# Brook Trout Populations (2005) Classified for Climate Change Vulnerability

## Climate Change Vulnerability Classes

- nhd+ stream layer
- ebtjv_quads polygon selection
- States where model was validated (n=100 sites)
- States where model was extrapolated (needs validation)
- <70% forest corridor-Active managment may change class

- High Exposure/ High Sensitivity n=1,026
- High Exposure/ Low Sensitivity n= 276
- Low Exposure/ High Sensitivity n=247
- Low Exposure/ Low Sensitivity n=780
- Historic Brook trout Range


**Abstract. –** Current assessments of brook trout and climate change are often not at a fine enough scale to address many management concerns. Many climate change models predict both subtle and dramatic changes to aquatic systems. Large scale models based on simple air temperature – water temperature relationships have been useful in highlighting potential threats to cold water dependent species such as brook trout, predicting major losses of suitable habitat and substantial reductions in geographic distribution. However these models have limited utility to mangers making decisions at the population scale. In addition, spatial variability in the relationship between changes in air temperature to changes in water temperature complicates predictions. In order to better predict changes in the persistence of cold water habitat at the population scale, we directly measured paired summer air and water temperatures in a stratified representative sample of 126 watersheds (habitat patches <1 – 274 km2) containing wild brook trout populations throughout Maryland, West Virginia and Virginia, We used these data to classify streams in terms of two important components of habitat vulnerability: (1) sensitivity (predicted change in water temperature per unit increase in air temperature) and (2) exposure (predicted frequency, magnitude, and duration of water temperatures averaged over a range of temperatures). Sensitivity was significantly lower (median sensitivity = 0.35 degrees) than the 0.80 degrees assumed in previous models. Variation in sensitivity and exposure among habitat patches (populations) was influenced by landscape metrics such as solar insolation, percent forested riparian corridor, patch area, maximum air temperature, and elevation. Overall, our direct measurement approach identified significantly more brook trout habitat patches with low sensitivity and low exposure that would persist under warming air temperatures than do previous large scale models. Our fine scale sensitivity and exposure classification should provide a useful general framework for managers in making investment decisions for protecting and restoring brook trout habitat at the population scale.


## How to Use This Map

1). Brook trout populations with a **green** vulnerability classification (low exposure / low sensitivity) **are good candidates for restoration and protecting genetic integrity** as they are less likely to disappear under various climate change scenarios.

2). Brook trout populations in **gray** **are less likely to persist** under various climate change scenarios. These populations will be the first to contract in size and may become extirpated.

3. Brook trout populations (all colors) that are cross hatched have less than 70% forested stream buffers. These **cross hatched populations can have their vulnerability improved** through active management (i.e. tree planting to reduce solar insolation).

4) **Next Steps** include **updating the old population assessment** (2005) and **validating the vulnerability model** in Pennsylvania and New Jersey.

5) **For further information:** contact Mark Hudy, National Aquatic Ecologist, USDA Forest Service; 540-568-2704; hudymx@csm.jmu.edu

Eastern Brook Trout JOINT VENTURE

Fish & Aquatic Ecology Unit

0 62.5 125 250 Kilometers