Climate Change and Impacts on Wild Trout: Conserving Brook Trout in an Uncertain Future

PFBC Wild Trout Summit

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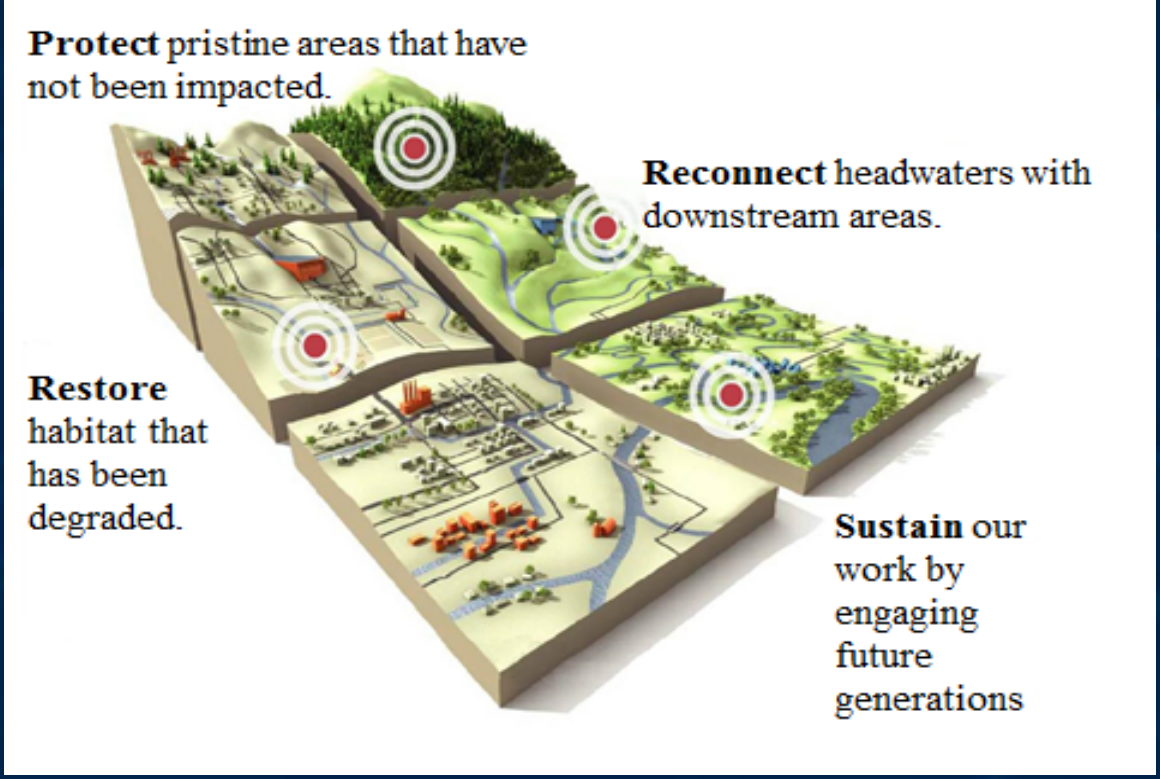
Trout Unlimited (TU)

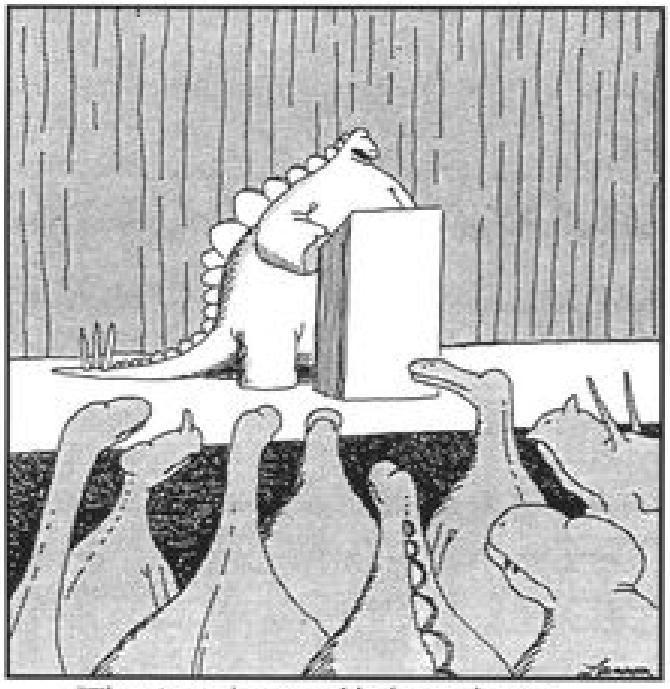
- **TU's Mission:**

  To conserve, protect, and restore North America's coldwater fisheries and watersheds.



Resiliency

- **Ability of populations to successfully cope in the face of stressors and/or disturbance (adapted from Holling 1973).**



"The picture's pretty bleak, gentlemen. . . . The world's climates are changing, the mammals are taking over, and we all have a brain about the size of a walnut."

Climate Change & Brook Trout Populations

Expected Change	Habitat Impacts	Brook Trout Impacts
Warmer Summer Temperatures	↑ Stream Temperatures; ↓ Suitable Habitat	Reduced growth, survival, and reproduction; Increased stress; Non-native trout and invasive species
Lower Summer Flows		
More Intense Storm Events	↑ Erosion & Sedimentation	Reduce aquatic insect community; fill-in spawning areas; inhibit movements
More High Flows in Winter	Scour stream beds; Increase erosion	**Reduce reproduction success**

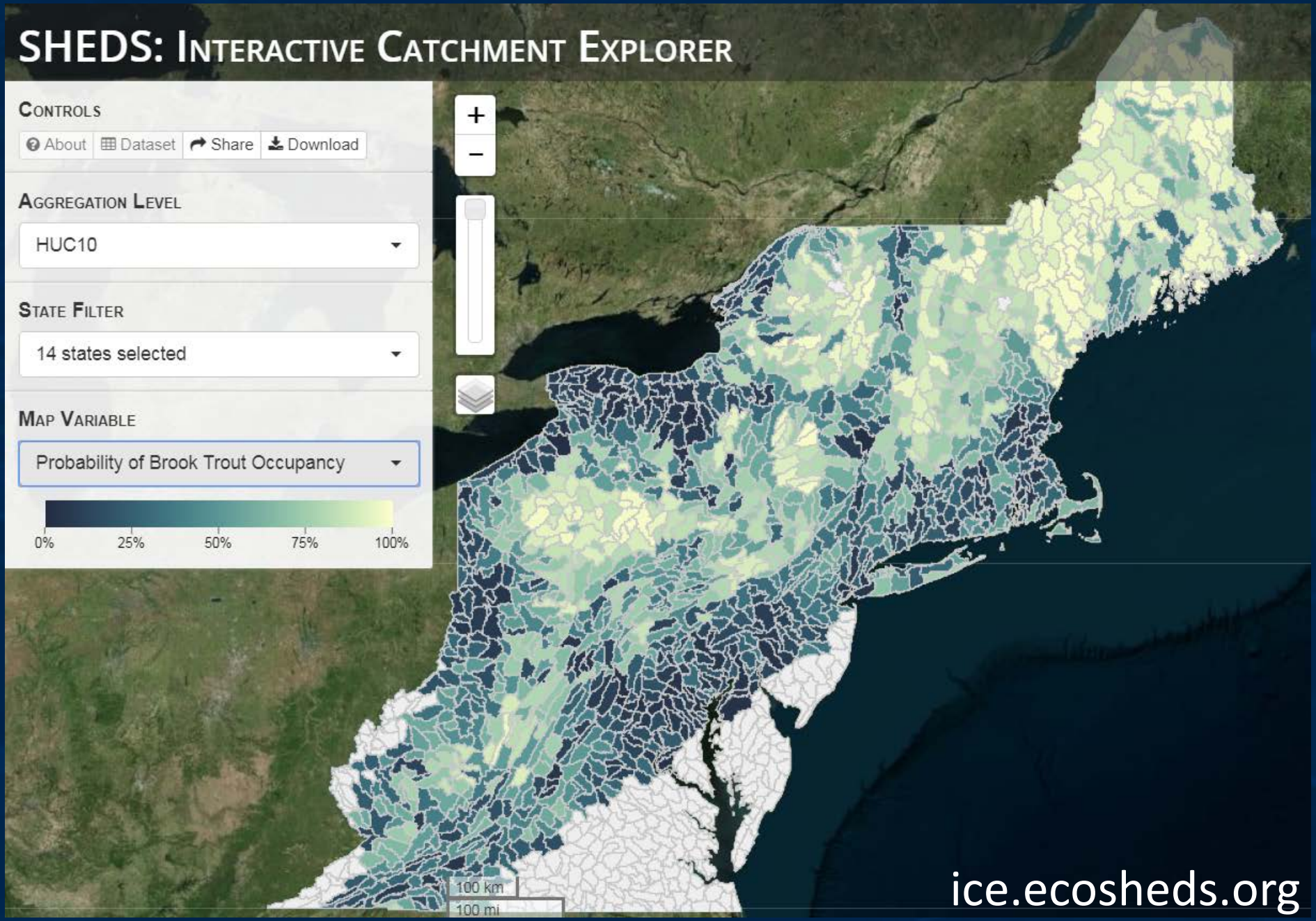
Some Stressors to Brook Trout

Variable	Literature Threshold
Water temp. °F	> 65- 70° F (DeWeber & Wagner 2015)
% agricultural land use	> 2.5 – 25 (Wagner & Midway 2014; DeWeber & Wagner 2015)
% forested riparian zone	< 80 (as % forested watershed: Stranko et al 2008; Kanno et al. 2015)
% forested watershed	< 80 (Stranko et al. 2008; Kanno et al. 2015)
Road density (km/km²)	> 2 (Hudy et al. 2008)
Percent impervious surface	< 4 (Stranko et al. 2008)

- Changes in land-use influence resiliency to climate change
- More narrow tolerance to other stressors with climate change
- Habitat for cold and cool water fish reduced by 30% to 50%[1]

[1]Eaton & Scheller 1996

SHEDS: Interactive Catchment Explorer



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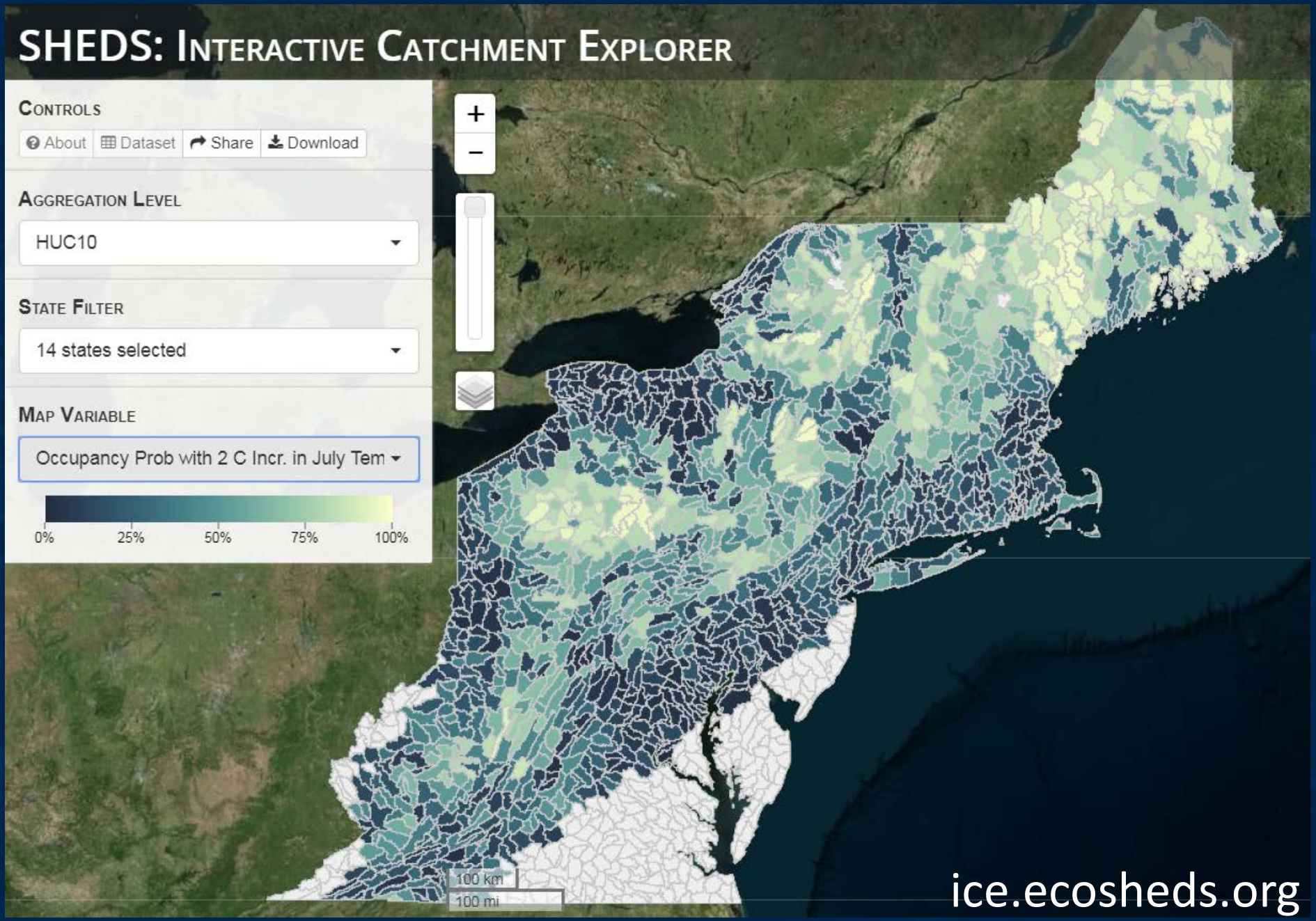

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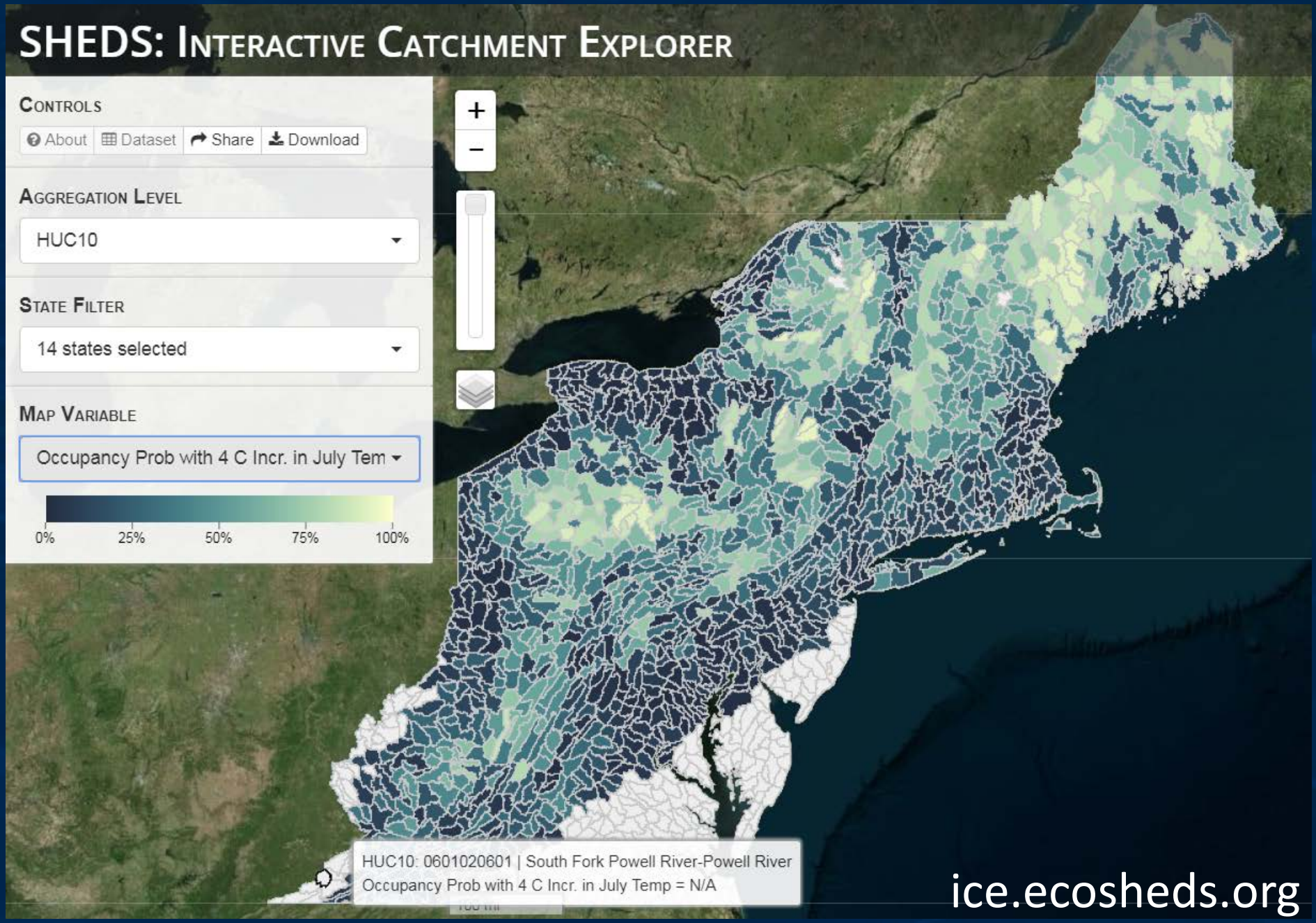

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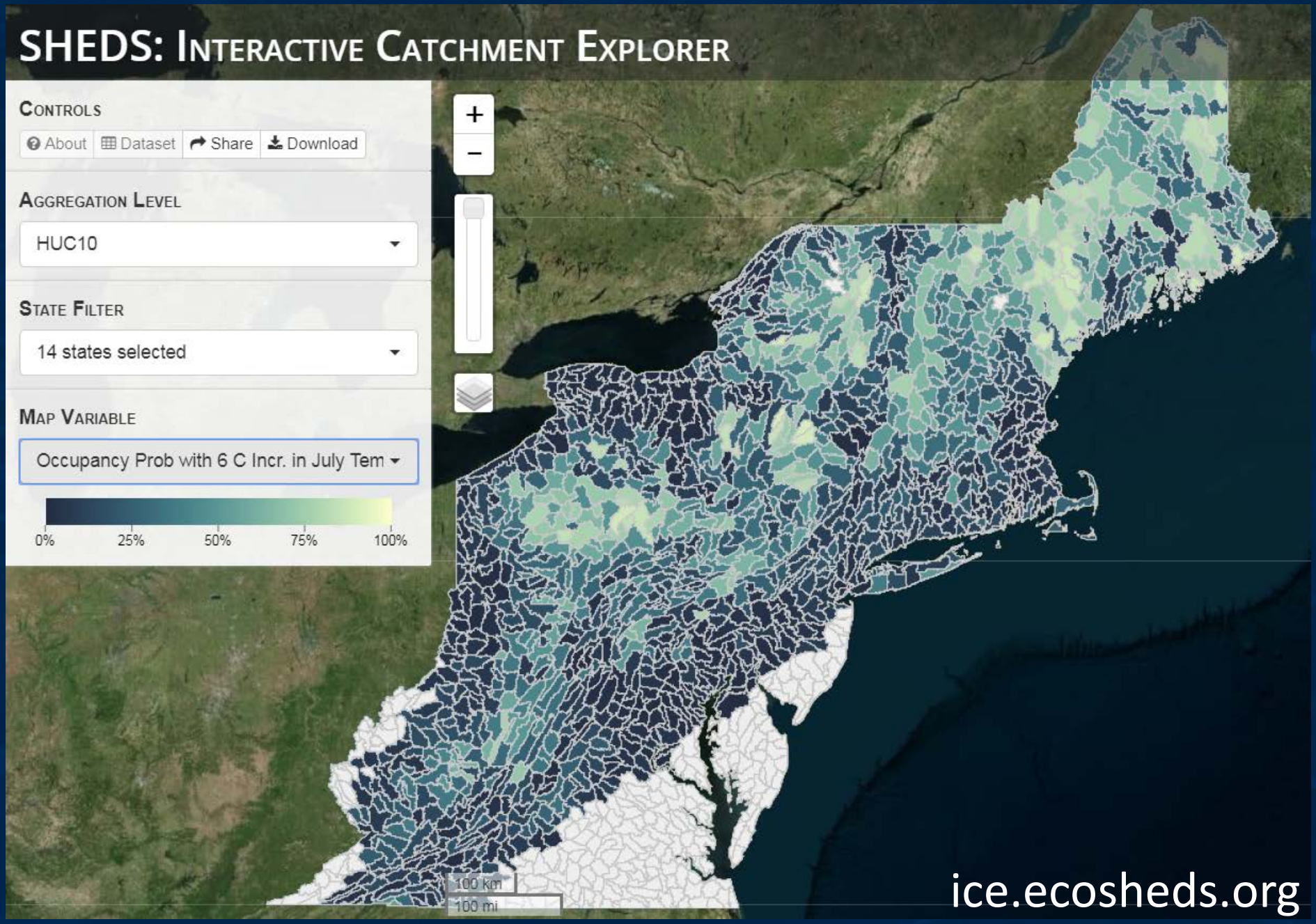

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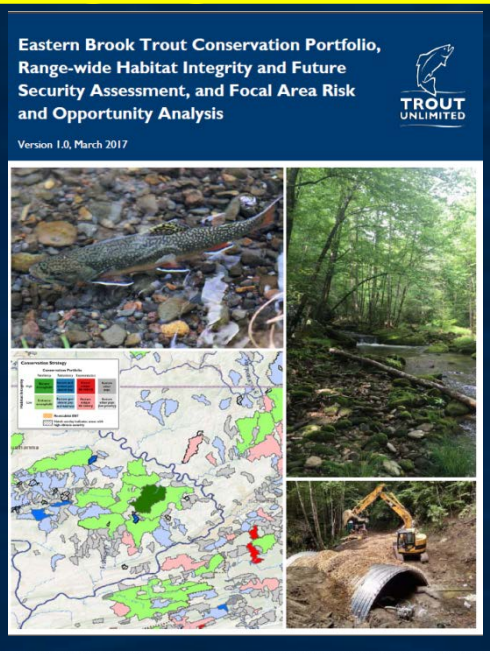
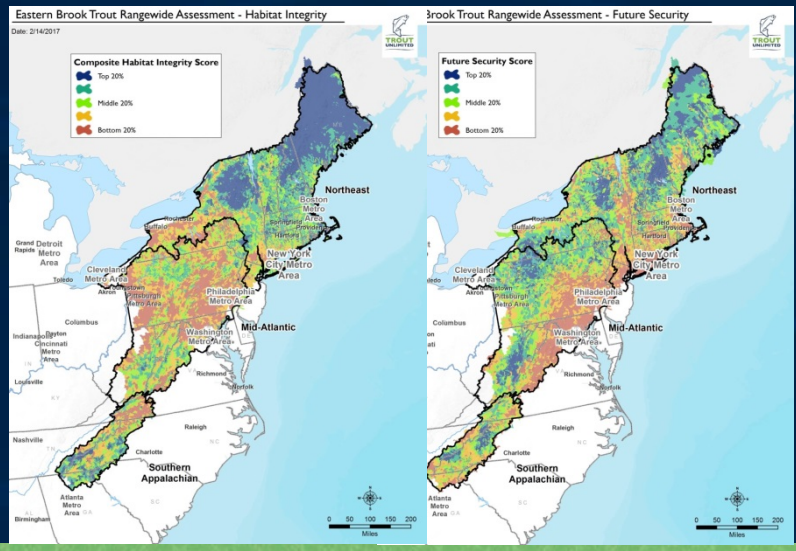
Conservation of Brook Trout in a Changing Climate

- **Prioritize the location and types of projects that will have the most benefit at a population or watershed scale.**
- **Conservation Portfolio and Range Wide Analysis for Brook Trout**
  - NFWF funded project
  - Identify strategic conservation opportunities and evaluate potential projects from Maine to Georgia



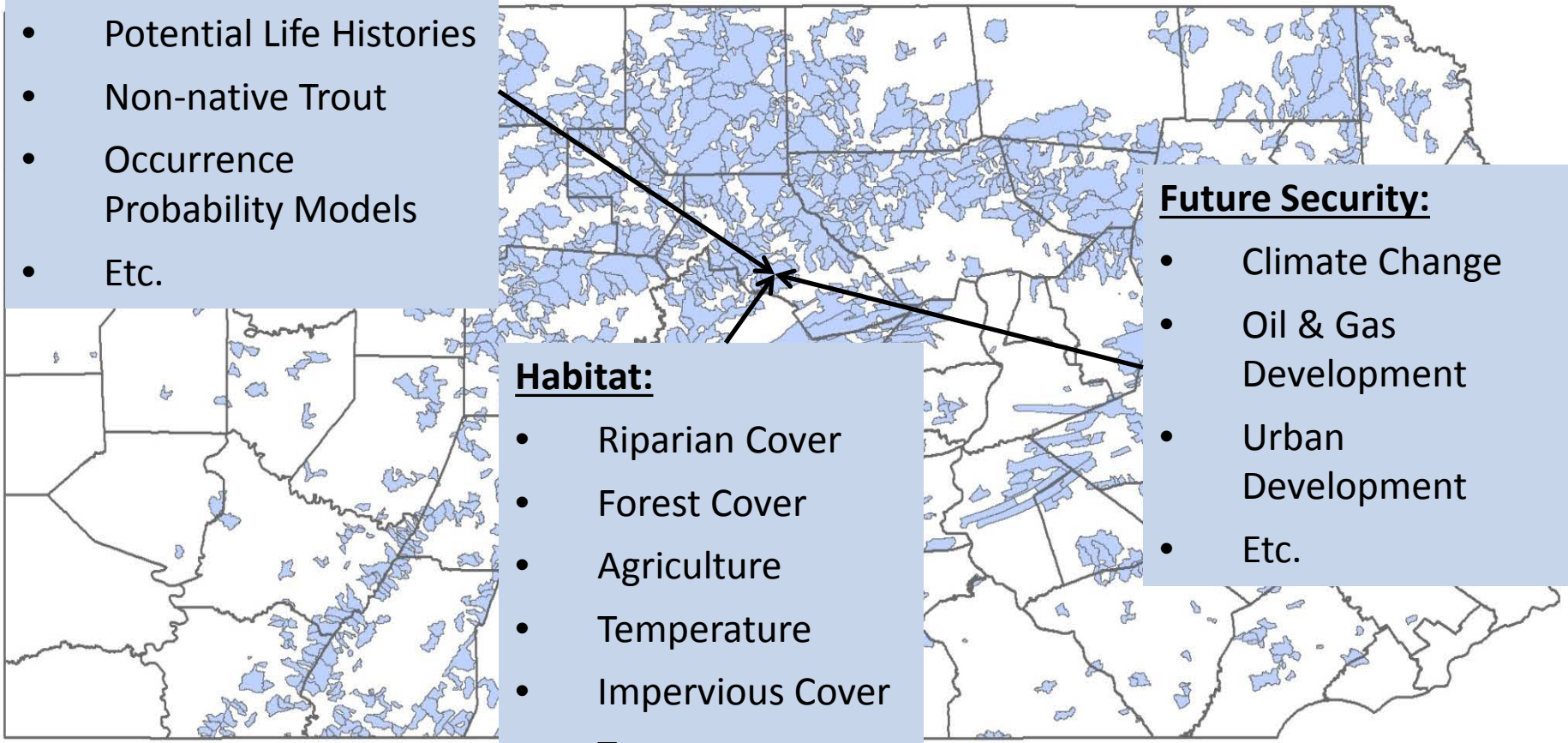


Brook Trout Populations in PA: Eastern Brook Trout Joint Venture

Brook Trout:

- Geographic Diversity
- Potential Life Histories
- Non-native Trout
- Occurrence Probability Models
- Etc.

1,761 trout populations; 26% of PA



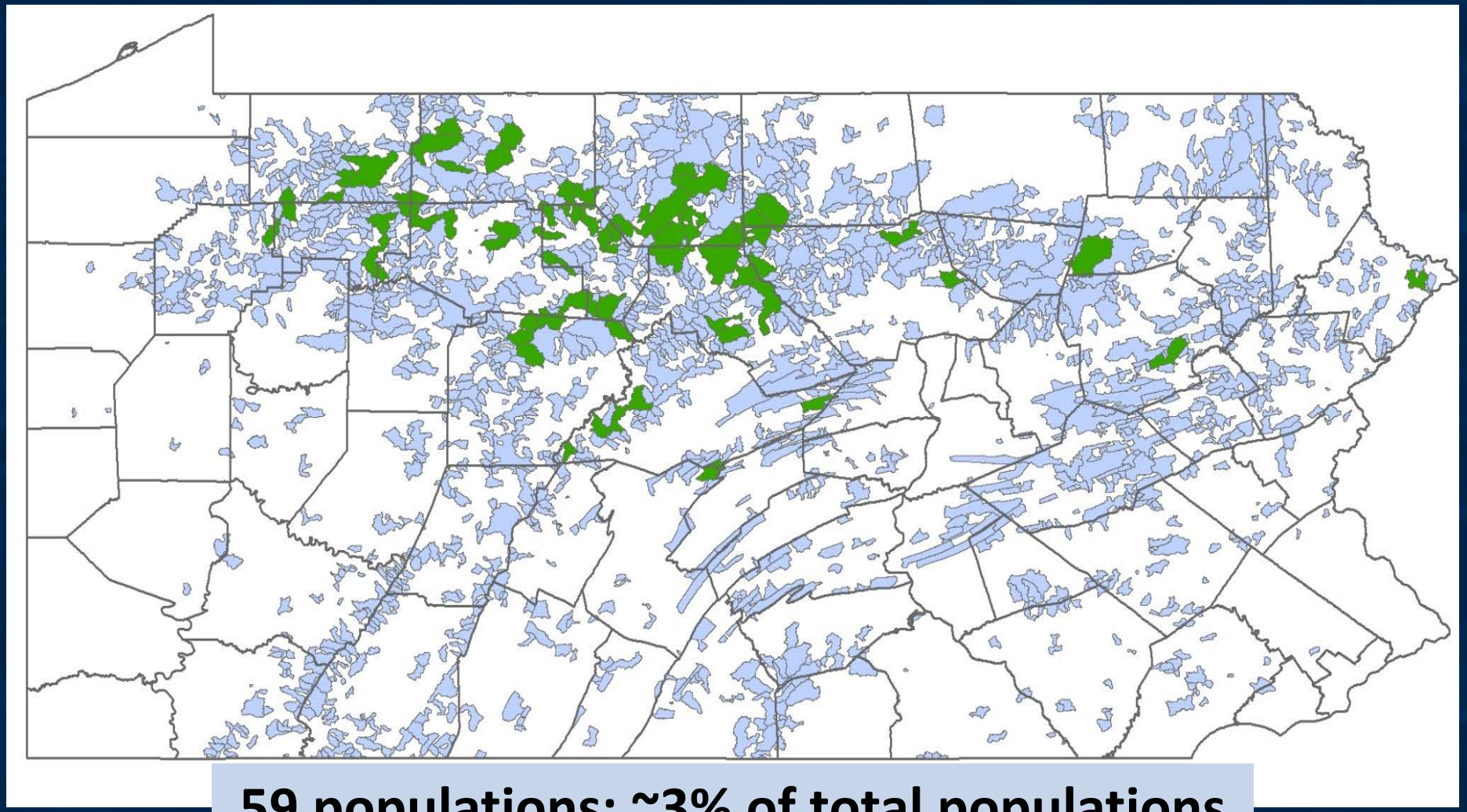
Habitat:

- Riparian Cover
- Forest Cover
- Agriculture
- Temperature
- Impervious Cover
- Temperature
- Geology
- Etc.

Future Security:

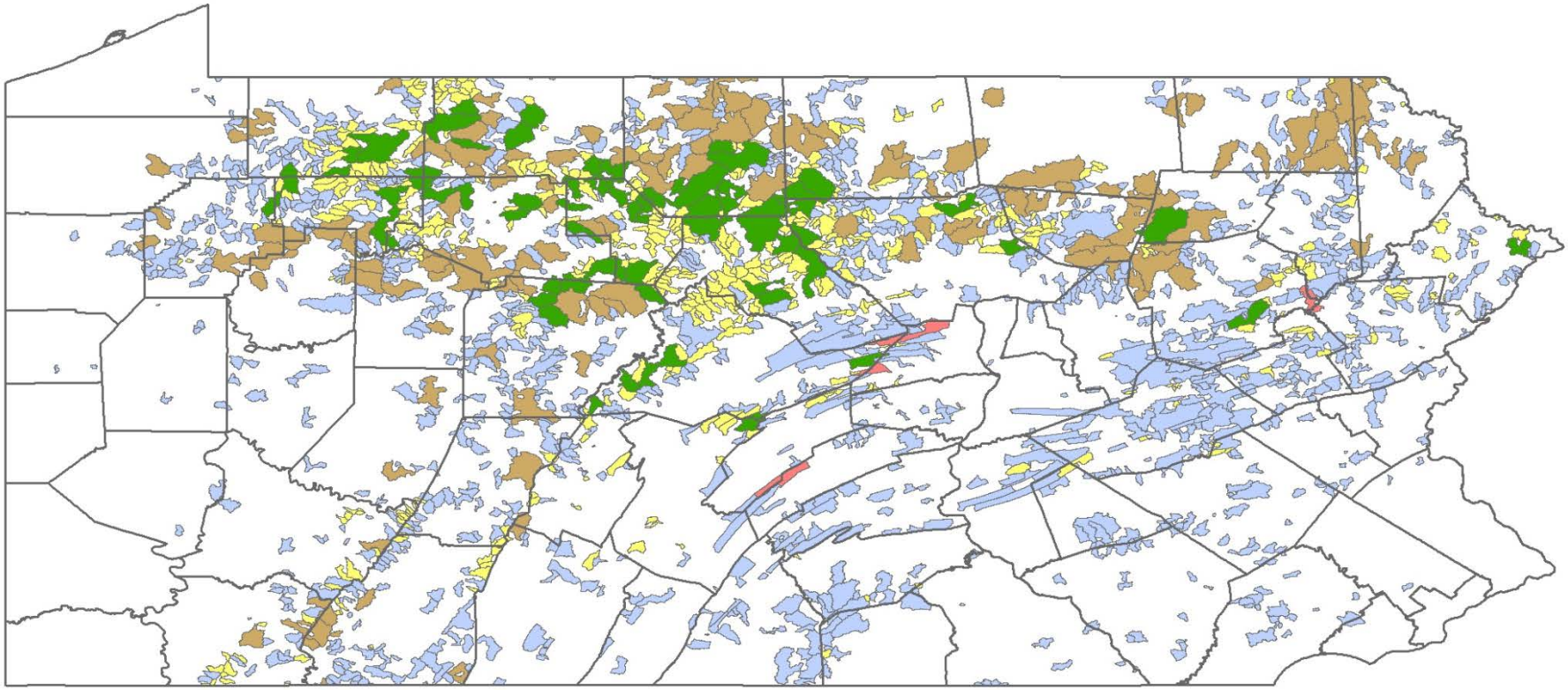
- Climate Change
- Oil & Gas Development
- Urban Development
- Etc.

1) Identifying Stronghold Populations



59 populations; ~3% of total populations

2) Identifying Major Stressors for Other Populations



EBTJV brook trout patch

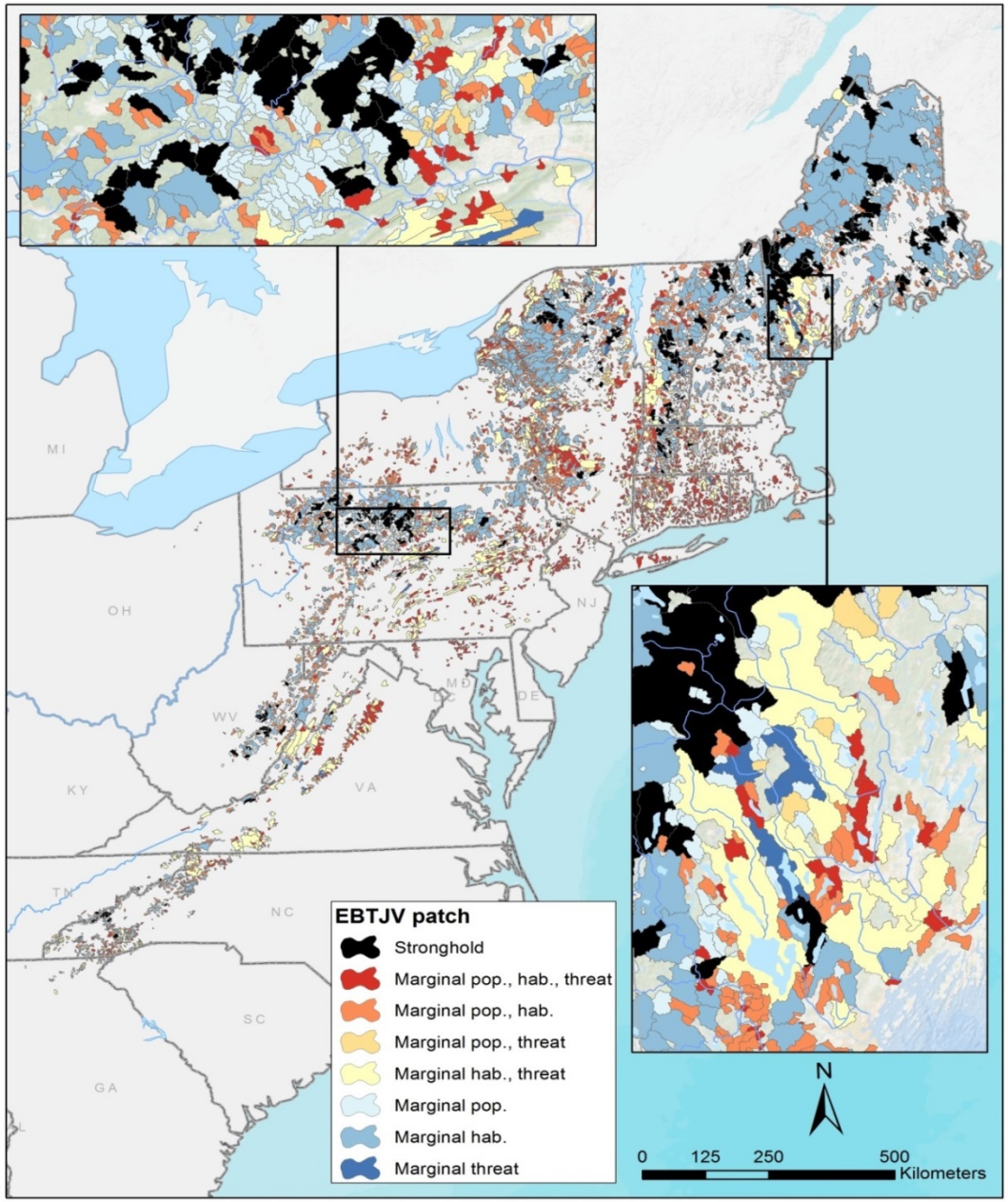
- Stronghold
- Impaired: Population
- Impaired: Habitat
- Impaired: Climate
- Impaired: Multiple categories

All: 1,761 populations
Strongholds: 3% of populations

Stressor:
Population: 27% of populations
Habitat: 7% of populations
Climate Change: 0.2% of populations
Multiple factors: 63% of populations

Range-wide

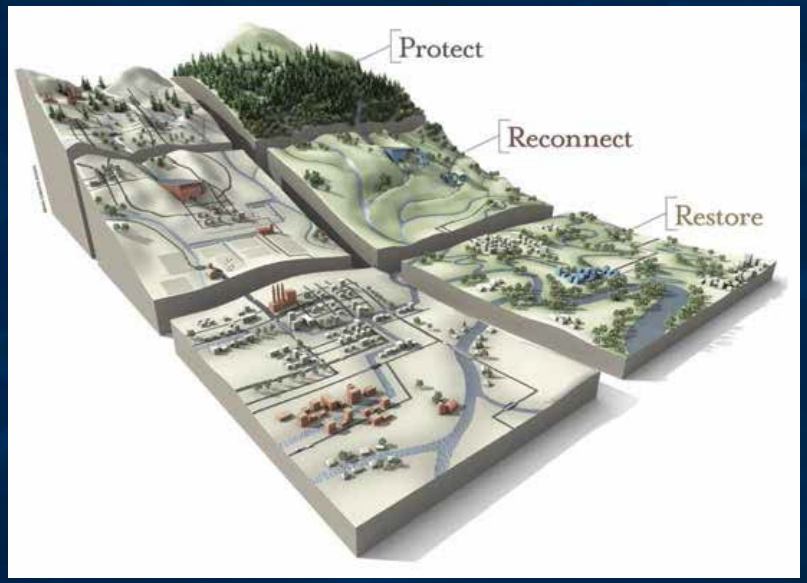
- Only 3% of populations are strongholds
- < 1% of pops. - threatened by climate change alone
- 33% of pops. – combination of other stressors and climate change



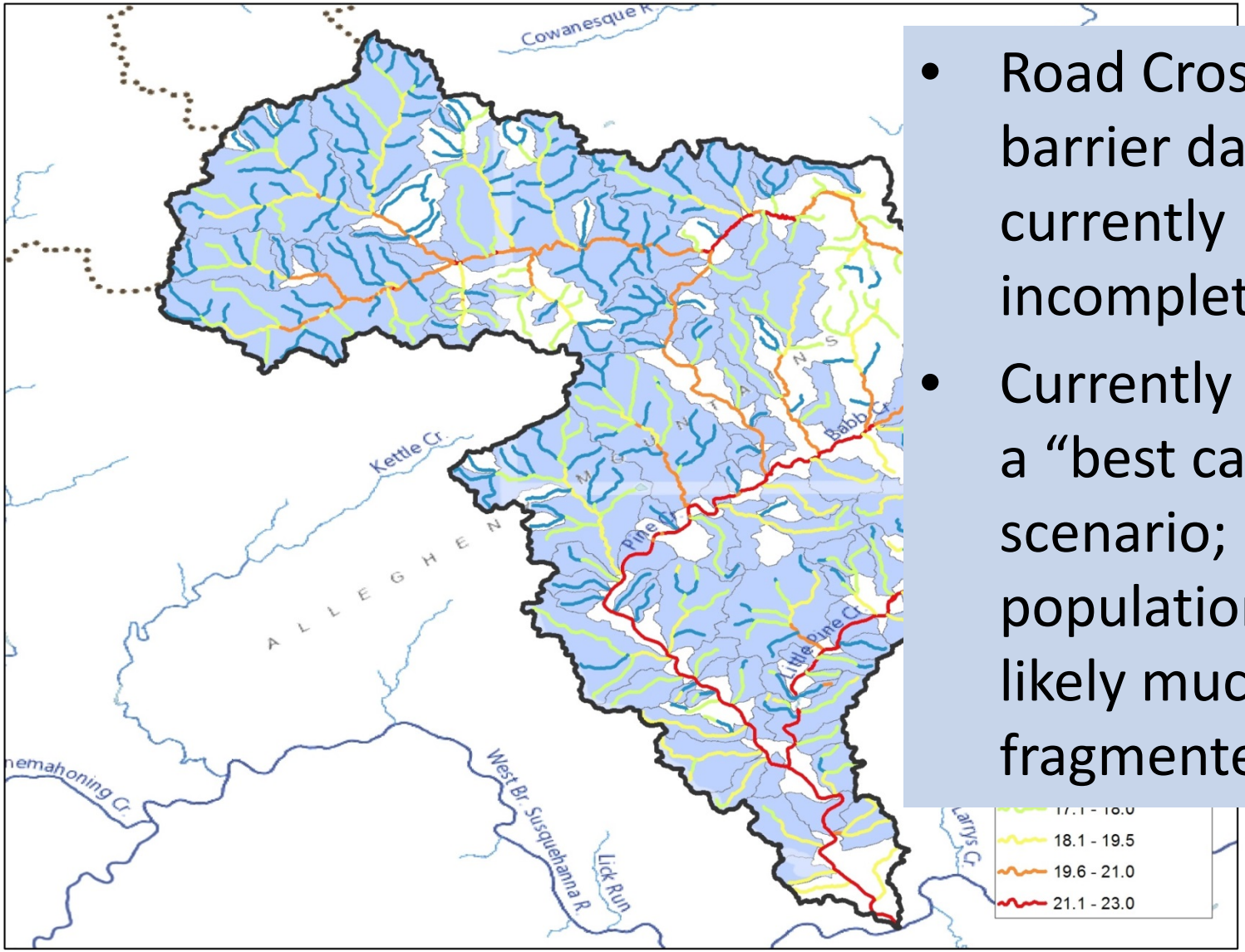
Rummel et al., *In Press*

Building Resiliency in Brook Trout Populations

- **Protect and Enhance– areas of high quality habitats containing brook trout populations (Strongholds)**
- **Restore – areas with degraded habitat quality**
  - In-stream habitat improvement
  - Riparian restoration
  - Water quality remediation
  - Agricultural improvements
- **Reconnect populations**
  - Remove barriers to movement
    - Dams, Culverts, Water chemistry barriers

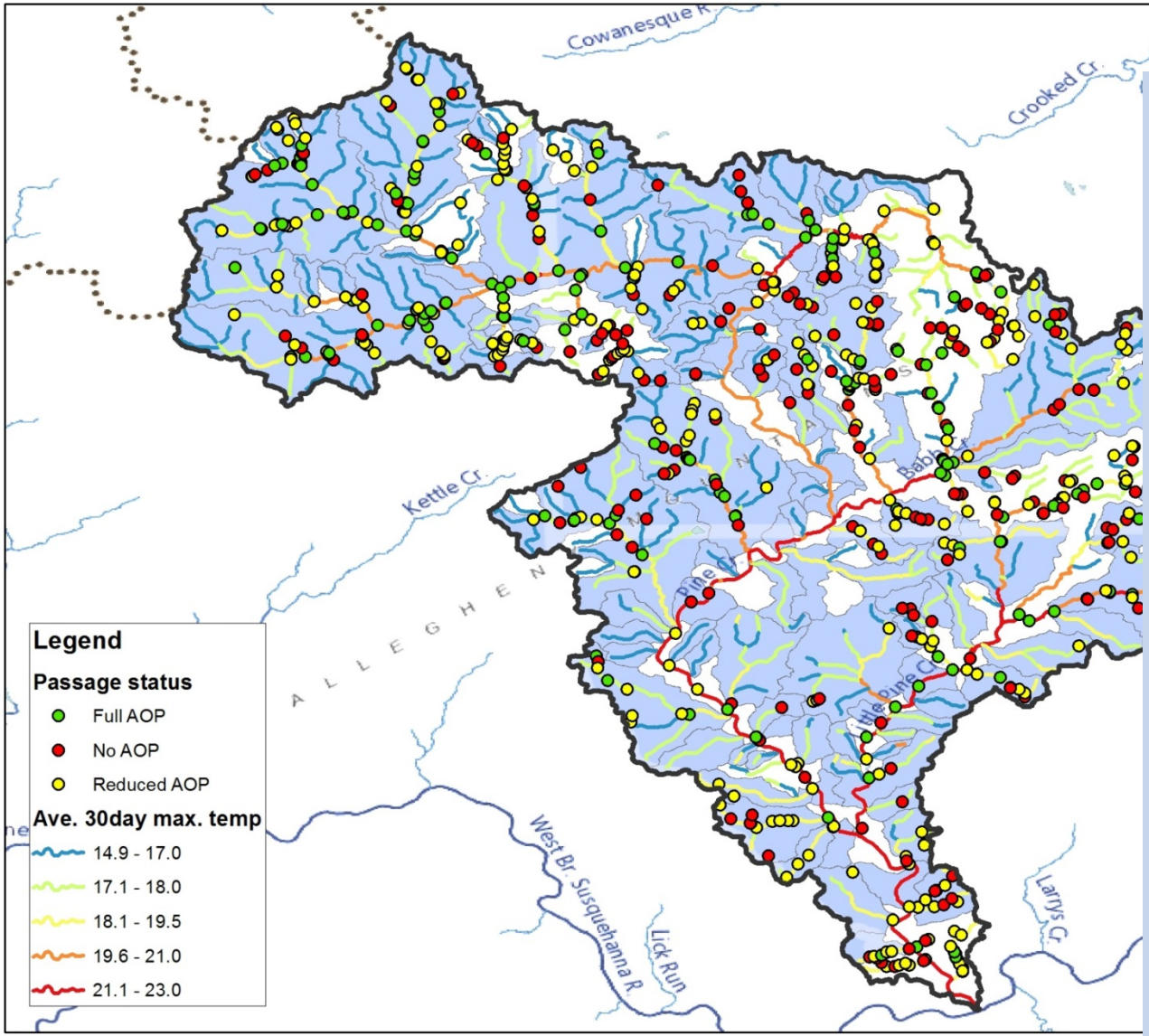


Importance of Reconnection Projects



- Road Crossing barrier dataset currently incomplete for PA
- Currently we have a “best case” scenario; populations are likely much more fragmented

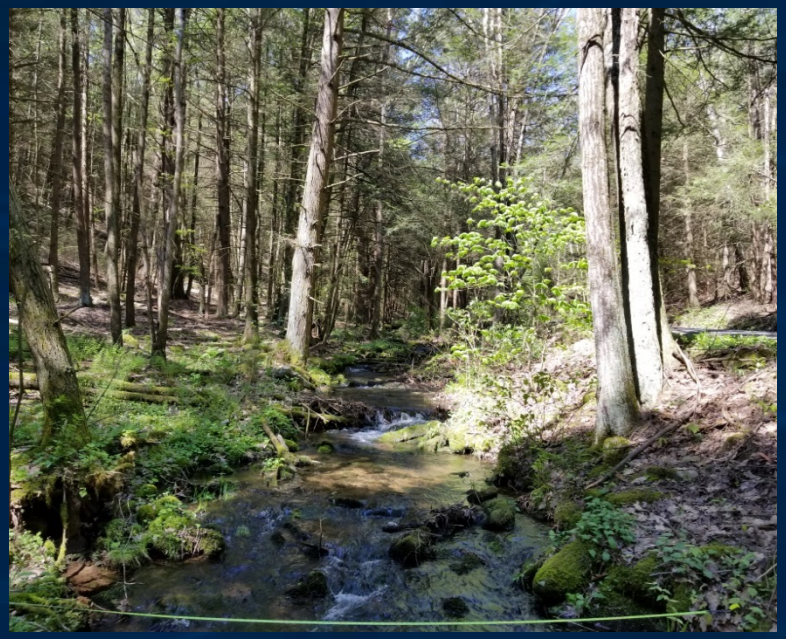
Importance of Reconnection Projects



- 700 road-stream crossings
  - **32% No Passage**
  - **43% Reduced**
  - **24% Full Passage**
- Prioritize culverts for replacement
- Seasonally available habitat

Summary/Conclusions

- The effects of climate change are likely to increase the cumulative impacts of stressors on stream systems.
- Conservation projects aimed at increasing resiliency, enhancing strongholds, and reducing stressors may help address threats of climate change
- Limited funding requires strategic planning, strong partnerships, and well designed and implemented projects to ensure success

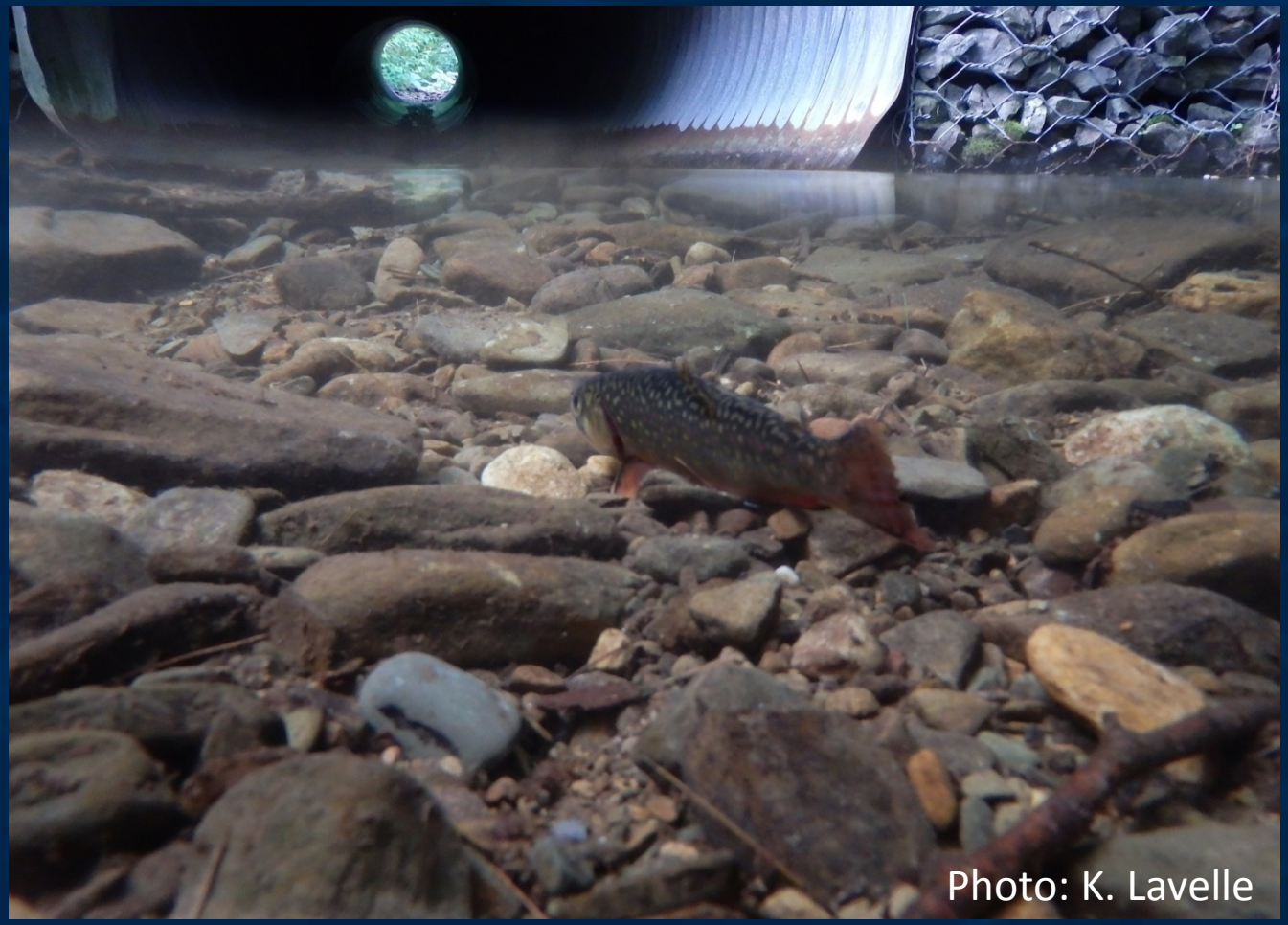


Summary/Conclusions

- **THINK BIG PICTURE!**

- **It's not enough to just have brook trout populations; need to ensure survival for generations to come.**

“Take care of the fish and the fishing will take care of itself”



Thank you!

- **For more info on the Conservation Portfolio and online mapping tools and data:**

  http://www.tu.org/ebt-portfolio-rwa

- **Brook Trout Atlas:**

  http://www.tu.org/brook-trout-atlas

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Richard King Mellon Foundation