

The rapid, range-wide inventory of bull trout: a crowd-sourced, eDNA-based approach with application to many aquatic species

Michael Young, Kevin McKelvey, Michael Schwartz, Dan Isaak, Kellie Carim, Taylor Wilcox, Katie Zarn, Kristy Pilgrim, Dona Horan, Sherry Wollrab



Collaborators



Bureau of Reclamation
Clark Fork Coalition
Clearwater Resource Council
Coeur d'Alene Tribes
Idaho Department of Fish and Game
Idaho Power Company
Montana Department of Natural Resources Conservation
Montana Fish, Wildlife & Parks
National Fish and Wildlife Foundation
The Nature Conservancy
Nez Perce Tribes
Oregon Department of Fish and Wildlife

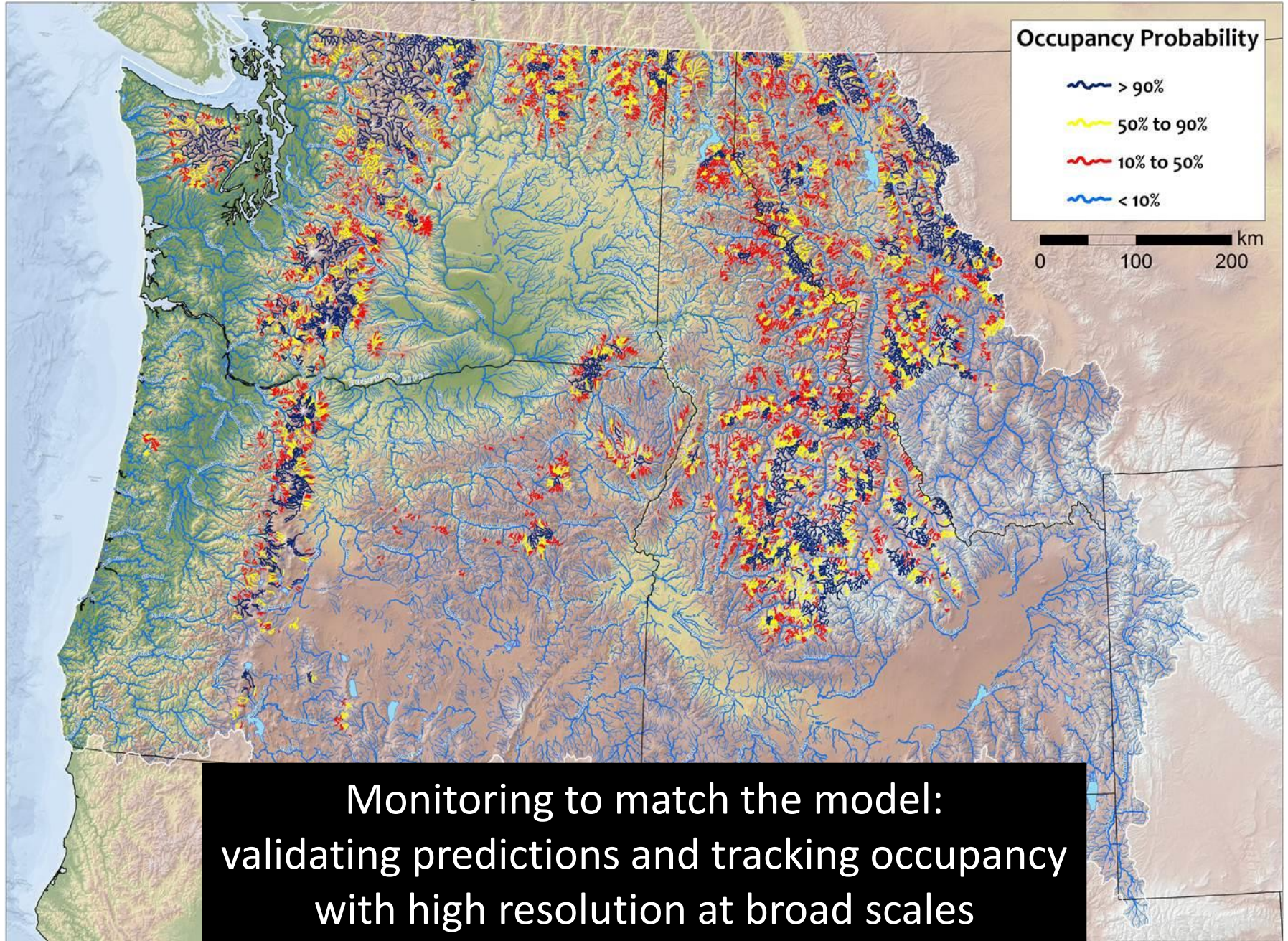


Trout Unlimited
U.S. Fish and Wildlife Service
USFS Beaverhead-Deer Lodge NF
USFS Boise NF
USFS Helena NF
USFS Idaho Panhandle NF
USFS Lolo NF
USFS Region 1
USFS Region 4
USFS Region 6
USFS Sawtooth NF
Washington Department of Fish and Wildlife
Yakima Nation



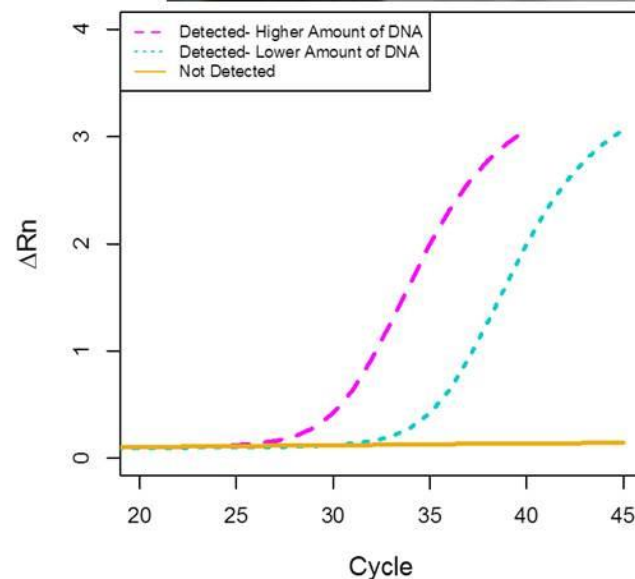
Climate Shield Cold-Water Habitats for Juvenile Bull Trout

Scenario: 1980s, 0% Brook Trout



The eDNA revolution

- NGC: pioneering this approach for species detection
- Extremely sensitive
- Extremely easy
- Costs: pennies on the dollar, minutes on the hour
- Optimizing for many species & applications



NGC: eDNA assay & survey

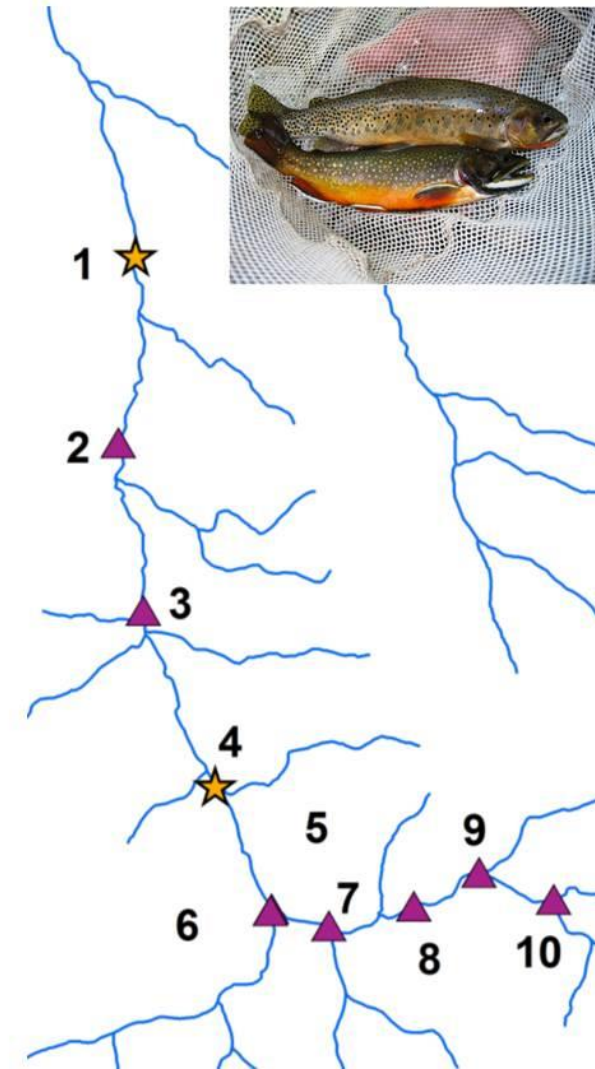
- Bull trout
- Brook trout
- Rainbow trout
- Westslope cutthroat trout
- Yellowstone cutthroat trout
- Brown trout
- Lake trout
- Dolly Varden
- Arctic charr
- Salmon: Chinook, chum, coho, pink, sockeye
- Arctic grayling
- Pacific & brook lamprey
- Northern pike
- Sculpin (several)
- Leatherside dace
- Loach minnow
- Spikedace
- Siberian sturgeon
- Rocky Mountain tailed frog
- Opossum shrimp
- Capniid stoneflies
- Western pearlshell mussel
- Crayfish
- River otter
- . . . and many others

Partners

- Regions 1, 2, 3, 4, 10
- National Forests: Idaho Panhandle, Lolo, Helena, Beaverhead-Deer Lodge, Grand Mesa-Uncompahgre-Gunnison, Boise, Payette, Salmon-Challis, Sawtooth
- Yellowstone National Park
- U.S. Fish and Wildlife Service
- U.S. Geological Survey
- Arizona Game and Fish Department
- California Department of Fish and Wildlife
- Idaho Department of Fish and Game
- Montana Fish, Wildlife and Parks
- Nevada Department of Wildlife
- New Mexico Department of Game and Fish
- Oregon Department of Fish and Wildlife
- Utah Division of Wildlife Resources
- Clark Fork Coalition
- Trout Unlimited
- Wild Fish Conservancy
- Wildlife Conservation Society
- Snoqualmie Tribe
- Nez Perce Tribe
- Hart Crowser Consultants

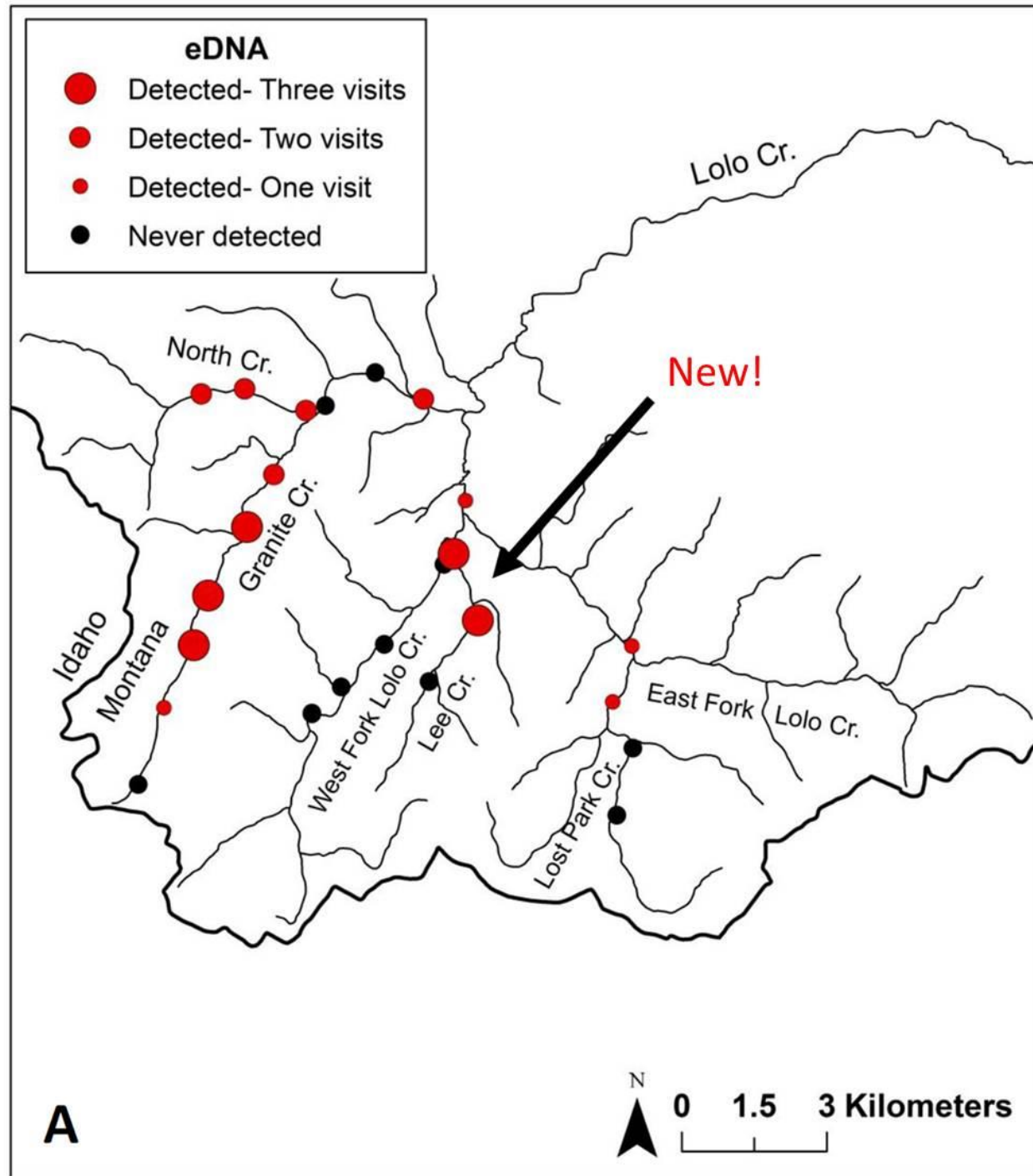
Applications

- Occupied habitats
- Population discovery
- Barrier effectiveness
- Assessment of nonnative species removals



Using eDNA to detect bull trout

- Federally listed as threatened
- Dictates land management & planning
- Widespread, rare, & difficult to detect
- Ideal candidate for eDNA detection
- Pilot test: Montana 2014
- Confirmed known habitats
- Discovered new ones



Scaling up: a range-wide eDNA inventory of bull trout

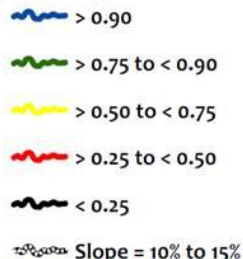
- Scope
 - U.S. range of bull trout
- Locations
 - Cold-water habitats identified by the Climate Shield model
 - Habitats about which recent occupancy is unknown
- Schedule
 - 2015: two 4th-code basins
 - 2016–2018: the rest

Climate Shield Cold-Water Habitats for Juvenile Bull Trout

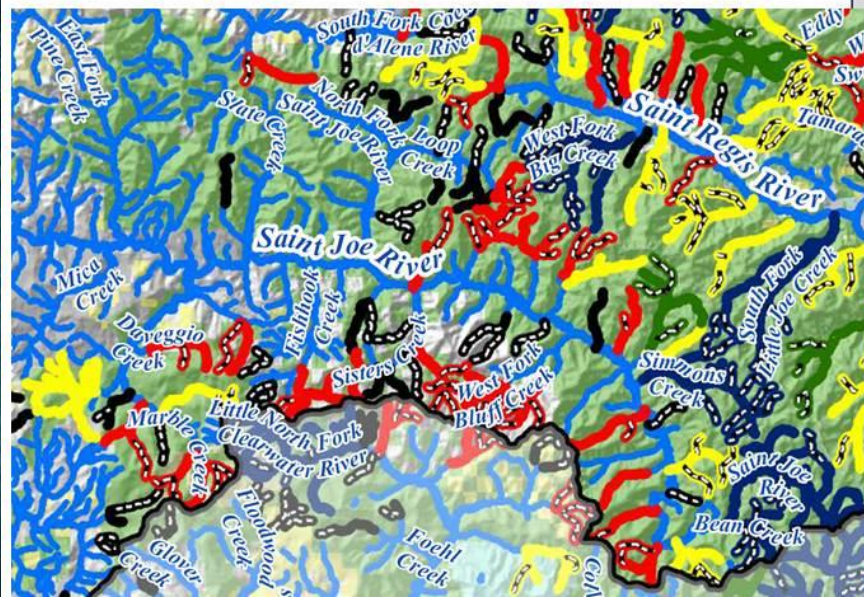
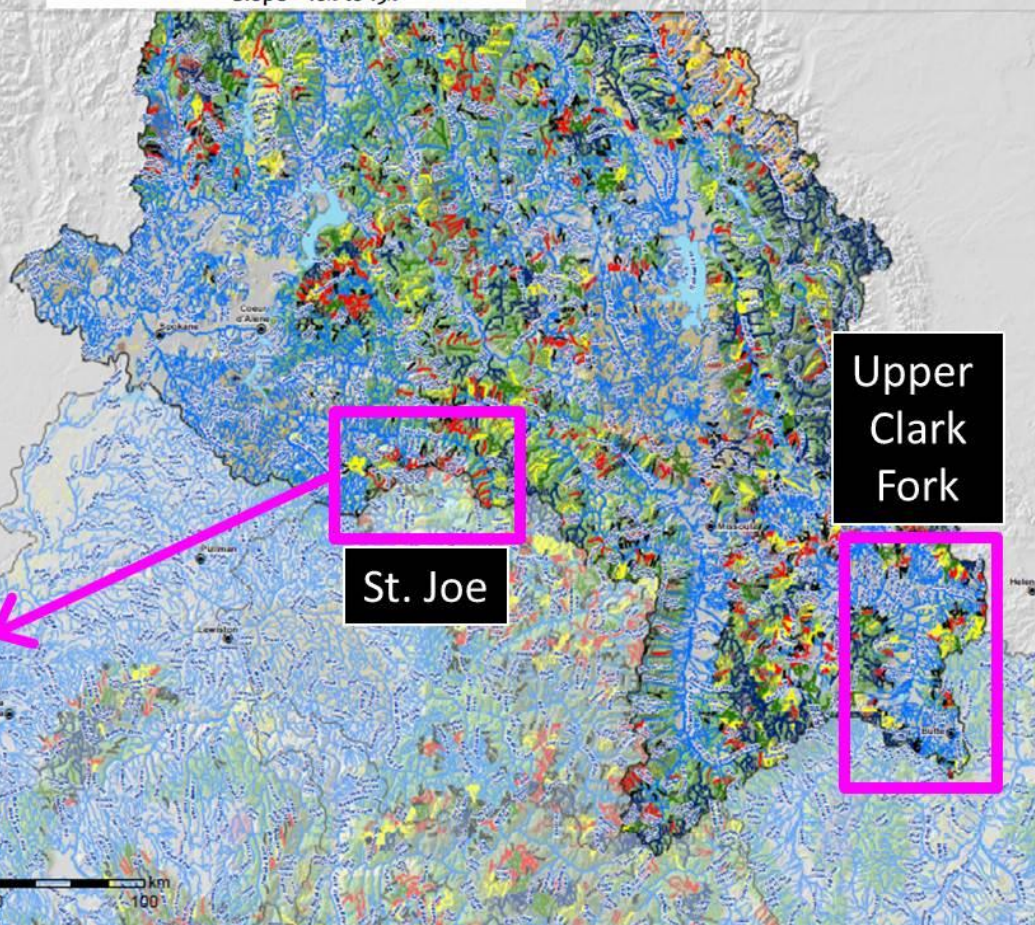
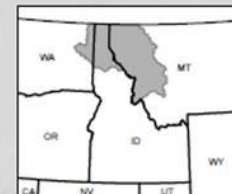
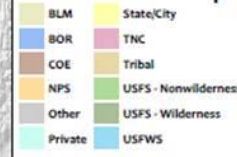
Scenario: 1980s, 0% Brook Trout
NorWeST Unit: SpoKoot



Occupancy Probability



Land Ownership



St. Joe River, Idaho



● 1-km sample site

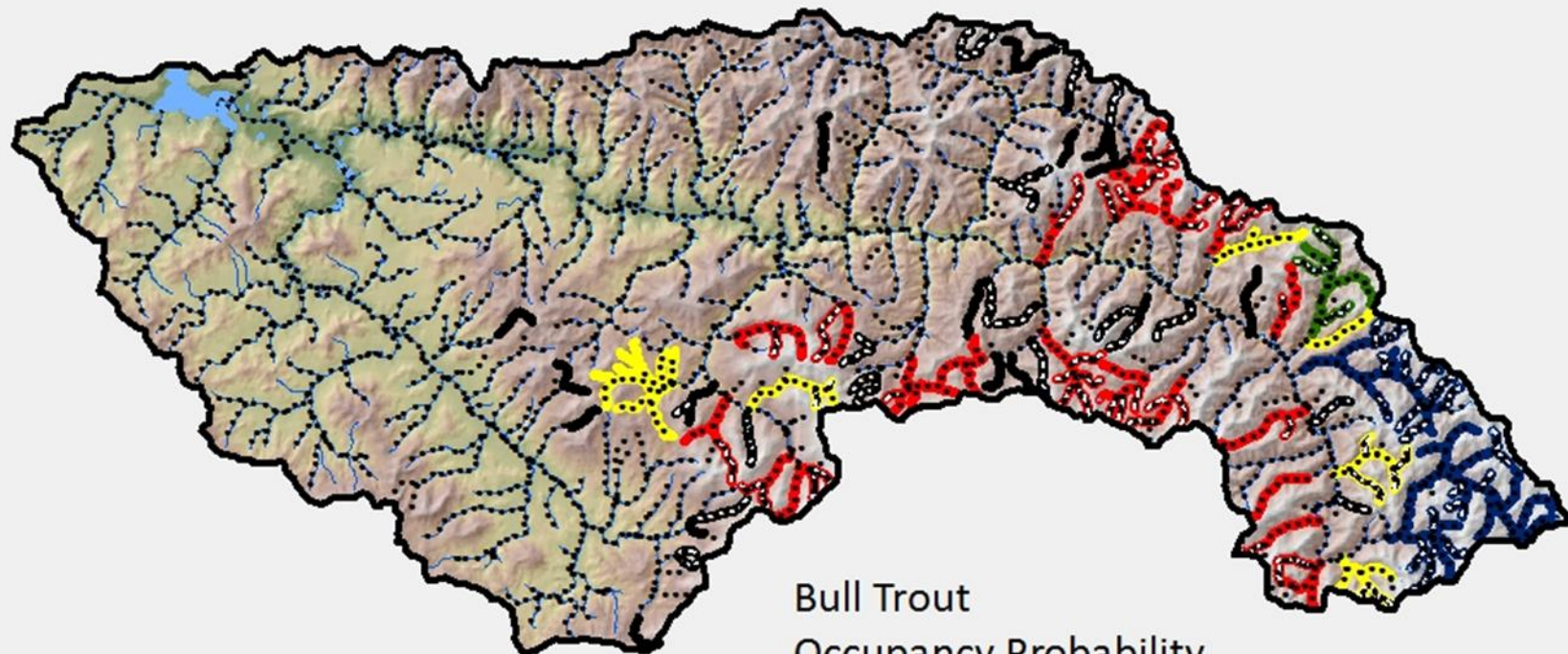
■ Lakes











0 15 30
MI

0 25 50
KM

St. Joe River, Idaho

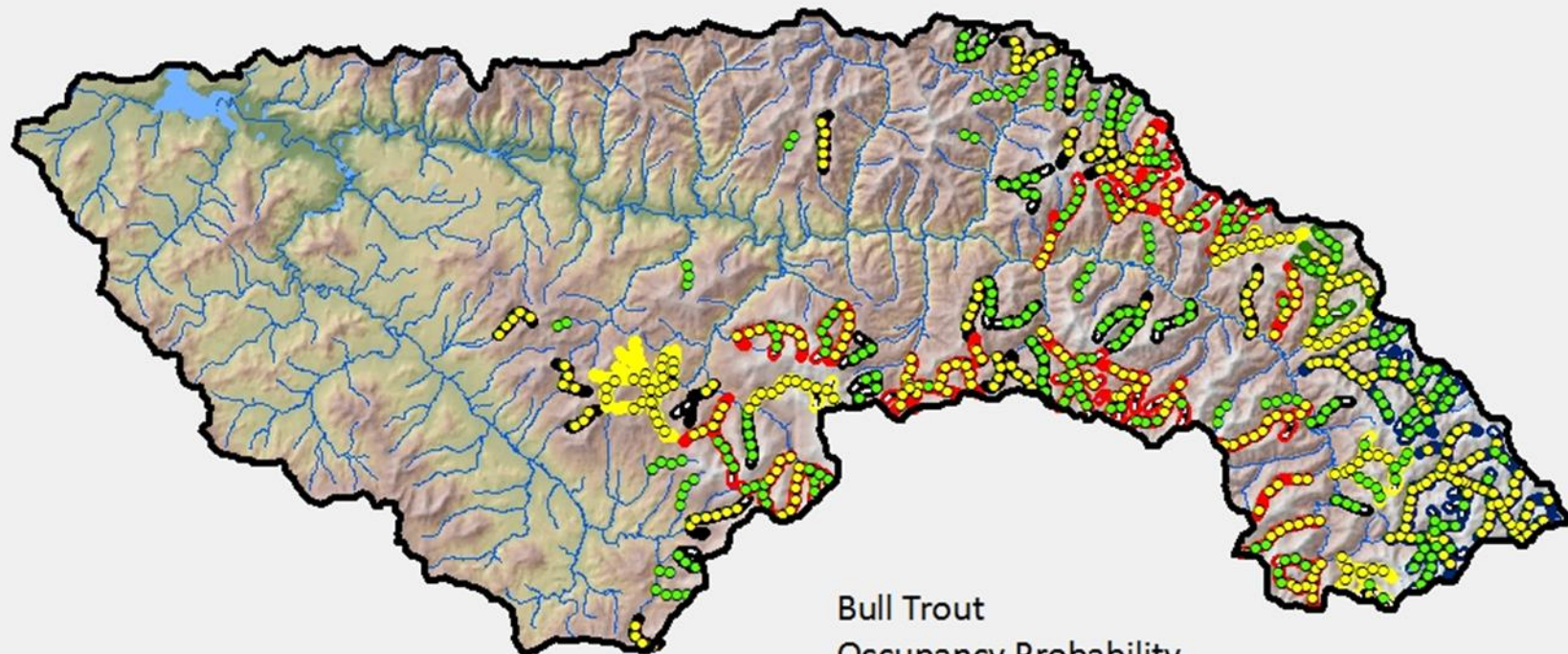


Bull Trout Occupancy Probability

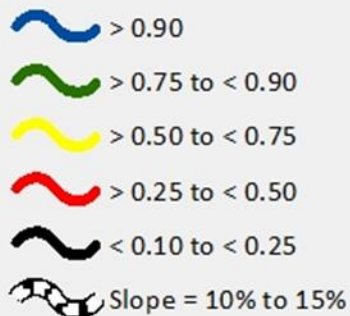
-  > 0.90
-  > 0.75 to < 0.90
-  > 0.50 to < 0.75
-  > 0.25 to < 0.50
-  < 0.10 to < 0.25
-  Slope = 10% to 15%
-  1-km sample site
-  Lakes



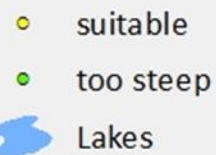
St. Joe River, Idaho



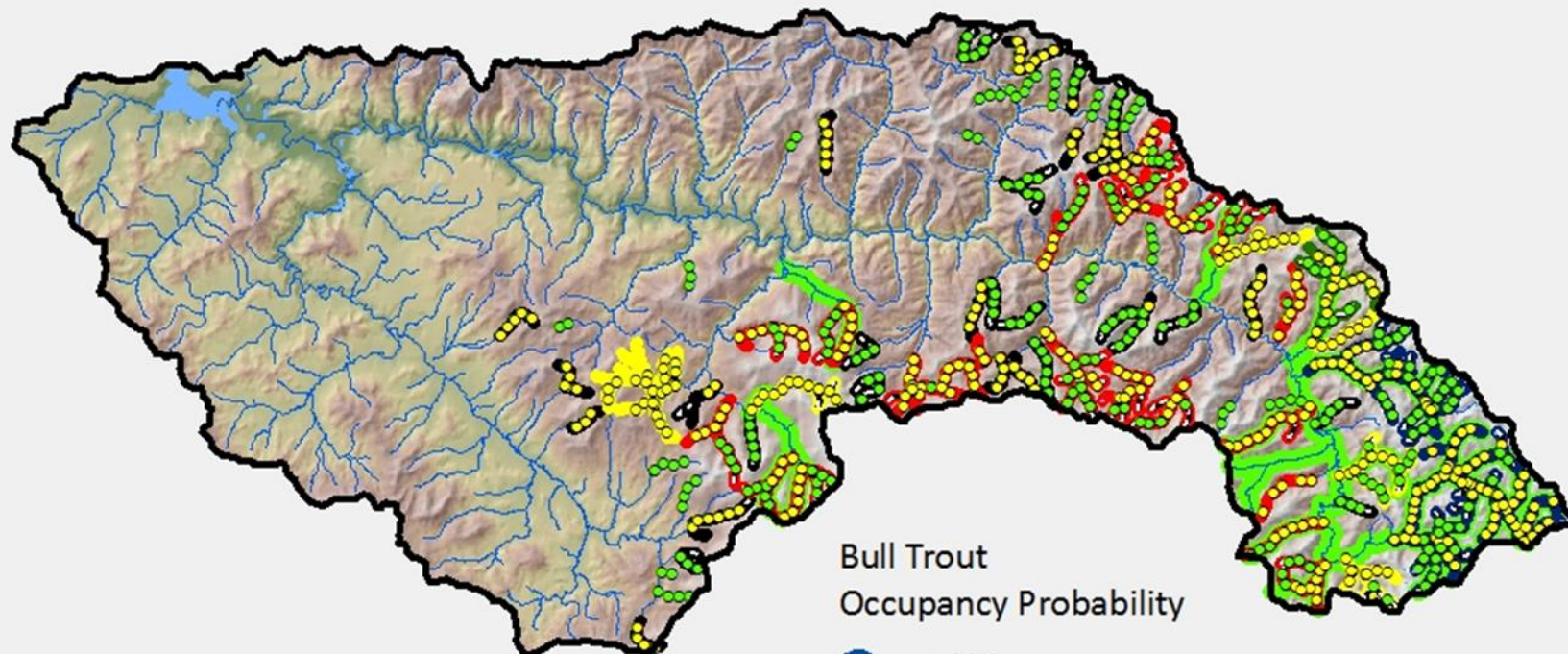
Bull Trout Occupancy Probability



Suitable sampling site:



St. Joe River, Idaho



Bull Trout Occupancy Probability

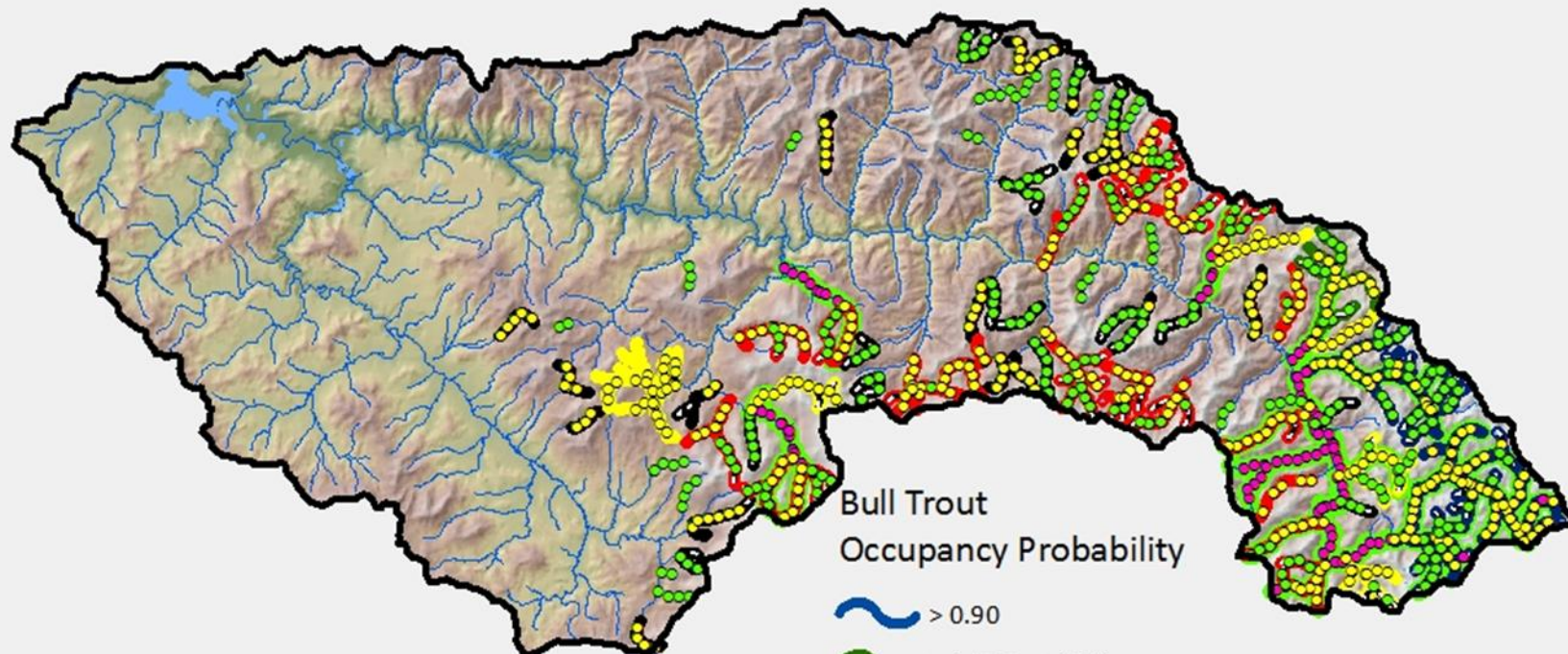
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- > 0.50 to < 0.75
- > 0.25 to < 0.50
- < 0.10 to < 0.25
- Slope = 10% to 15%
- USFWS critical habitat

Suitable sampling site:

- suitable
- too steep
- Lakes



St. Joe River, Idaho



Bull Trout Occupancy Probability

- > 0.90
- > 0.75 to < 0.90
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- > 0.25 to < 0.50
- < 0.10 to < 0.25
- Slope = 10% to 15%
- FWS critical habitat
- suitable site on FWS critical habitat

Suitable sampling site:

- suitable
- too steep
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Climate Shield Cold-Water Habitats for

Scenario: 1980s, 0% Brook Trout

