Ranking Brook Trout Habitat Patches for Resiliency to Climate Change

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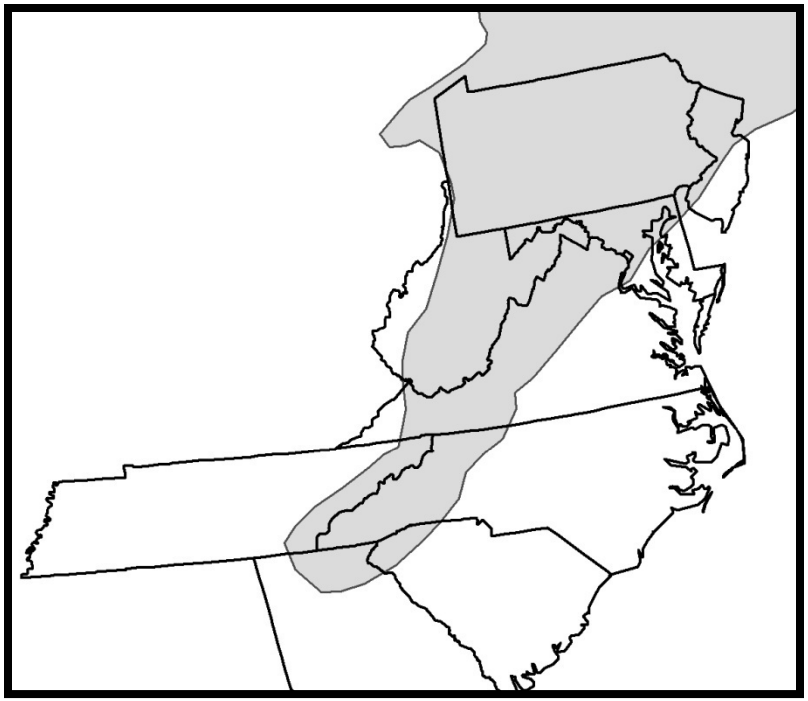
Under various climate change scenarios, brook trout are predicted to be extirpated from many states.

- Flebbe et al. 2006. **Spatial Modeling to Project Southern Appalachian Trout Distribution in a Warmer Climate**. TAFS
- Clark et al. 2001. **Predicting Climate Change Effects on Appalachian Trout: Combining GIS and Individual –Based Modeling.** Ecological Applications.
- Meisner. 1990. **Effect of Climatic Warming on the southern margins of the Native Brook Trout** . CJAS



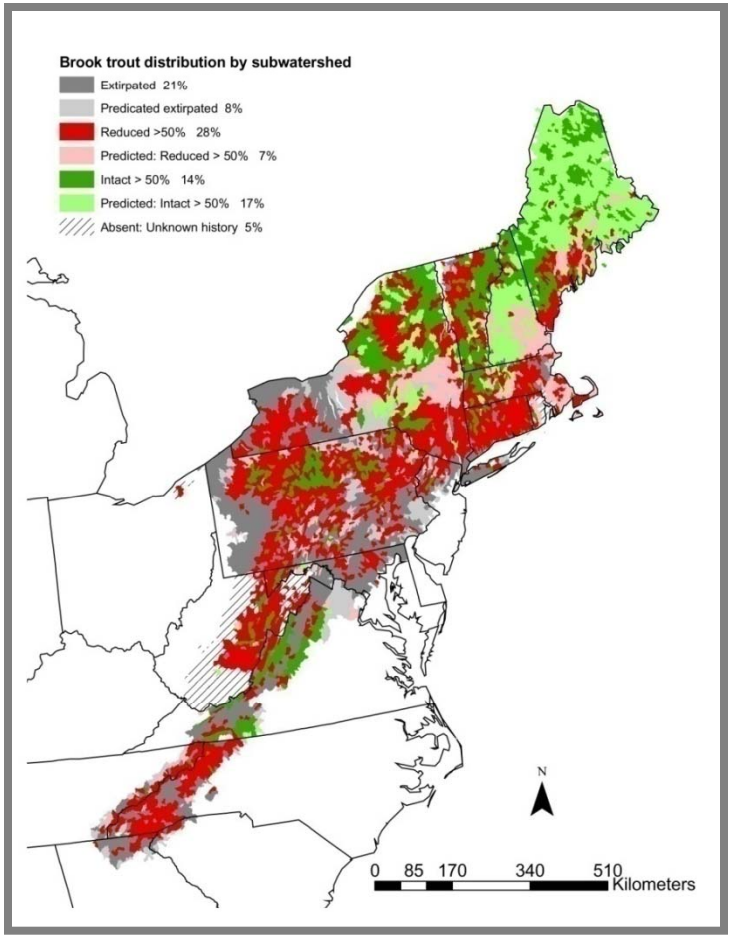
Are the model's accurate at smaller scales? Are small refugia likely ?

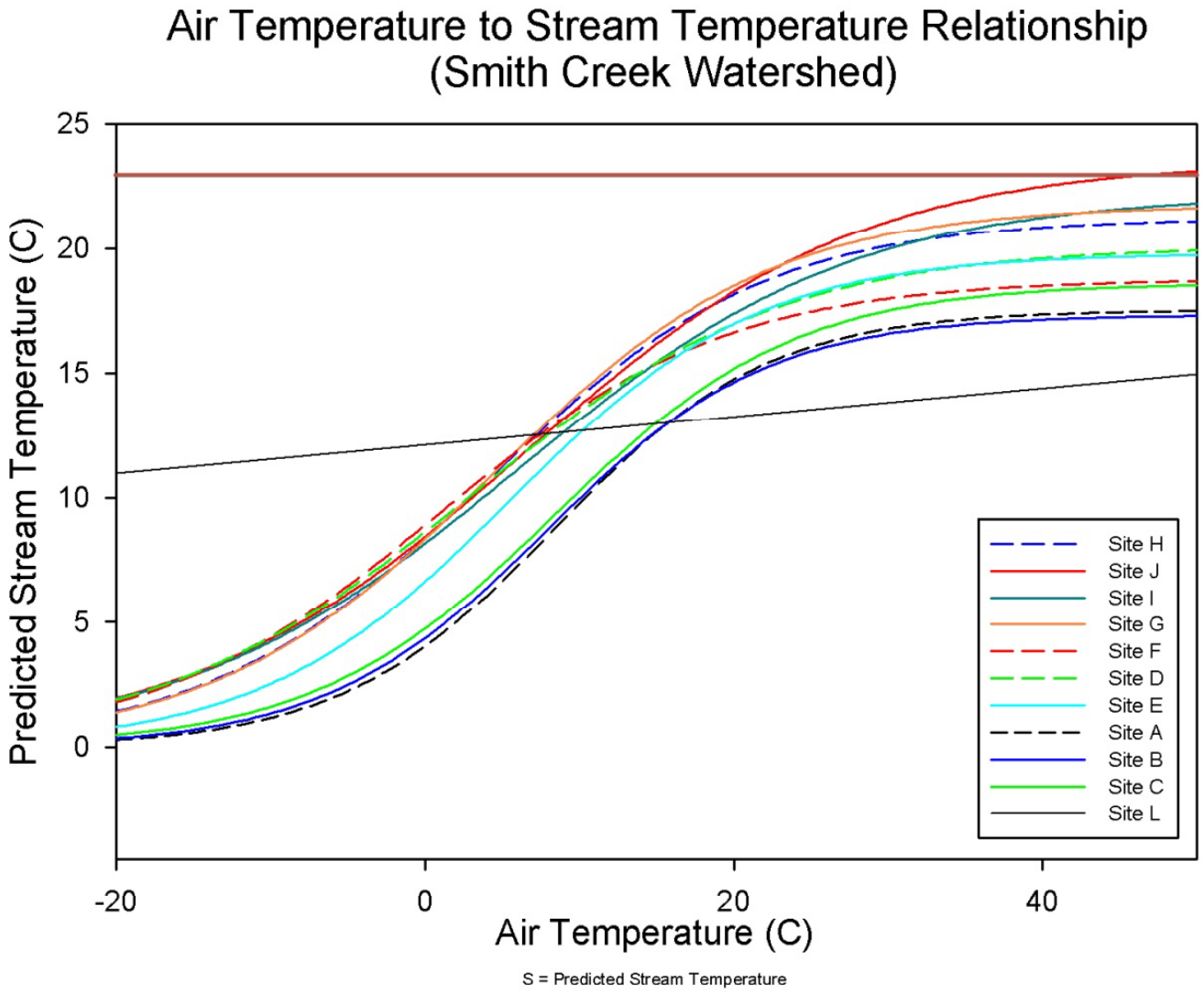
- Small Area Influences
  - Land use
  - Riparian vegetation
  - Groundwater
  - Aspect
  - Elevation
  - Latitude
  - Solar input

A question of Scale ?

1. While large scale climate models predict extirpation throughout much of the EBTJV study area, **our pilot studies suggest potential refugia** for brook trout.

2. Refugia may exist because of the **different air/water temperature relationships at the catchment scale.**



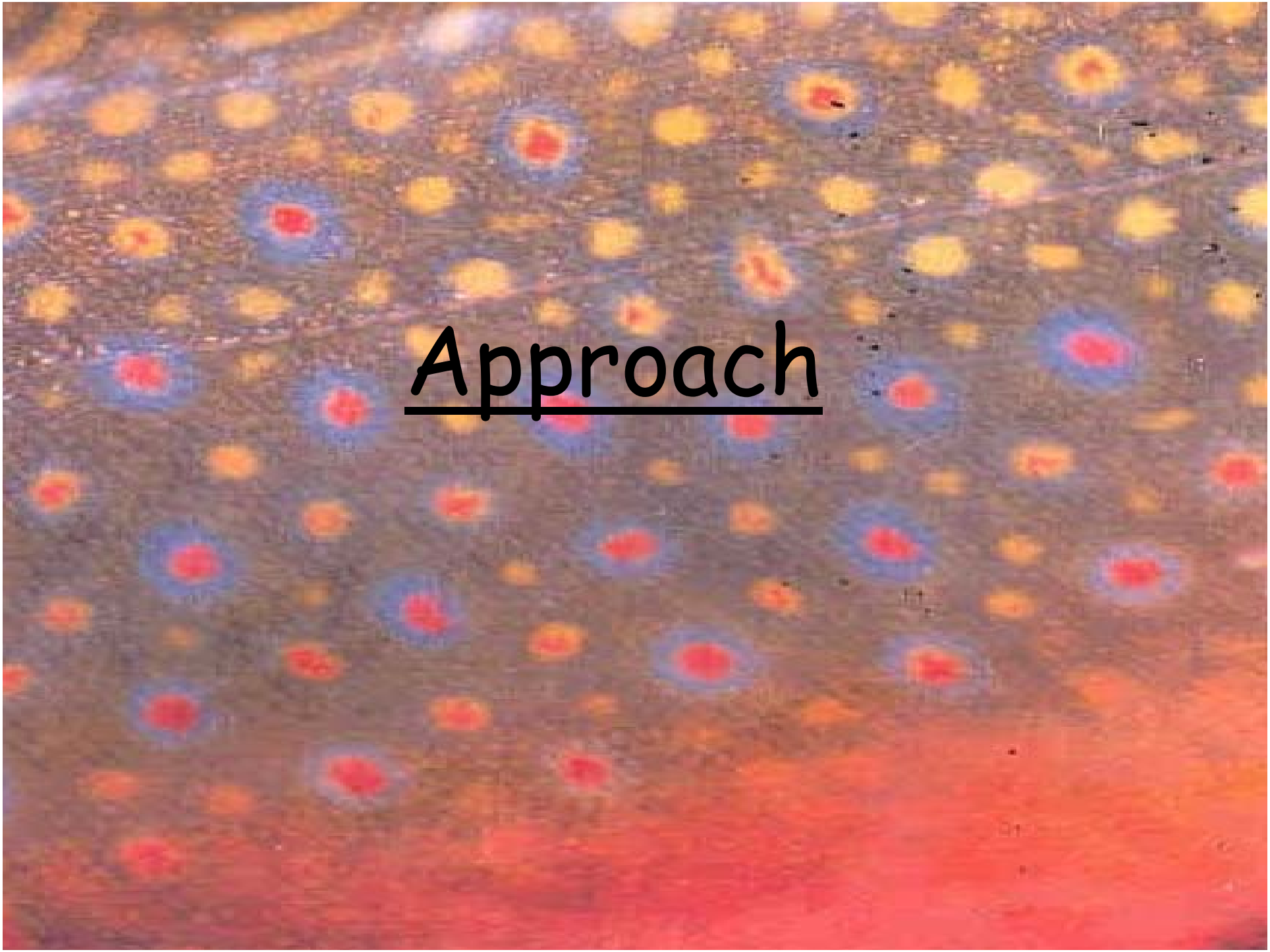

Air Temperature to Stream Temperature Relationship
(Smith Creek Watershed)
Predicted Stream Temperature (C)
25
20
15
10
5
0
-20
0
20
40
Air Temperature (C)
Site H
Site J
Site I
Site G
Site F
Site D
Site E
Site A
Site B
Site C
Site L
S = Predicted Stream Temperature

Working hypothesis:

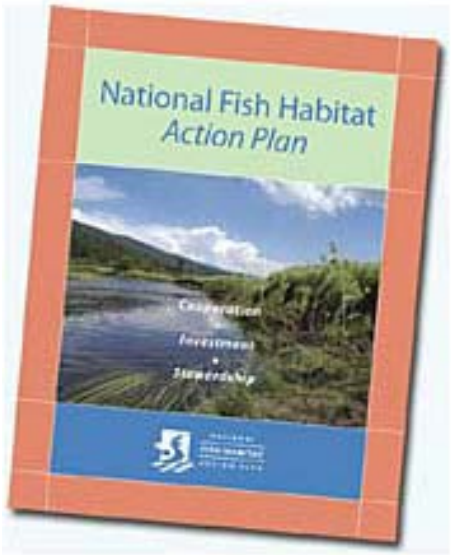
1. **Landscape characteristics can explain the residuals** of these local air/water temperature relationships.

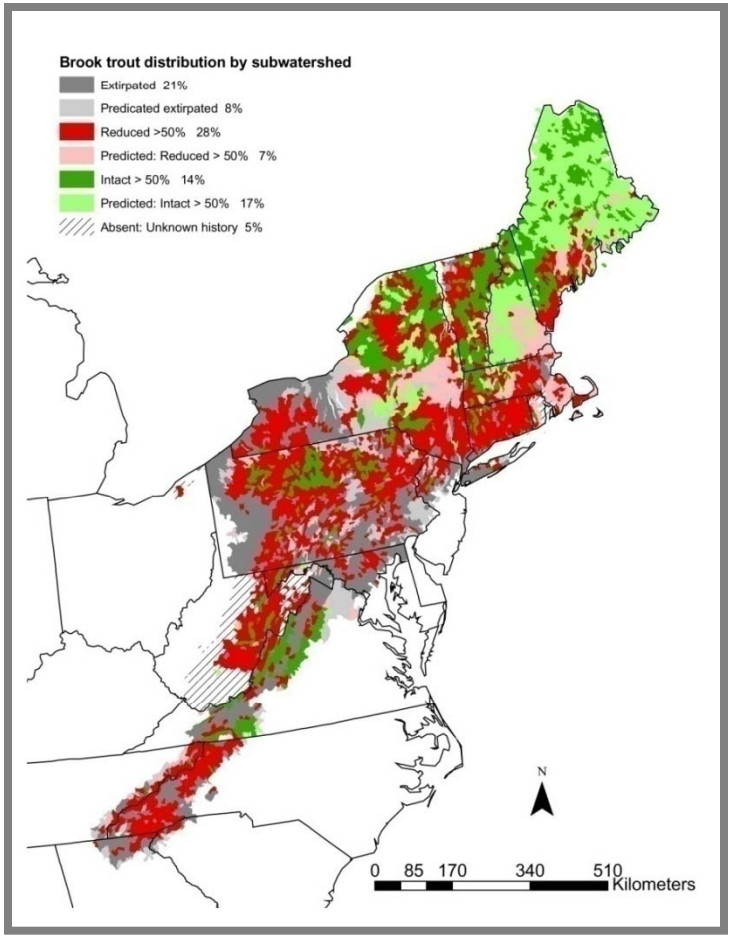
2. Models predicting these air/water temperature relationships from local landscape characteristics can be **used to rank brook trout populations for resiliency to climate change.**

3. These rankings can be used by managers for prioritization of future, protection and restoration efforts of the EBTJV.

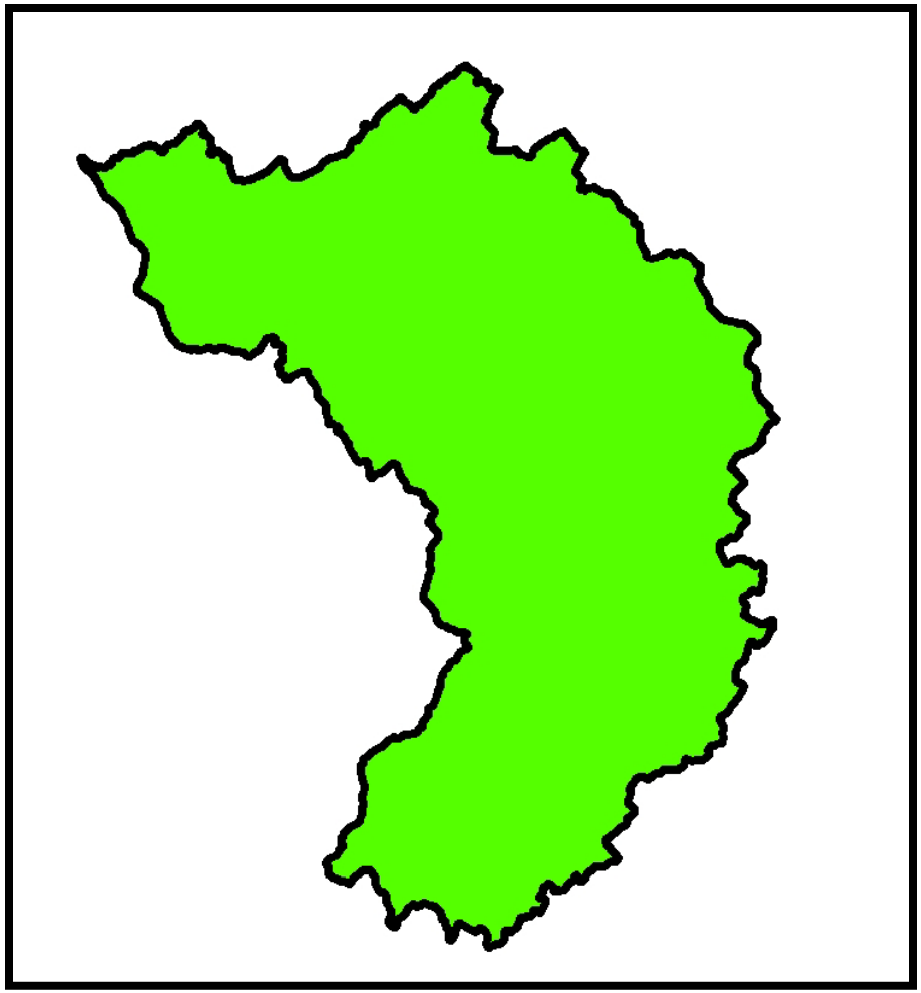

Approach

EBTJV Data Set

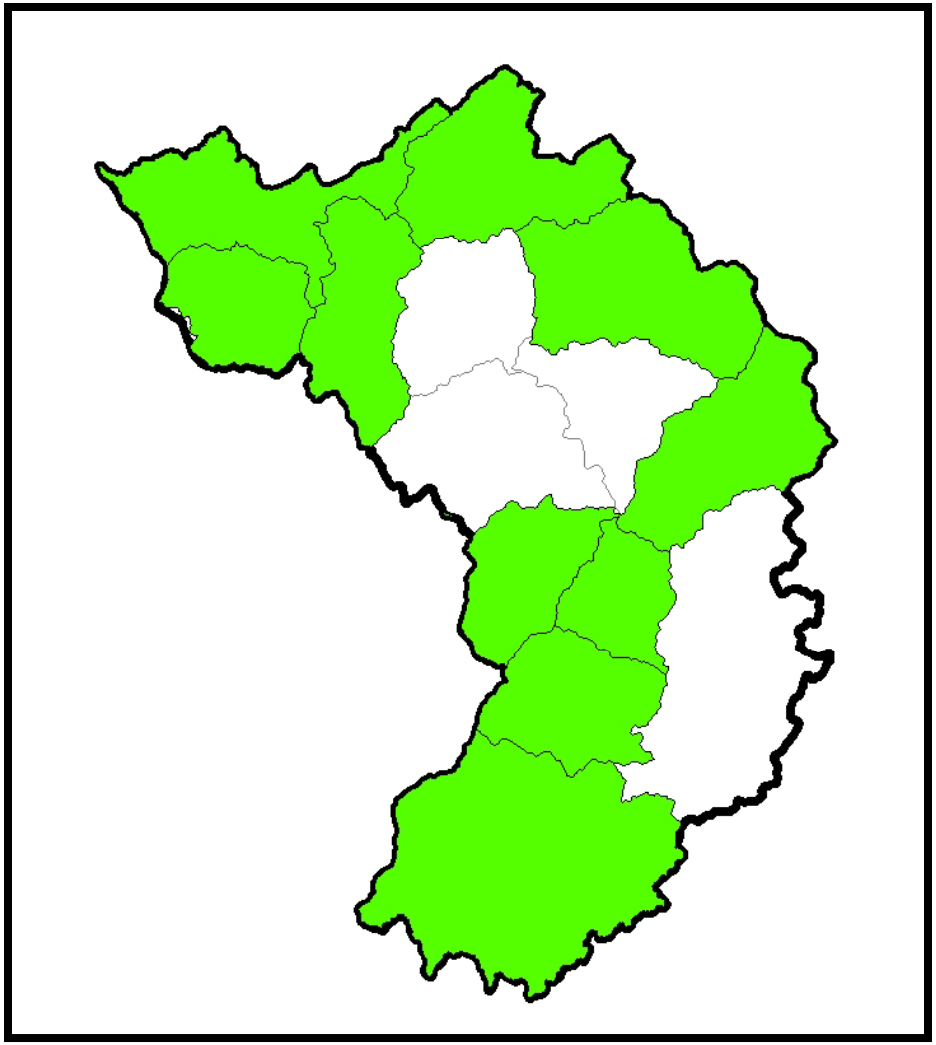




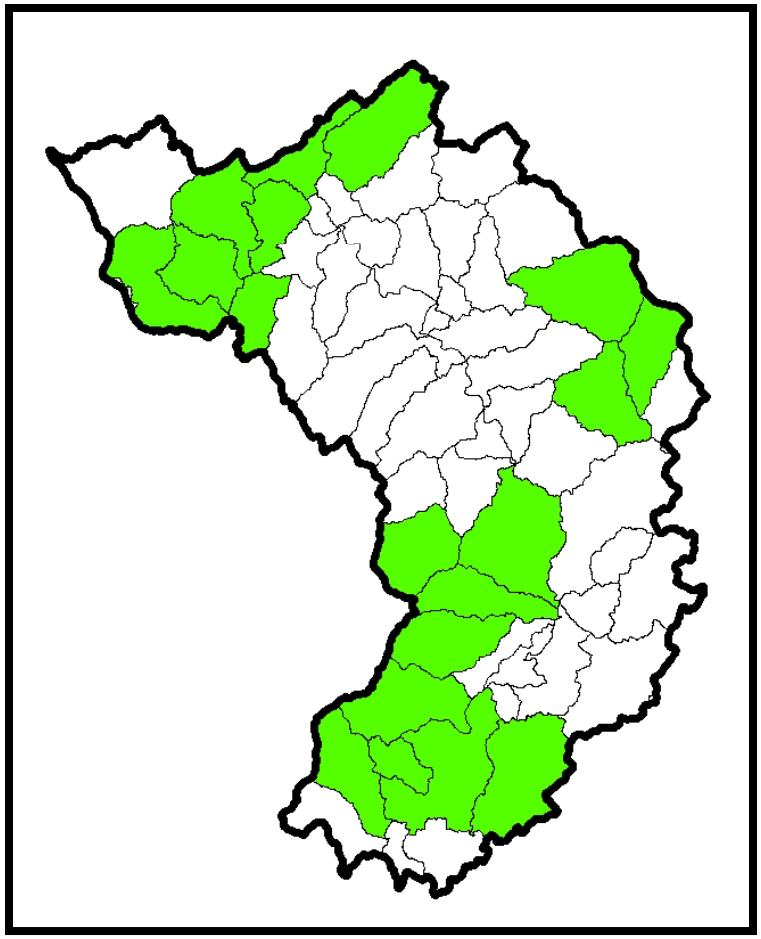
Sub-basins (4th HUC)



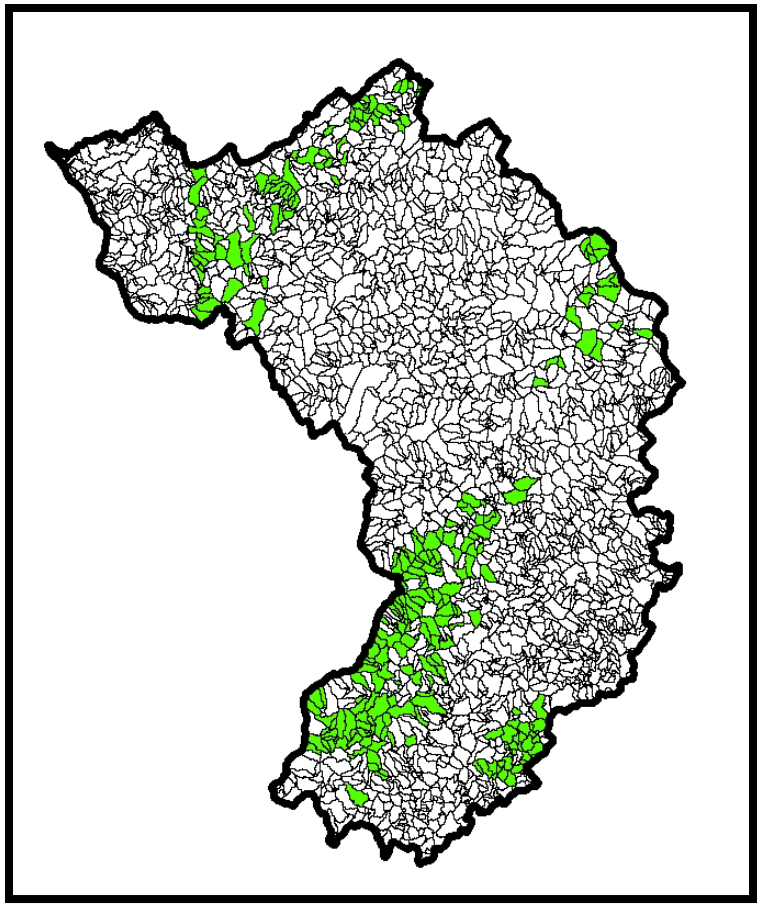
Watersheds (5th HUC)



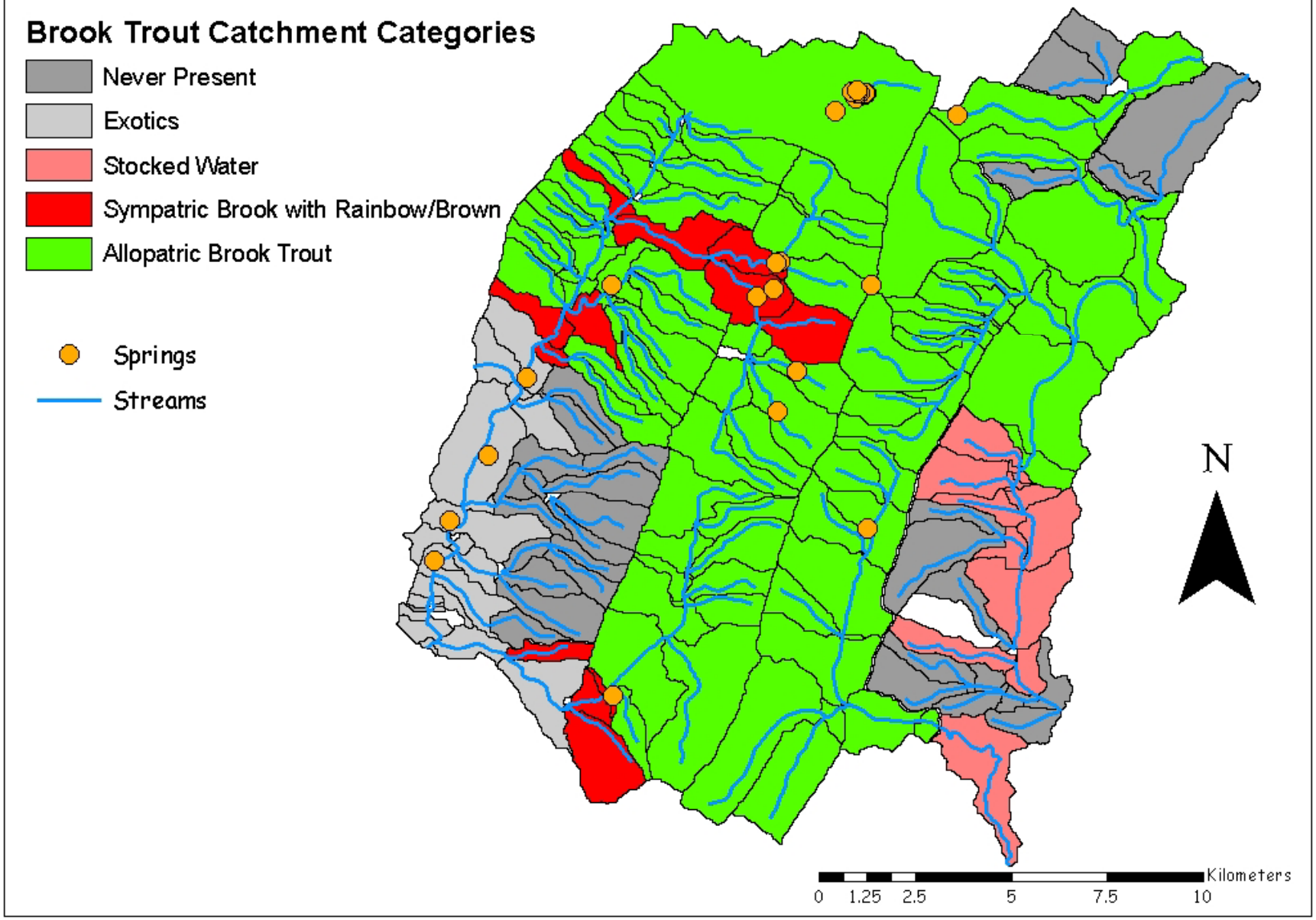
Subwatersheds (6th HUC)



Catchments



Cedar and Smith Creek Watersheds Near Covington VA



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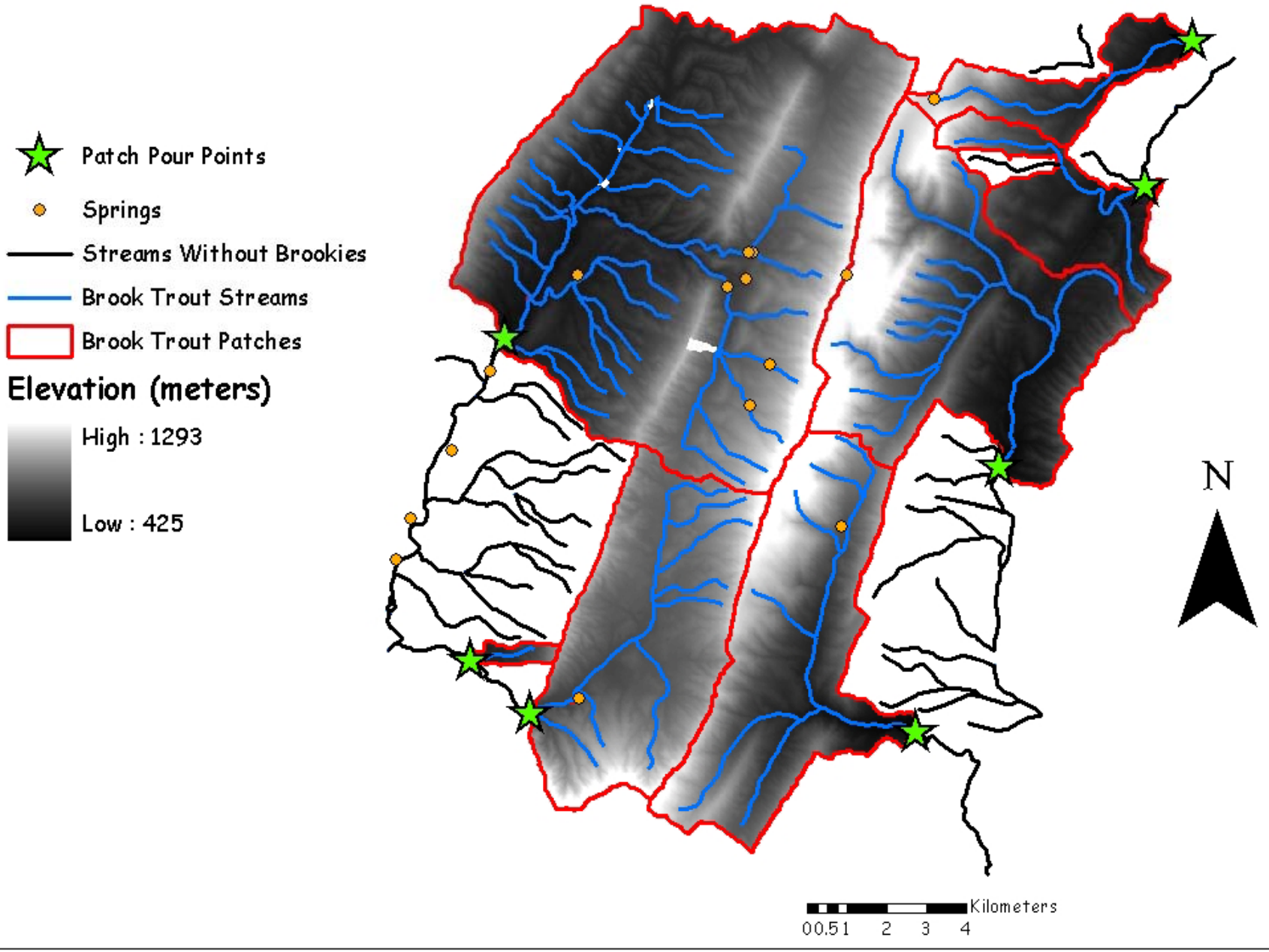
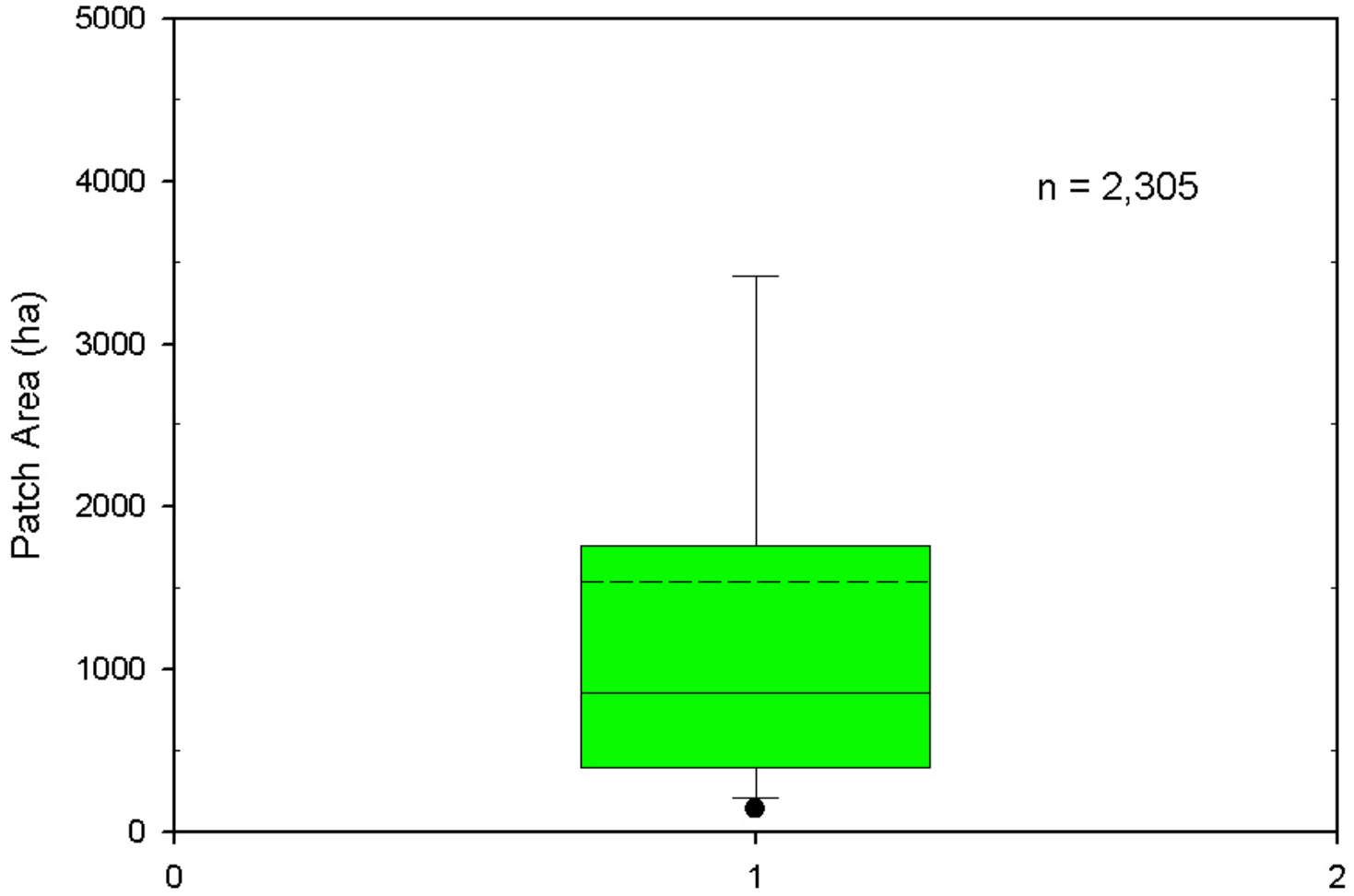
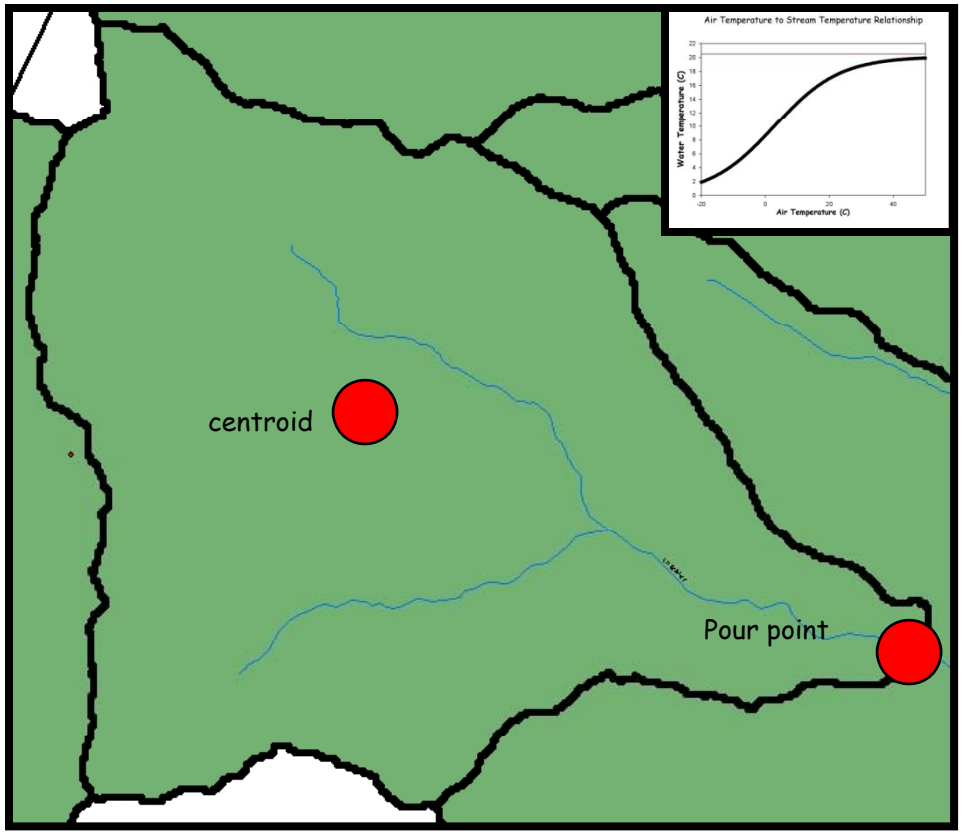



5000
4000
3000
2000
1000
0
Patch Area (ha)
n = 2,305
0
1
2


Methods

Sampling Methods



- Paired air and water temperature data will be used to develop the **unique sigmoid curve function** for the pour point and centroid of each selected patch.

Sample Duration

- Temperature data is being collected at **30 minute intervals** for **17 months** including **two critical summer periods (July-September 15)**

- Various temperature metrics will be plotted to **detect critical limits** as well as define the air/water **temperature relationships**.

Thermograph Specifications

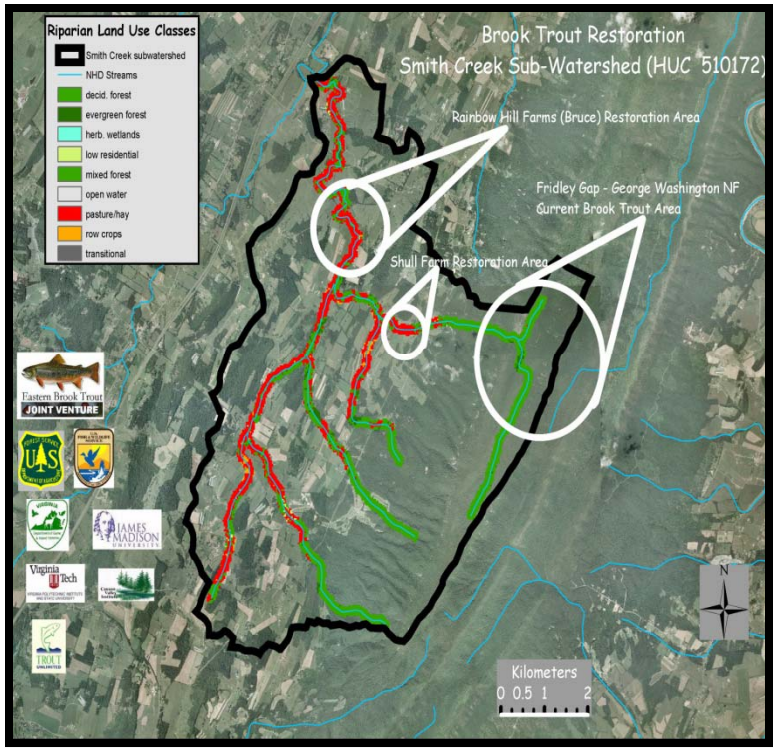
Onset HOBO Water Temp Pro v2

- Operation Range: -20 to 70°C
- Accuracy: 0.2°C over 0° to 50°C
- Resolution: 0.02°C at 25°C


$$ Sampling $$

Candidate Metrics for Clustering

- Percent Riparian Canopy Cover
- Total Annual Riparian Area Solar Gain (kWh)
- Total forest area in each patch
- Pour Point Elevation
- 30 year annual mean max air temperature at the Pour Point
- Number of springs in each patch



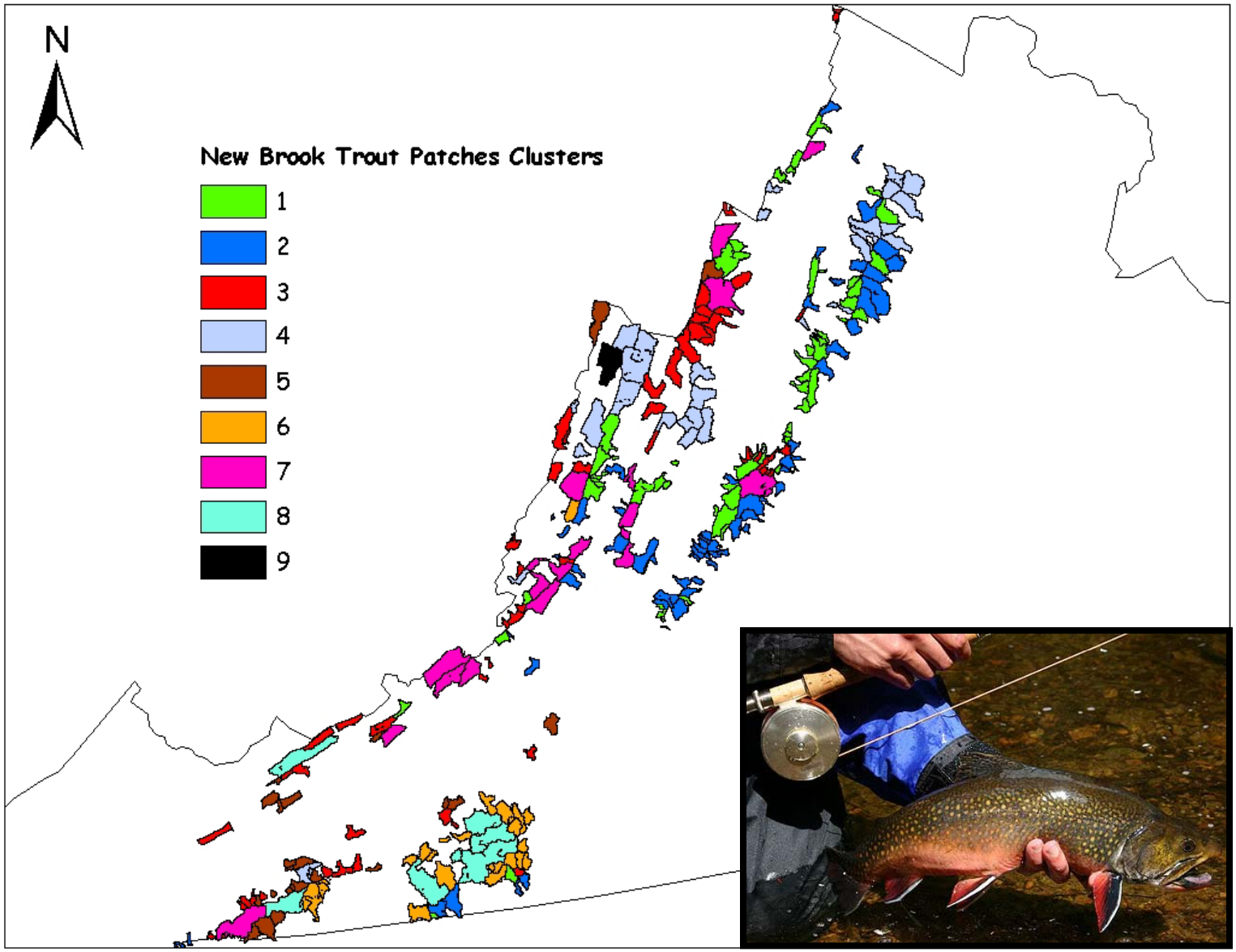

N
New Brook Trout Patches Clusters
1
2
3
4
5
6
7
8
9

Table Comparing Cluster Metrics

Cluster	# Patches	# Sampled	Solar Gain	# Springs	% Canopy	Pour Pt Elev	Pour Pt Max Air Temp	Patch Forest Area
1	56	9	Low	Low	High	Low	High	High
2	61	10	Low	Low	Medium	Low	High	High
3	56	8	Low	Low	High	Medium	Medium	High
4	25	5	Low	Medium	Low	Medium	Medium	Medium
5	23	5	Medium	Low	High	High	Low	High
6	25	5	Medium	Low	Medium	High	Medium	Low
7	18	4	High	Medium	High	Medium	High	High
8	7	3	High	Low	Medium	High	Medium	Low
9	1	1	Medium	High	Low	High	Low	Low
Sum	272	50						

Summary

- Managers need climate change information at various scales. This project focuses on monitoring at the habitat patch scale.
- Habitat patches have different air/water temperature relationships that can be explained by landscape charactersitics.
- Identify brook trout patches within the EBTJV.
- Stratified random subsample (n = 200) of patches from cluster groupings.
- Collecting matched air/water temperature data at pour point and centroid of selected patches.
- Model landscape charactersitics that explain Air/water temperature relationships.


WHENEVER YOU TALK, I THINK ABOUT MY FISHING LURES UNTIL THE NOISE STOPS.