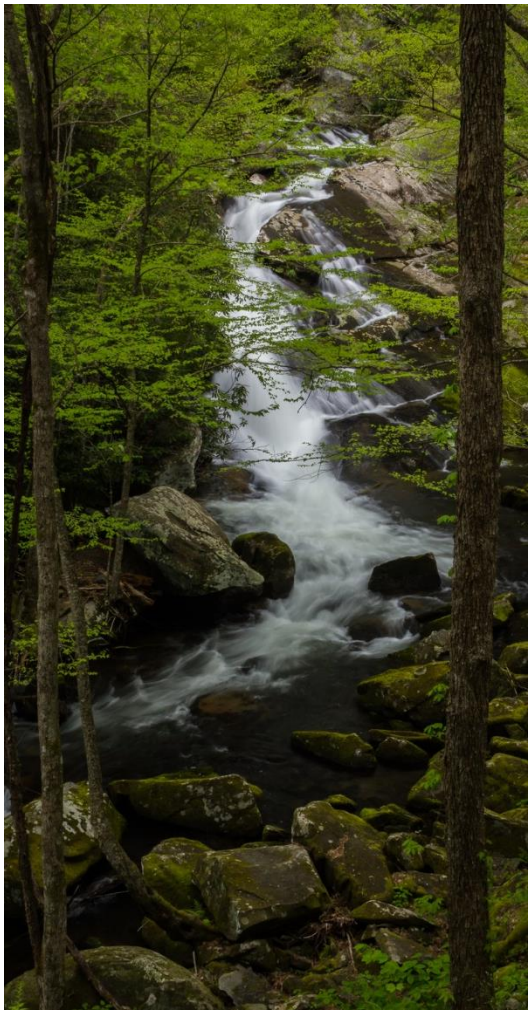


Motivations

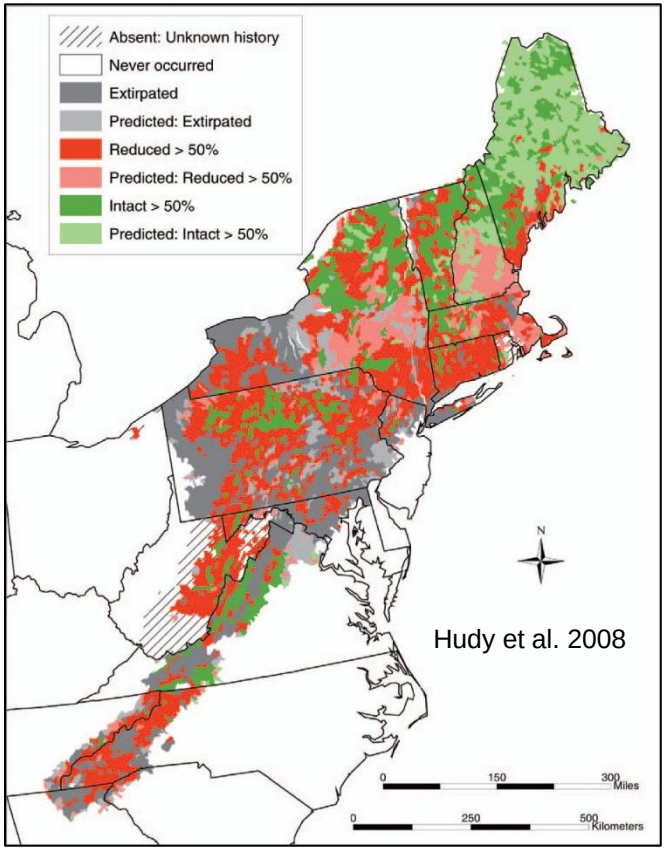
- Can we identify priority conservation areas in a changing climate (i.e., climate refugia) ?

  ➡ On-going effort

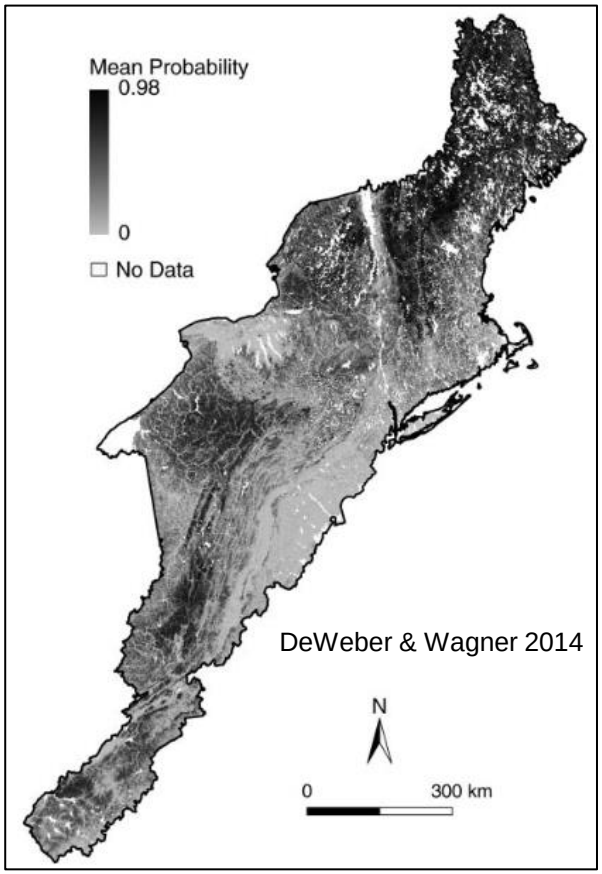
- How can that information be best incorporated in conservation actions?

  ➡ Future effort (potentially)

What's new in our ongoing effort?



Hudy et al. 2008



DeWeber & Wagner 2014

- Our analyses are based on:
  - Trout count data (not presence/absence)
  - Spatially and temporally replicated (not just space)

Questions we are addressing

- Is climate affecting local trout populations similarly? (spatial synchrony)
- At what geographic distance does spatial synchrony decay?
- Are trout populations becoming increasingly more vulnerable to climate variation over time?

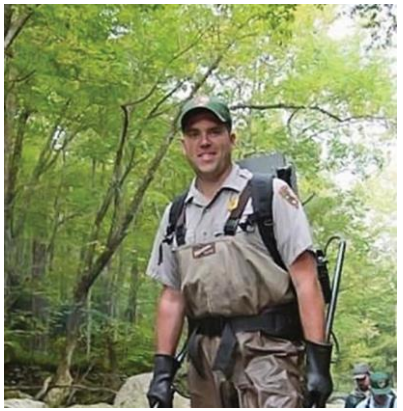
Funding and team

SOUTHEAST
Climate Adaptation Science Center


Yoichiro Kanno


Mevin Hooten


Jake Rash


Matt Kulp

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR


Lucy Lu (Post-doc)


George Valentine
(Grad student)


Andy Dolloff

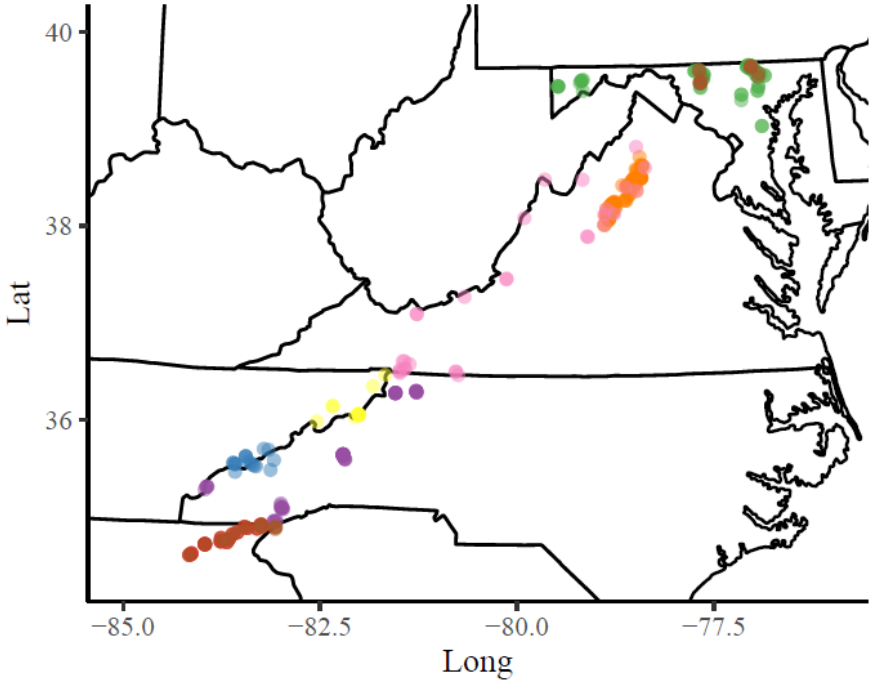
On the next slides

- Bird-view updates on our results
  - Data sets
  - Ecological inferences

- Links to EBTJV's priorities
  - Web-based visualization
  - Landscape conservation planning

Data

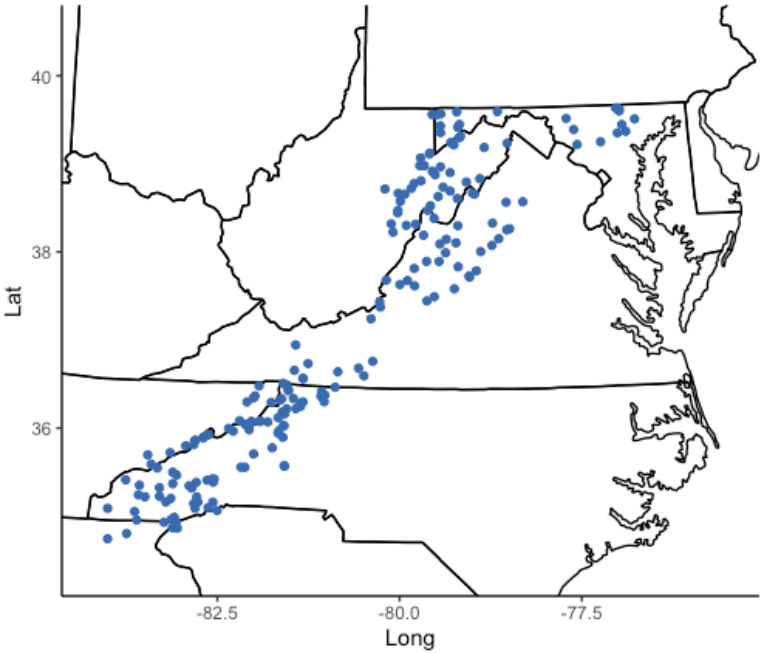
Trout Count (3,500 sites; 750,000 individuals; 1982-2019)



Source

- GA Dept. Natural Resources
- Great Smoky Mountain Nat'l Park
- MD Dept. Natural Resources
- NC Wildlife Resources Commission
- Shenandoah Nat'l Park
- TN Wildlife Resources Agency
- US Geological Survey
- VA Dept. Wildlife Resources

Paired stream-air temp (204 sites; 25 million hourly measurements)



Plus:

- NHDplus data
- Climate/flow data (Daymet, NOAA)

Data products will be available publicly

USGS science for a changing world

ScienceBase-Catalog Communities Help

ScienceBase Catalog → National and Regional Clima... → Southeast CASC → FY 2020 Projects → Brook Trout Population Resp...

Brook Trout Population Responses to Climate Variation Across the Southeast USA

View

Principal Investigator : Yoichiro Kanno

Dates

Release Date : 2020
Start Date : 2020-09-01
End Date : 2024-06-30

Summary

Brook trout are the only native fish from the salmon family in the southeastern United States. Despite their recreational and cultural significance, human activities, such as habitat degradation and introduction of non-native species, have led to serious declines of brook trout populations in the region. Stream temperature and flow alterations from climate change are projected to impact this cold-water species even further.

Recent studies show that there is much site-to-site variation in how climate affects stream temperature and flow. Therefore, vulnerability of local trout populations to climate change also varies. Understanding local variation in climate responses across the region is critical to maintaining brook trout populations for current and future generations.

The project team, consisting of scientists and fisheries managers, will use long term (longer than 5 years) trout population data and stream temperature data from sites throughout the region to investigate why climate variation affects local trout populations differently. They will also identify key environmental factors that make trout populations more resilient to climate change. By working closely with fisheries managers, outcomes of this study will directly result in management actions such as transfer of fish to different locations, habitat restoration, and non-native trout removal.

Child Items (3)

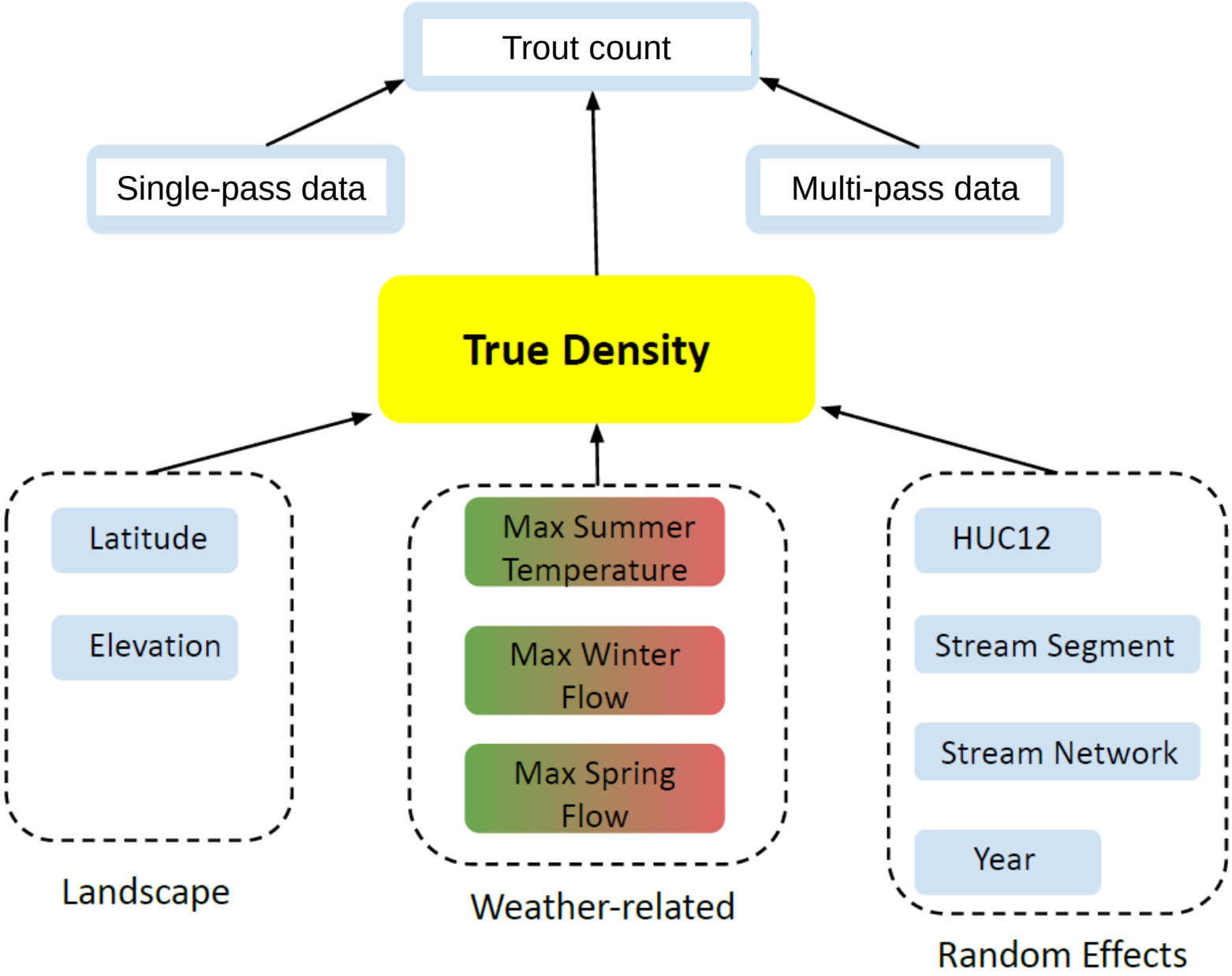
- Approved DataSets
- Approved Products
- Other (Approved for Public)

Brook Trout; Eric Engbretson, USFWS

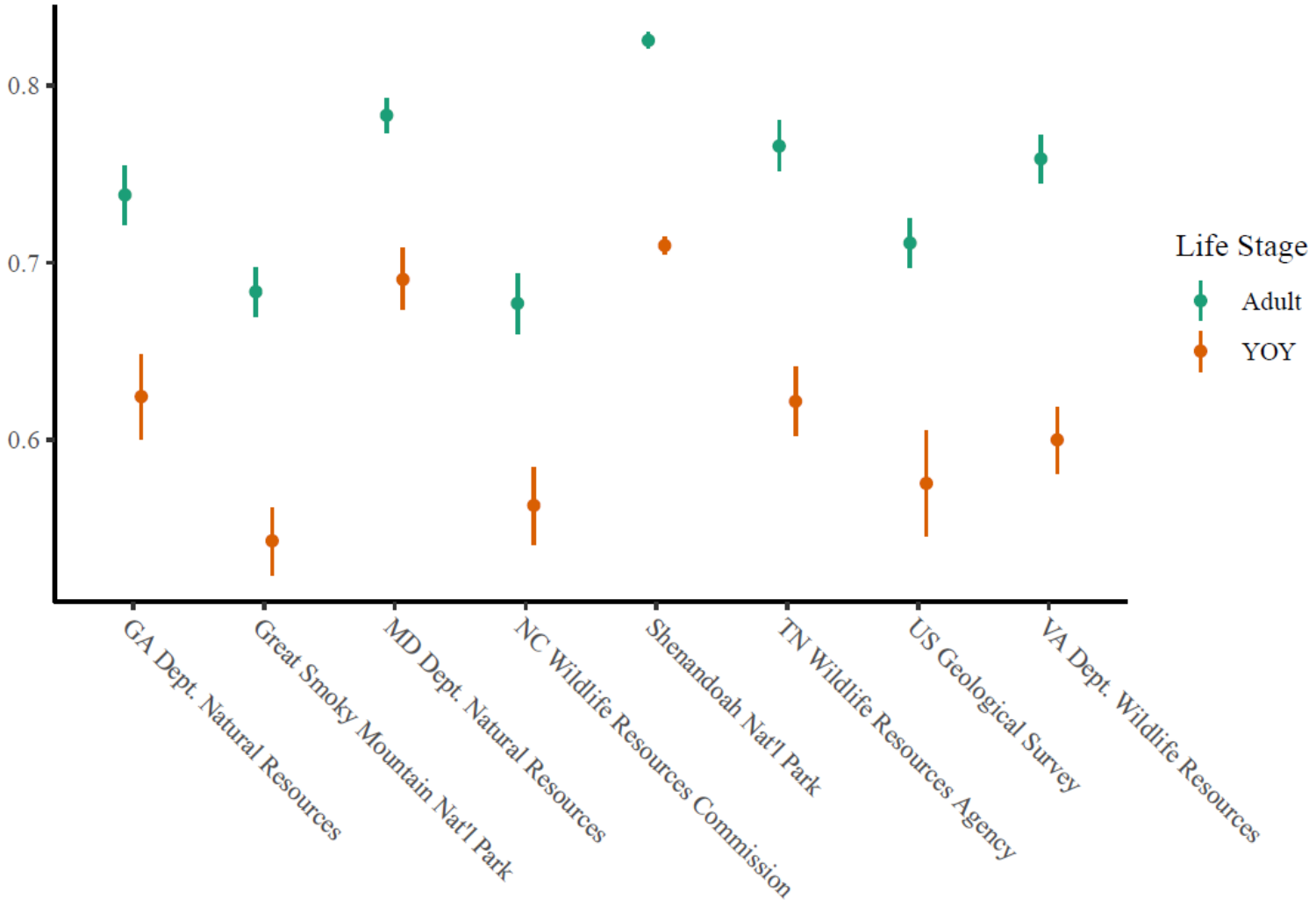
Map »

Spatial Services

Conceptual workflow

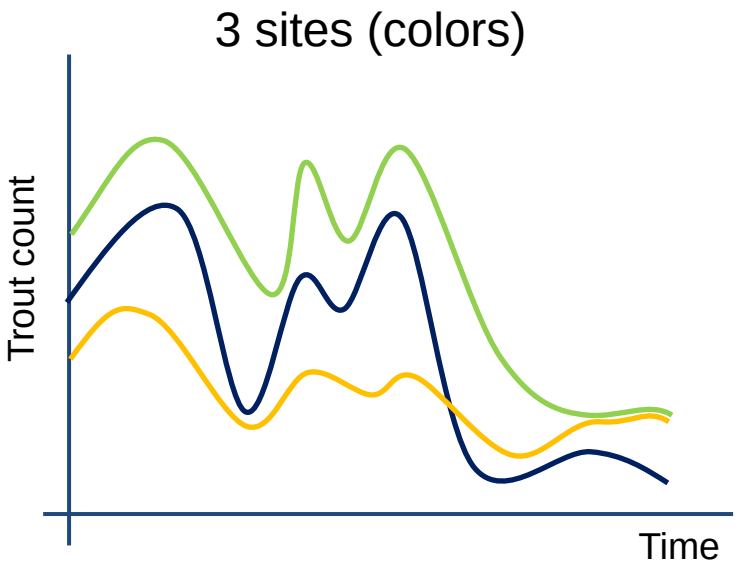


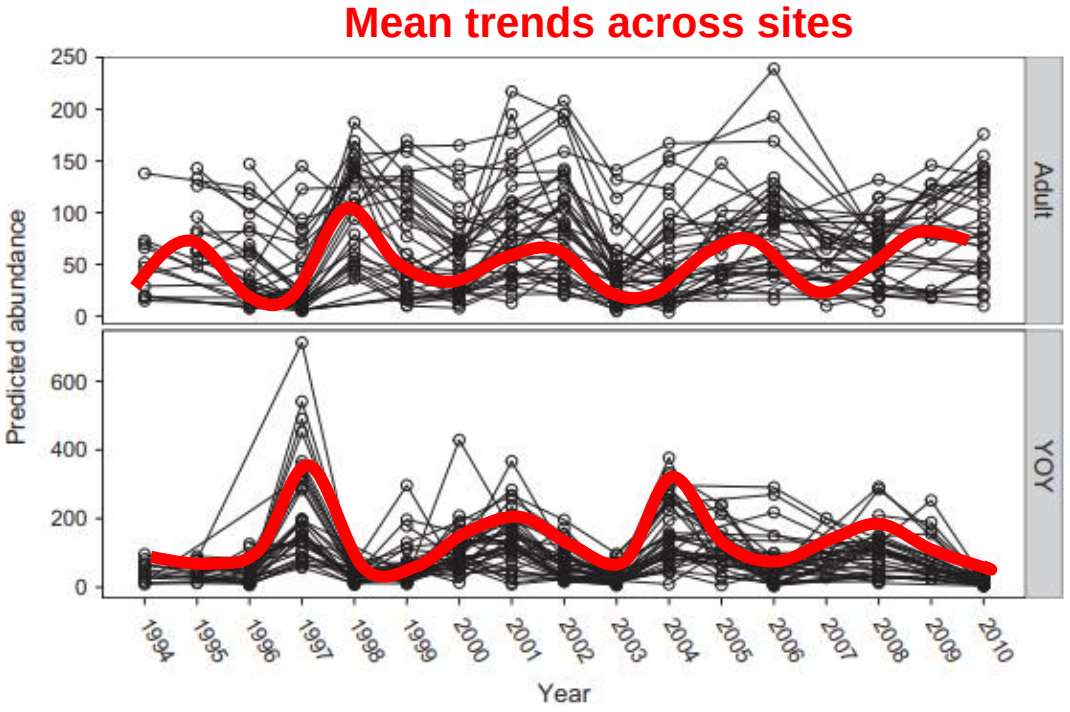
Capture probability of individuals per pass



Spatial synchrony

- Spatial synchrony: Correlation of time-series count across space





Shenandoah data (Kanno et al. 2016)

Distributions of synchronous and asynchronous sites

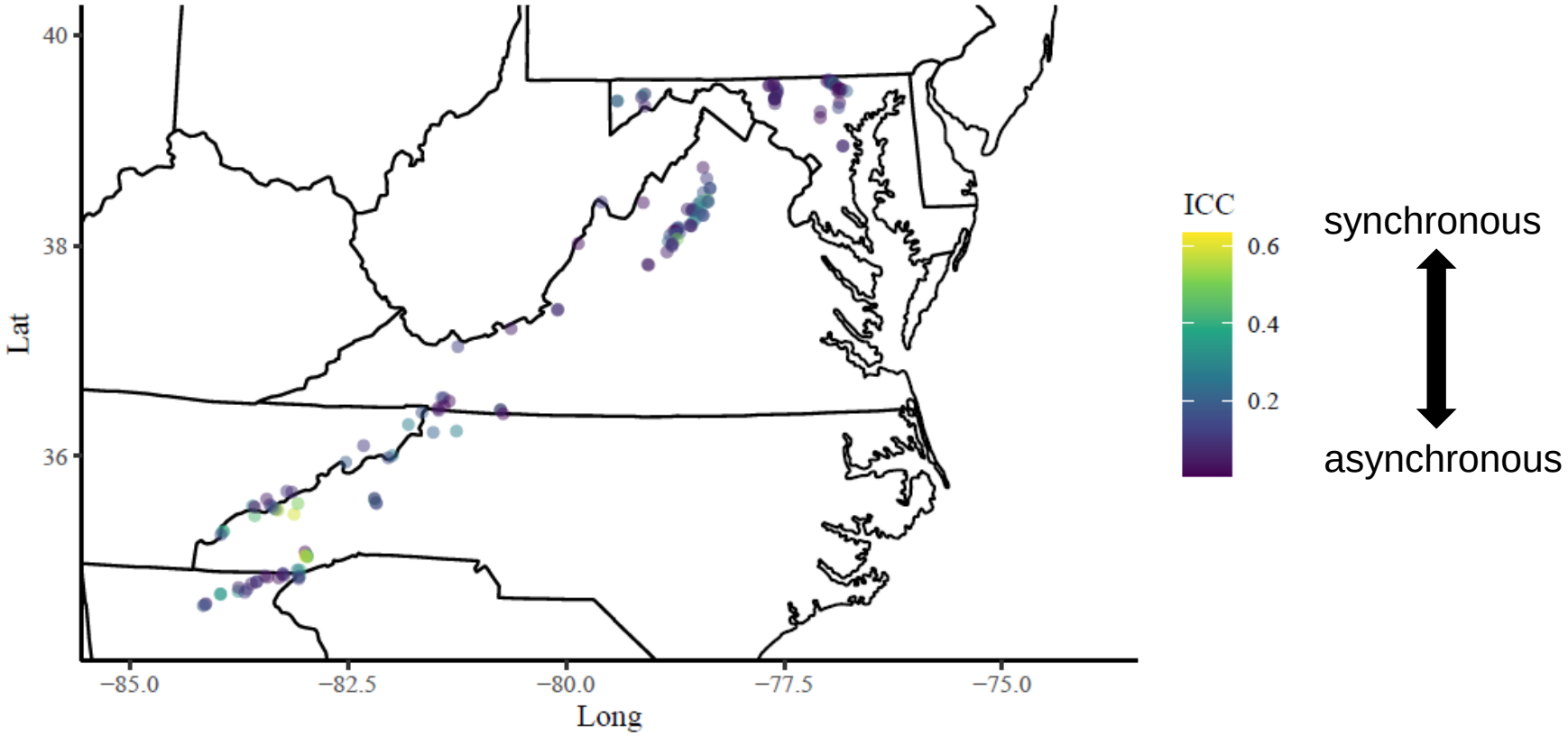
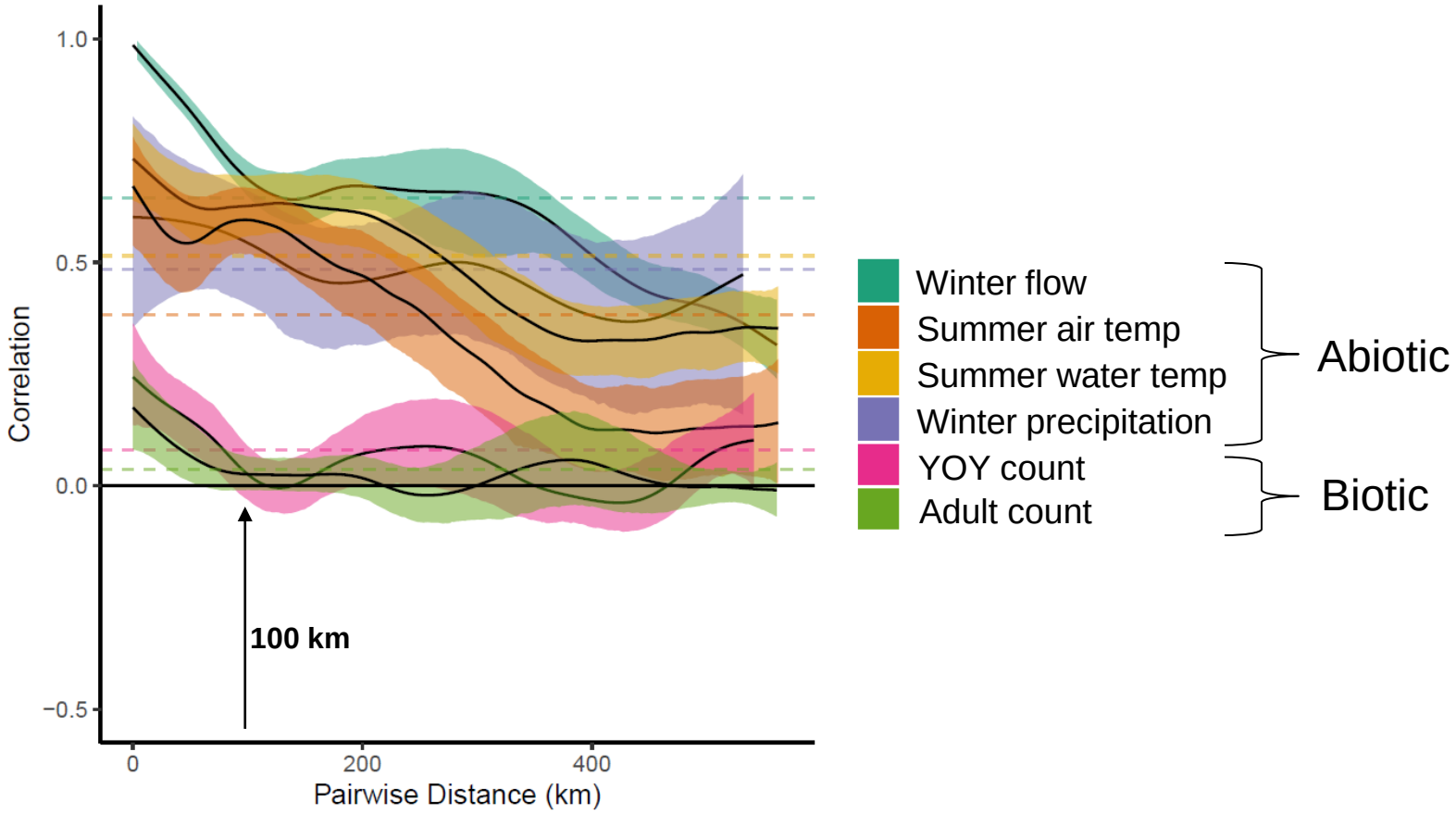


Figure 5: Intraclass correlation coefficient (ICC) values for populations of young-of-year brook trout in the southeastern USA.

Spatial autocorrelation (Correlogram)

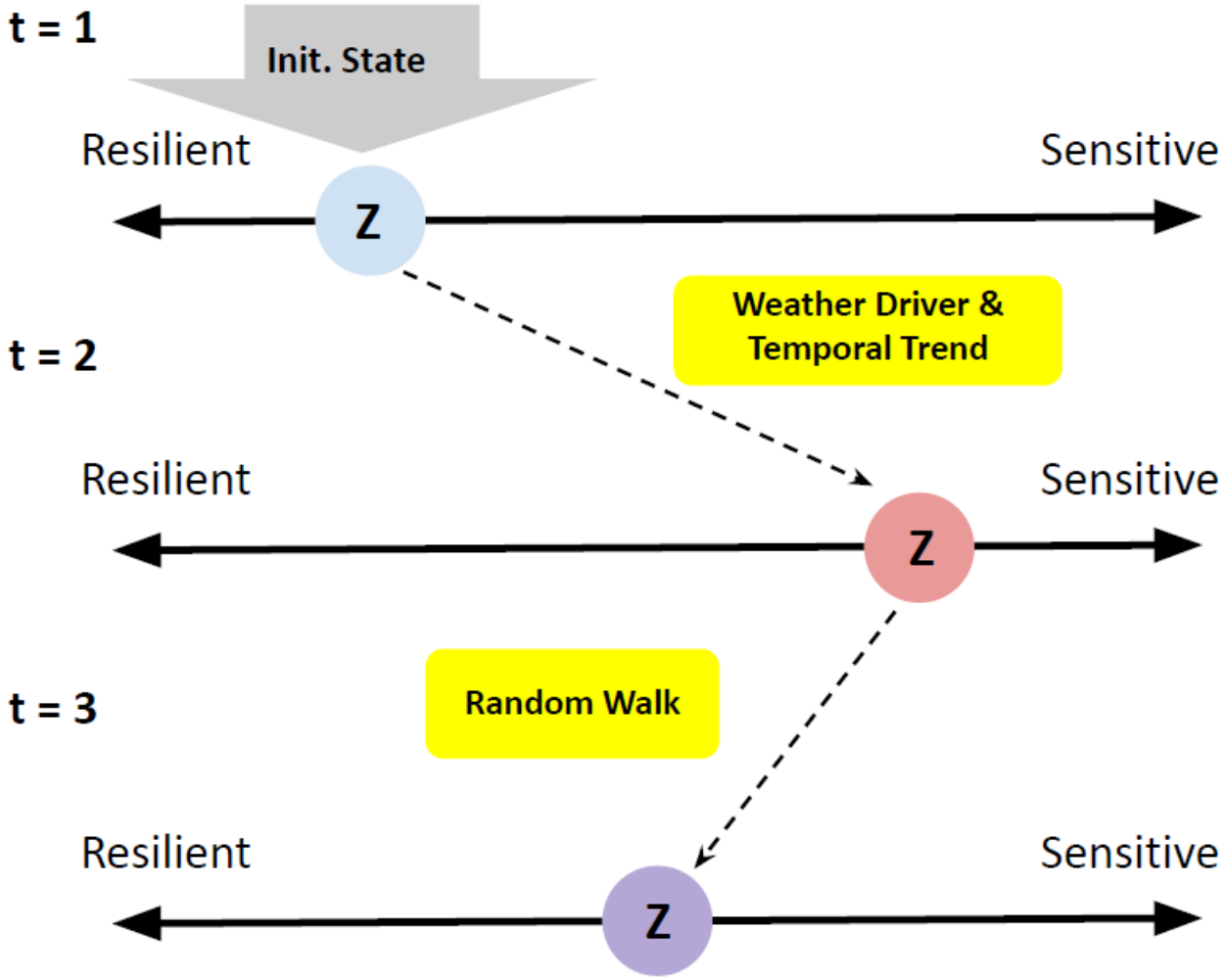
- Populations closer to each other behavior more similarly to each other than those farther apart.

  - Stronger in abiotic variables than trout count.

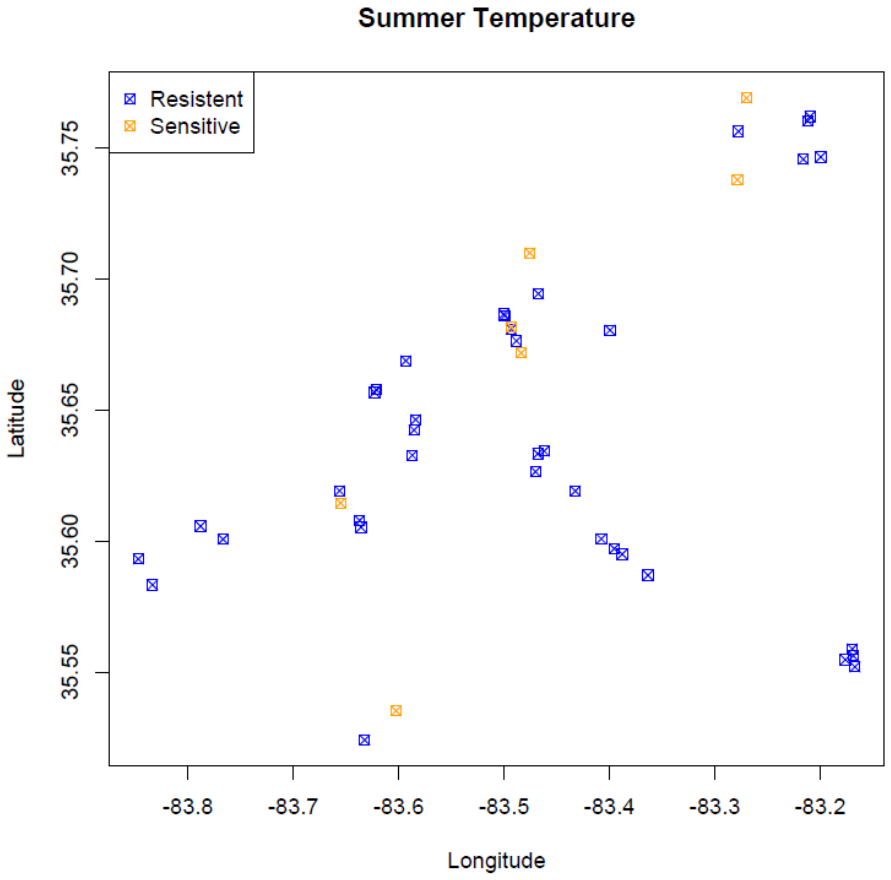


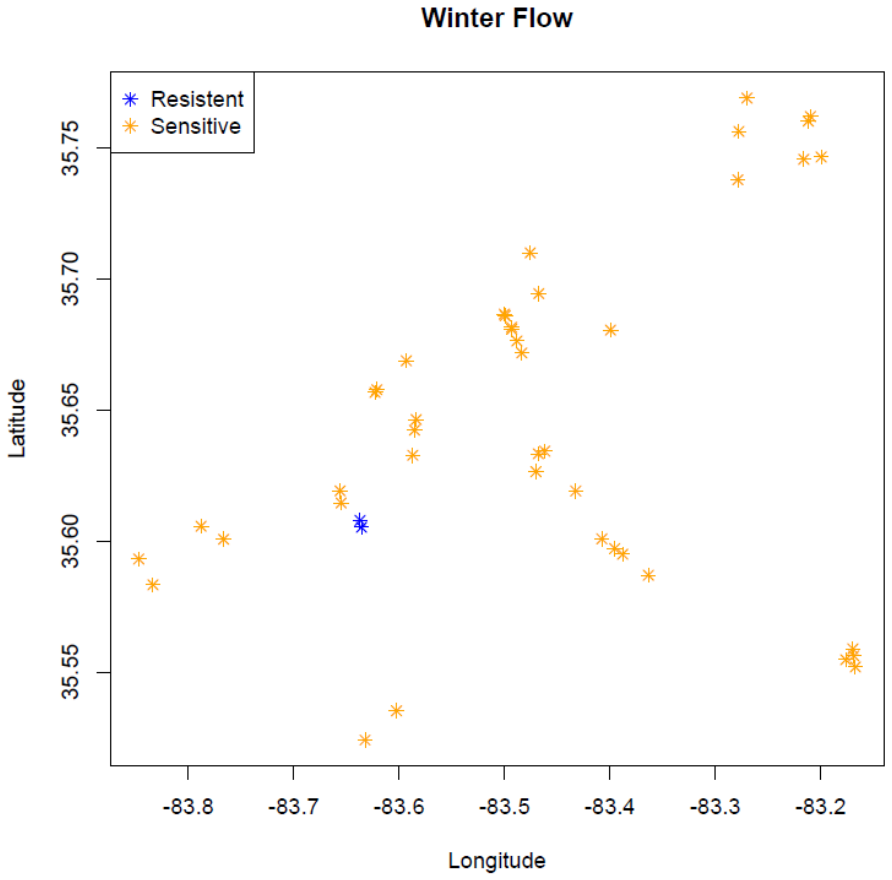
Temporal dynamics in weather sensitivity

Are populations becoming more sensitive to weather variation over time?



Spatial heterogeneity in weather sensitivity of YOY count





Research summary

- Synthesis of multiple data sets provides novel insights into trout conservation ecology (as opposed of analysis of individual data sets).

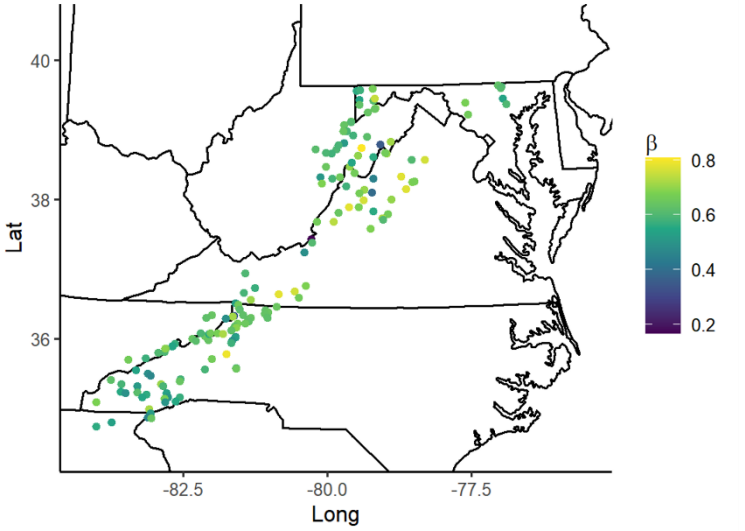
- Trout population responses to climate change will be heterogenous at fine spatial scales.

- The biggest challenge is to explain how the heterogeneous responses are generated (but we are taking steps into a right direction).

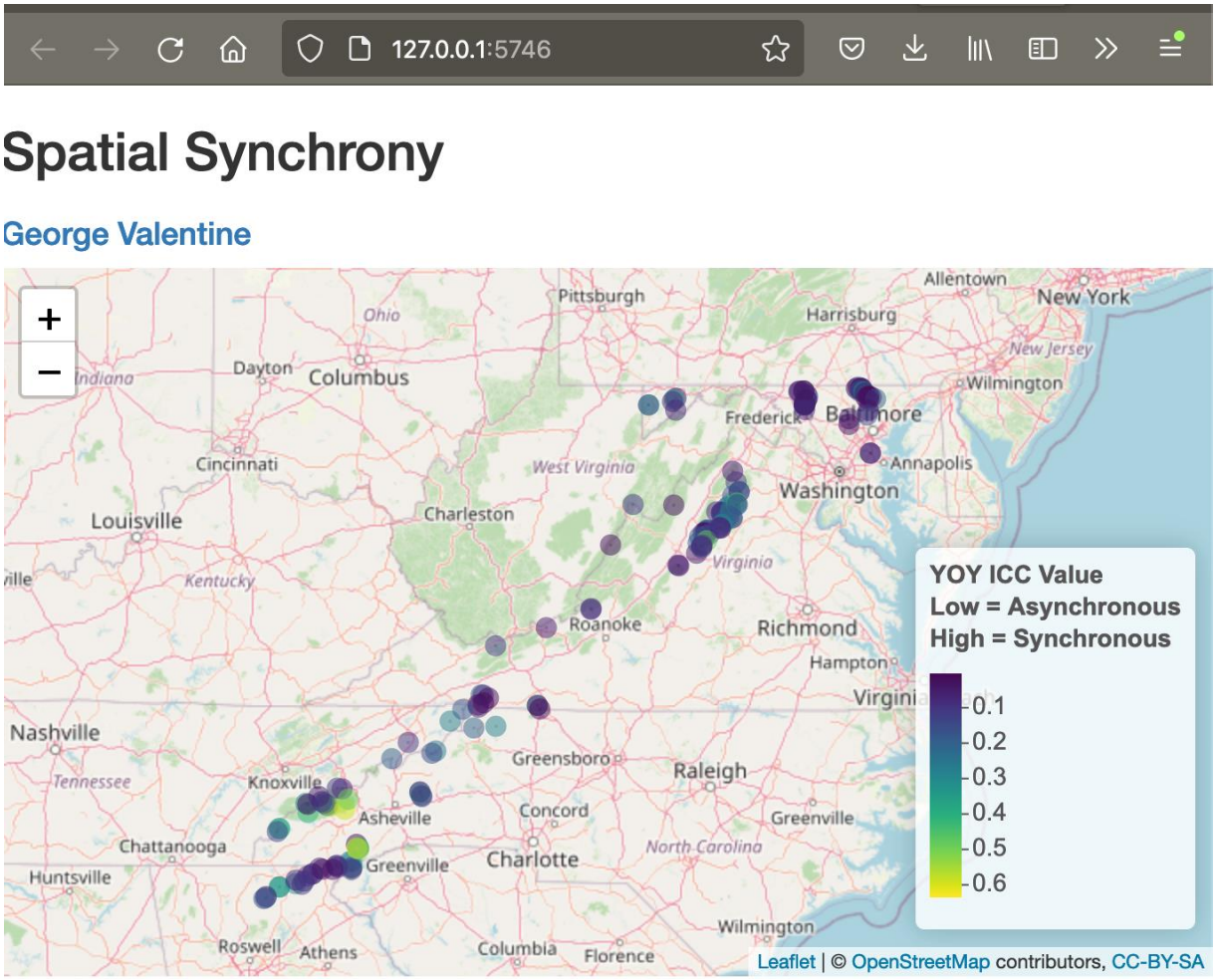
Priority populations in a changing climate

- Sites resilient to climate variation
- Sites with asynchronous trends with other sites
- Sites with colder temperature
- Sites with more trout
- Sites with stable population size

Increase in stream temp when air temp increased by 1 °C.



Map products



- Currently housed on local desktops
- Potentially housed online

Timeline

- ~ Fall 2023: Current analysis

  - Explanatory models at sampled sites

- 2024- : Additional analysis & visualization

  (Pending funding availability)

  - NHD segment ranking (GA to MD) using predictive models for unsampled sites

Questions?

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