

# Science Briefing

## CLIMATE SHIELD REFUGE STREAMS FOR PRESERVING NATIVE TROUT

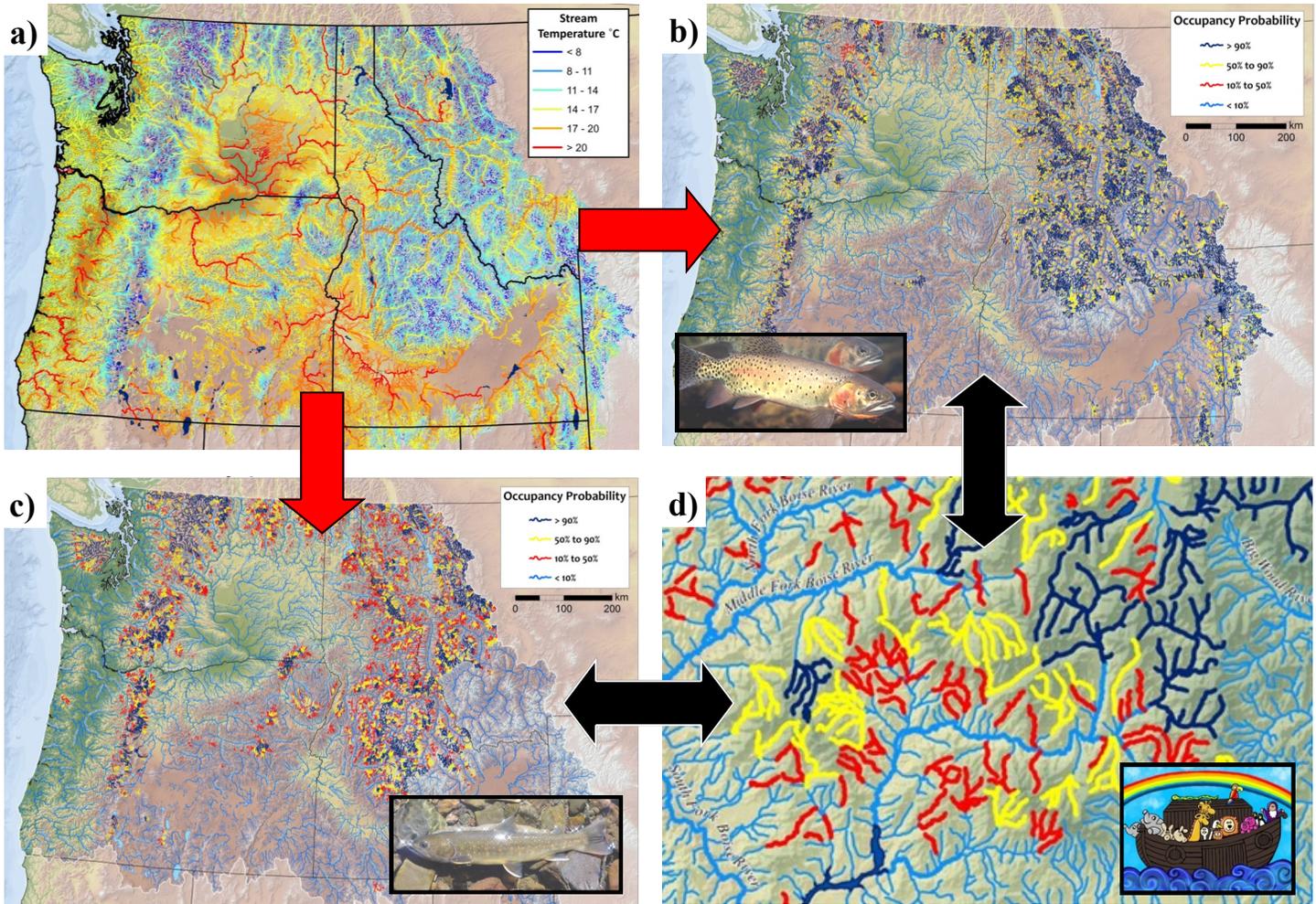


**Issue:** Native trout are culturally and ecologically important, but likely to continue undergoing declines as some of the cold-water environments they require are invaded by non-native species and shrink in association with climate change. Much can be done to preserve these fish but efficient planning and targeting of conservation resources has been hindered by a lack of broad-scale datasets and precise information about which streams are most likely to support native trout populations later this century.

**Application:** Crowd-sourced biological datasets contributed by multiple agencies were coupled with high-resolution NorWeST stream temperature scenarios to delineate invasion resistant, climate refuge streams across >450,000 stream kilometers in the northwestern U.S. for two native trout species of concern—Bull Trout and Cutthroat Trout. Under both moderate and extreme climate change scenarios, refugia with high probabilities of trout population occupancy (>0.9) were predicted to exist for both species. Most refugia are on public lands (>90%) where few currently have protected status in National Parks or Wilderness Areas (<15%). Forecasts of refuge locations could enable protection of key watersheds, be used to rally support among multiple stakeholders, and provide a foundation for climate-smart planning to preserve native trout through the 21<sup>st</sup> century

**Advantages:** The “Climate Shield” approach is generalizable to other species and geographic areas because it has a strong physiological basis, relies on nationally available geospatial data, and mines existing biological and temperature datasets to develop valuable information inexpensively. Most importantly, Climate Shield creates a framework to integrate data contributed by many individuals and resource agencies, and a process that strengthens the collaborative and social networks needed for effective conservation.

**Acknowledgements:** Climate Shield was inspired by the landscapes of the Rocky Mountains and people everywhere that are working to preserve native trout. Special thanks to the many biologists with the National Forest system, MTFWP, WYGF, and IDFG for providing thousands of fish survey locations from their monitoring programs to enable development of trout distribution models. The Northern Rockies Adaptation Partnership provided a valuable forum that accelerated this research. The U.S. Fish and Wildlife Service’s Great Northern and North Pacific Landscape Conservation Cooperatives generously funded the NorWeST stream temperature project, which serves as the foundation for Climate Shield.



High-resolution NorWeST stream temperature climate scenarios (a) developed from massive interagency databases (>15,000 monitoring sites, >80 contributing agencies) were used to make precise predictions across the range of Cutthroat trout (b) and ESA-listed Bull Trout (c) about which streams will be resistant to non-native species invasions and will also serve as climate refugia this century (d). The information is available as user-friendly digital maps and GIS databases from the Climate Shield website for conservation planning purposes.

### Publications and Websites

Climate Shield Native Trout Refugia website: <http://www.fs.fed.us/rm/boise/AWAE/projects/ClimateShield.html>

NorWeST Stream Temperature website: <http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST.html>

Isaak, D., M. Young, D. Nagel, and D. Horan. 2014. Cold water as a climate shield to preserve native trout through the 21st century. Pages 110-116 in R. F. Carline and C. LoSapio, editors. Wild Trout XI: Looking Back and Moving Forward. Wild Trout Symposium, Bozeman, Montana.

Isaak, D., M. Young, D. Nagel, D. Horan, and M. Groce. 2015. The cold-water climate shield: Delineating refugia for preserving native trout through the 21<sup>st</sup> century. *Global Change Biology* 21:000.

### Science Contacts:

### Geospatial Data Contact:



**Dan Isaak**  
USFS RMRS  
Aquatic Sciences Lab  
Boise, ID 83702  
Phone: 208-373-4385  
Email: [disaak@fs.fed.us](mailto:disaak@fs.fed.us)



**Mike Young**  
USFS RMRS  
Forestry Sciences Lab  
Missoula, MT 59801  
Phone: 406-396-1209  
Email: [mkyoung@fs.fed.us](mailto:mkyoung@fs.fed.us)



**David Nagel**  
USFS RMRS  
Geospatial Analyst  
Aquatic Sciences Lab  
Phone: 208-373-4397  
Email: [dnagel@fs.fed.us](mailto:dnagel@fs.fed.us)

