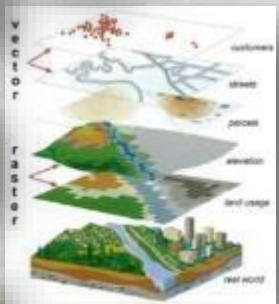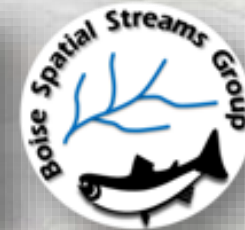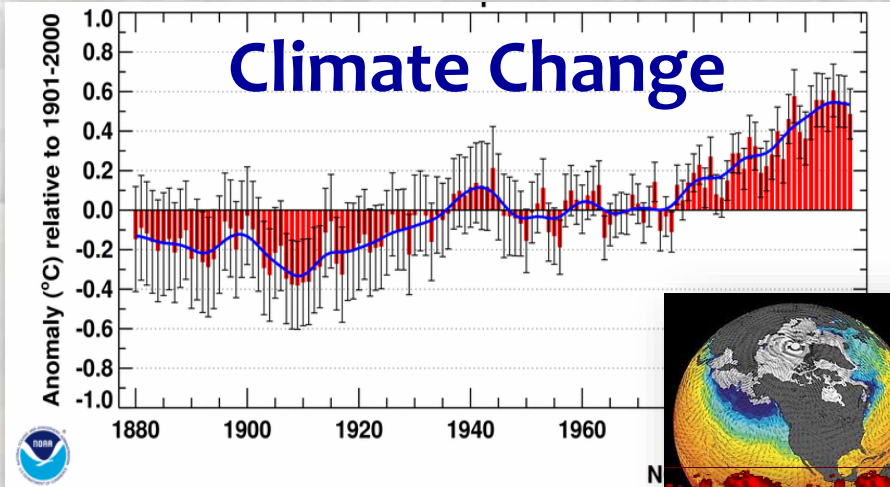# The Aquatic eDNAtlas for the American West:
All Species, All Streams through Crowd-Sourcing and One Interagency Database
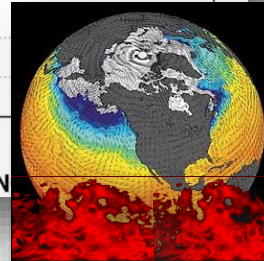
Dan Isaak, Mike Young, Mike Schwartz, Kevin McKelvey, Taylor Wilcox, Tommy Franklin, Kellie Carim, Gwynne Chandler, Dave Nagel, Sharon Parkes, Dona Horan, Sherry Wollrab

More Pressure, Fewer Resources

Climate Change

Urbanization & Population Growth

Shrinking Budgets
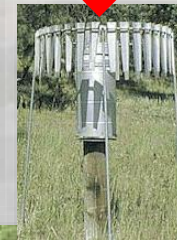
Need to do more with less

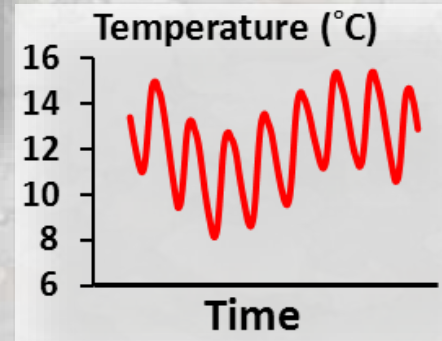# Coordination Creates Synergies Among All Aquatic Resource Groups
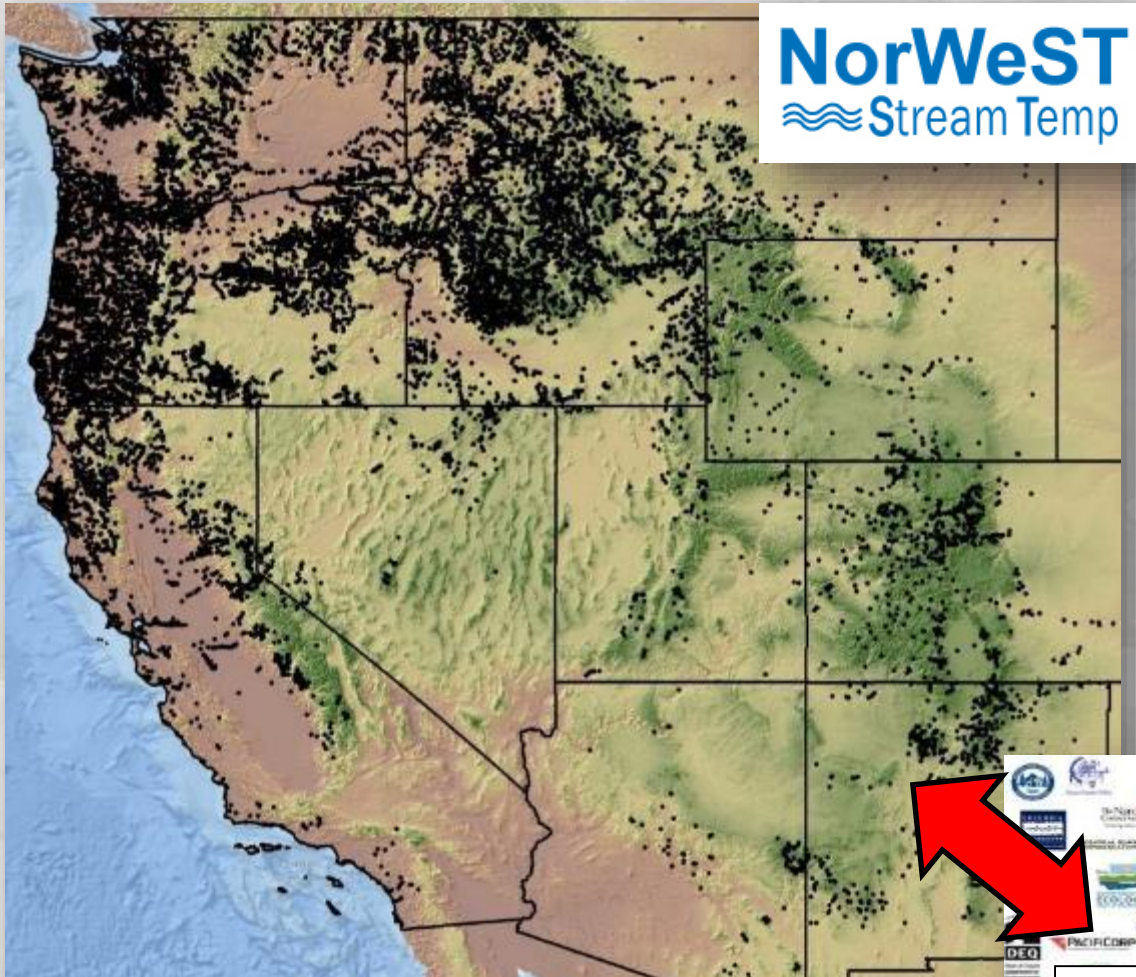
Many stakeholders

"Boots-on-the-Ground"

Research develops databases & relevant information

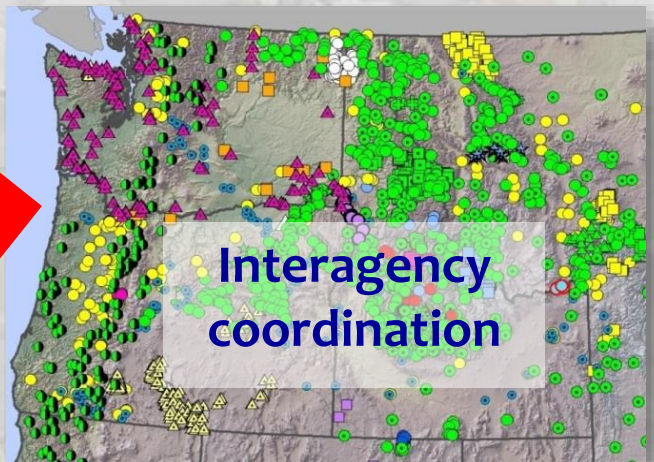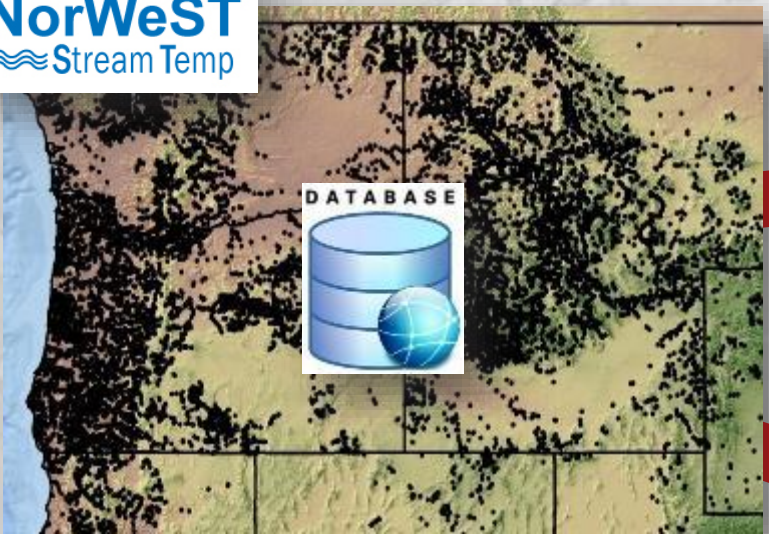**Standard data protocols**

Lots of Data but Huge Redundancies & Gaps

>200,000,000 hourly records
>20,000 unique stream sites
>$10,000,000 to collect

>100 agencies
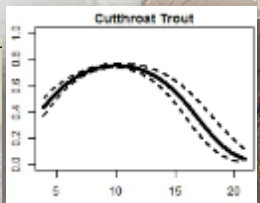
Database: Creates Order & Usable Data

NorWeST Stream Temp

DATABASE

Interagency coordination

Stream temperature models

Temperature Scenarios

Cutthroat Trout

Heat Flux(Φ_{net})
Φ_{solar}(direct and diffuse)
$\Phi_{longwave}$, $\Phi_{evaporation}$
$\Phi_{convection}$

Q_{in}
T_{in}
SUBREACH
Q_{out}
T_{out}
Q_{gw} T_{gw}
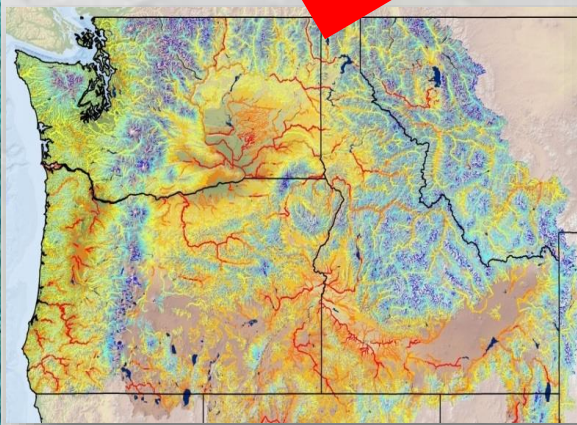
Species distribution & niche models
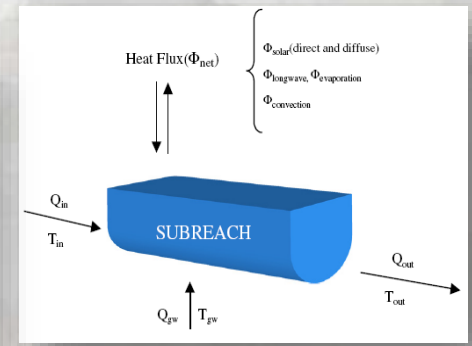
Website: Makes Data Accessible

1) GIS shapefiles of stream temperature scenarios

Google "**NorWeST temperature**"
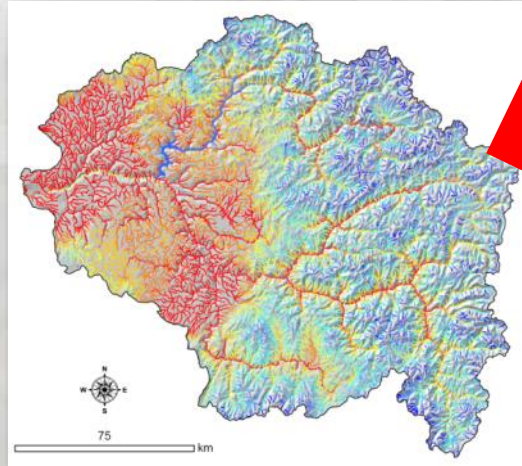

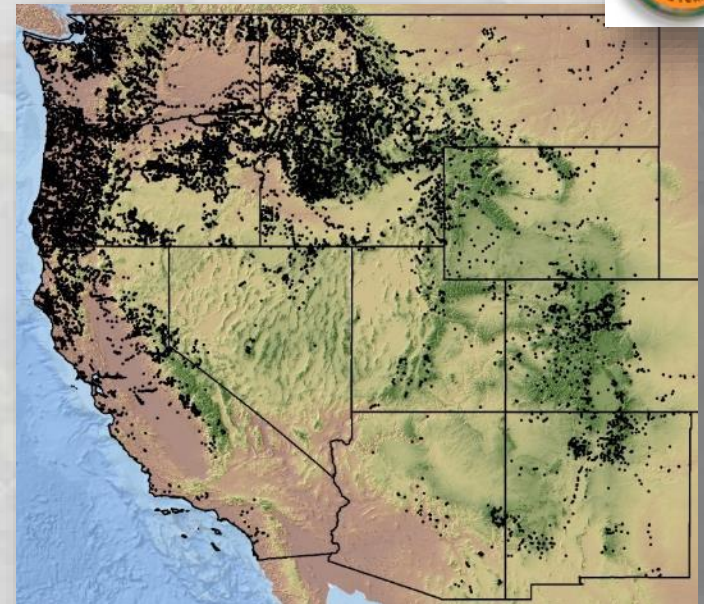*Salmon River*
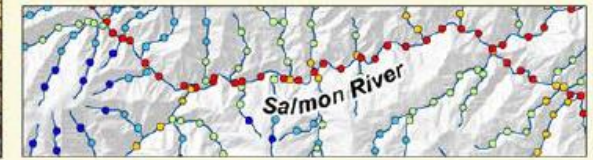
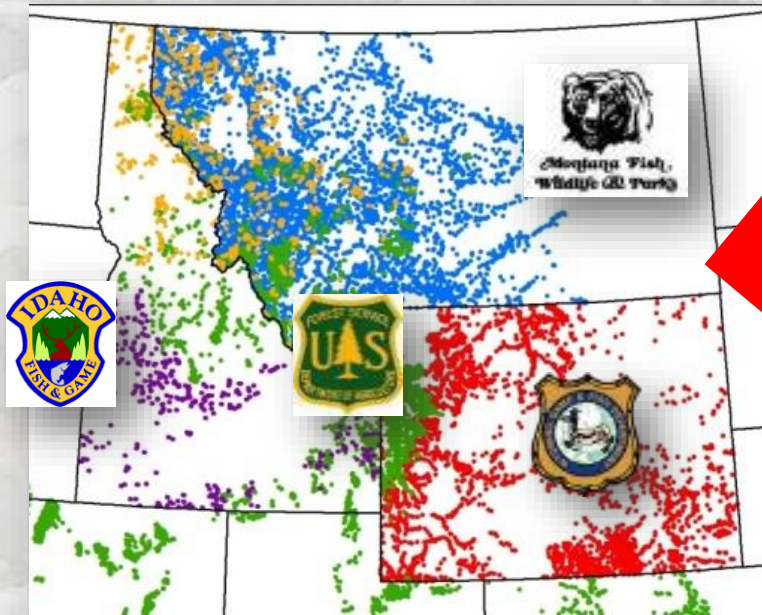**Regional Database and Modeled Stream Temperatures**

2) Temperature data

40-50 visits/day; 12,000 visits/year

Redundancy Also Rules Biological Datasets

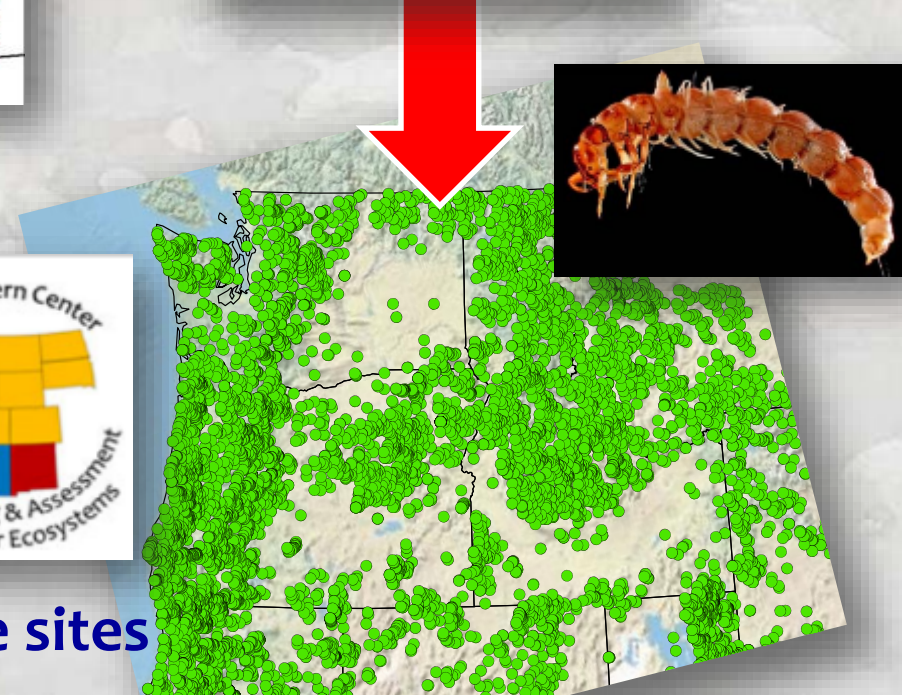**>13,000 fish sample sites**

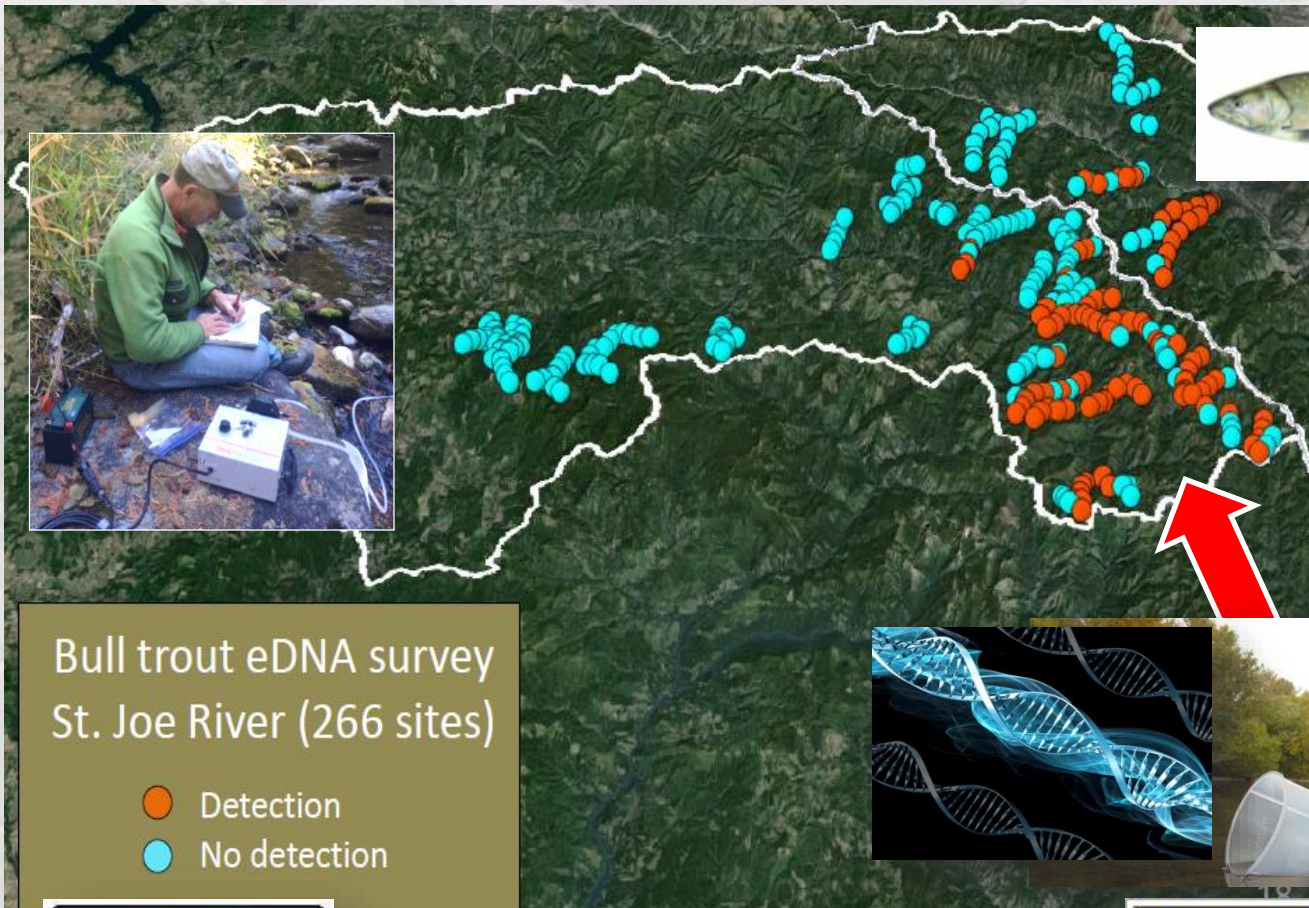Isaak et al. 2017. Big biology meets microclimatology. *Ecol. Apps.* **27**

>10,000 macroinvertebrate sites

eDNA is the Ultimate…

One Person Easily Samples Many Sites

Bull trout eDNA survey
St. Joe River (266 sites)

- Detection
- No detection

DANGER
DO NOT ENTER

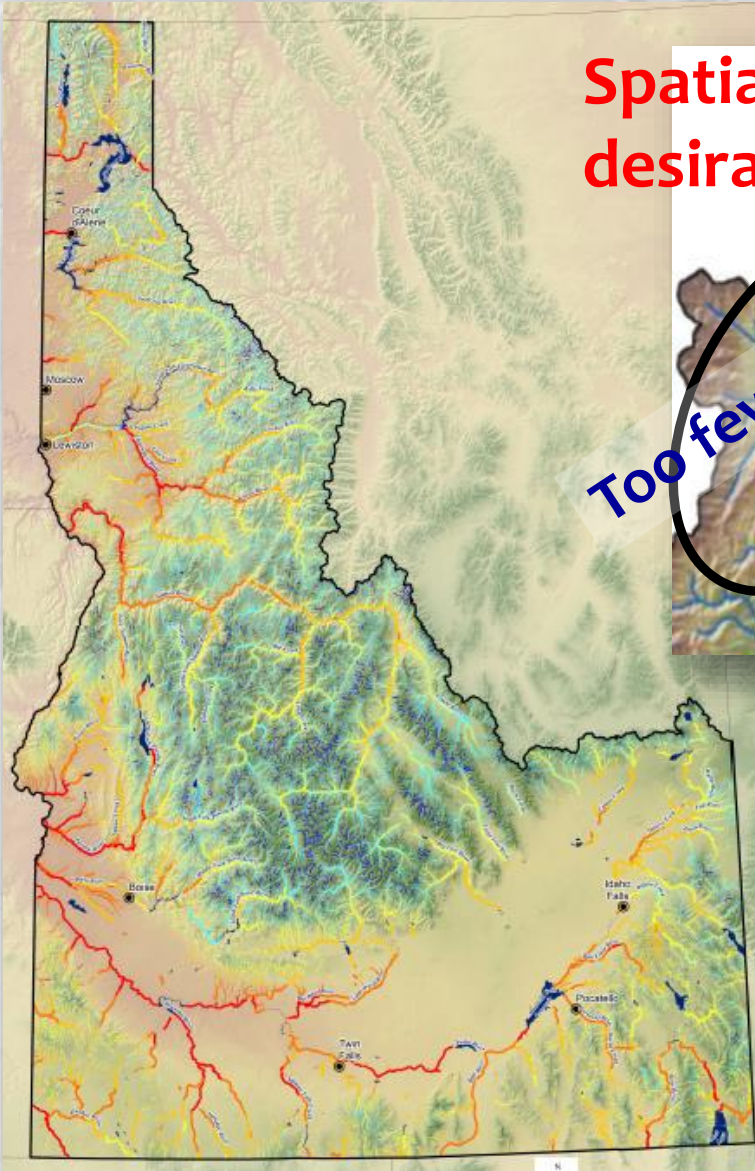**CAUTION**
Watch your step

Redundancy & Inefficiency Lurk Dead Ahead!!!

Inefficiency Isn't Affordable (or Smart)
Idaho has ~35,000 miles of perennial stream

Spatial balance is desirable
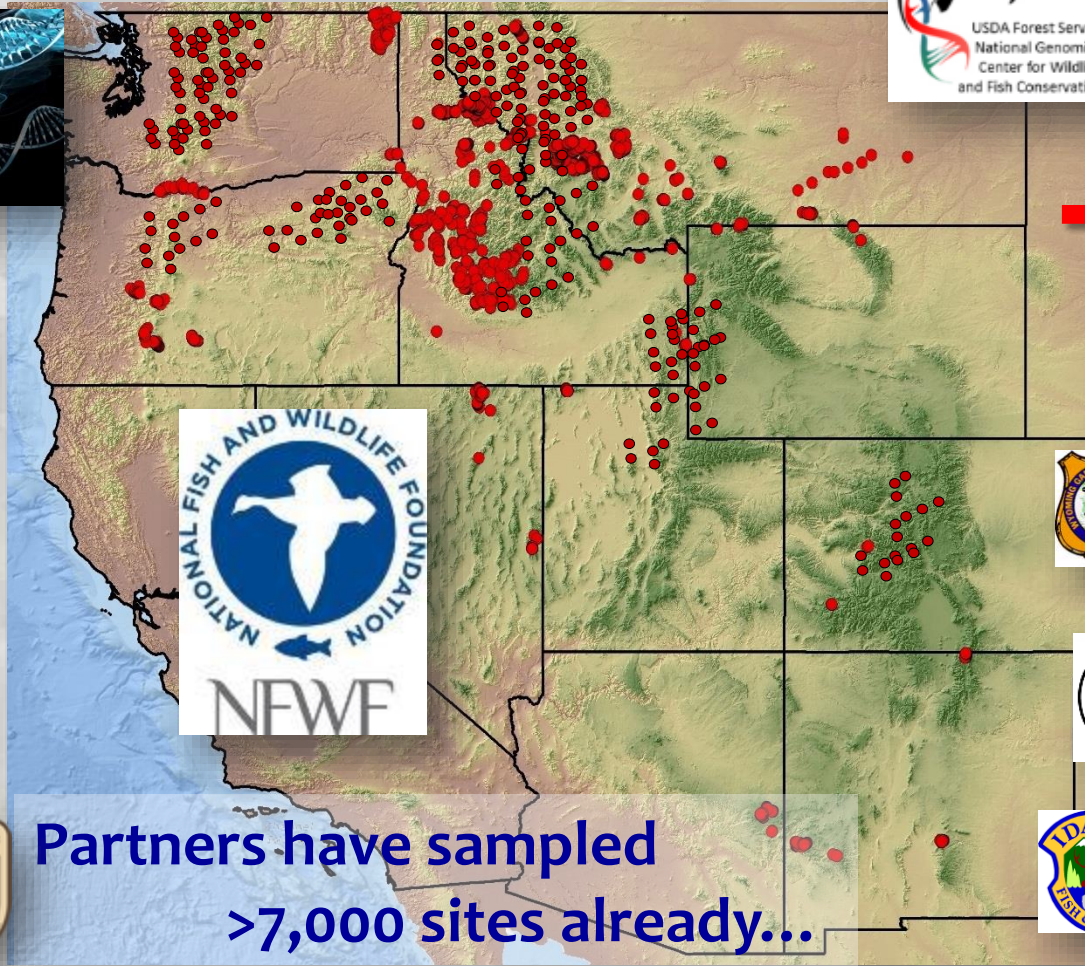
Too many…

Too few…

Just right

Repeat Sample Some Sites for Trend Monitoring (e.g., BURP)

Aquatic eDNAtlas Project: Open-Access Database for all Species in the American West

National Genomics Center for Wildlife & Fish Conservation

Partners have sampled >7,000 sites already…

Databases are Built by Database Teams

Steps in Atlas Database Development

Data collected with standard protocol

QA/QC procedures (laboratory & data)

A Protocol for Collecting Environmental DNA Samples From Streams

Kellie J. Carim, Kevin S. McKelvey, Michael K. Young, Taylor M. Wilcox, and Michael K. Schwartz

General Technical Report RMRS-GTR-355

Metadata documentation & website delivery in user-friendly formats

Database entry (relational & geospatial)
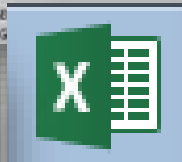
A Microcosm of the Aquatic eDNAtlas:
Rangewide eDNA Bull Trout Project
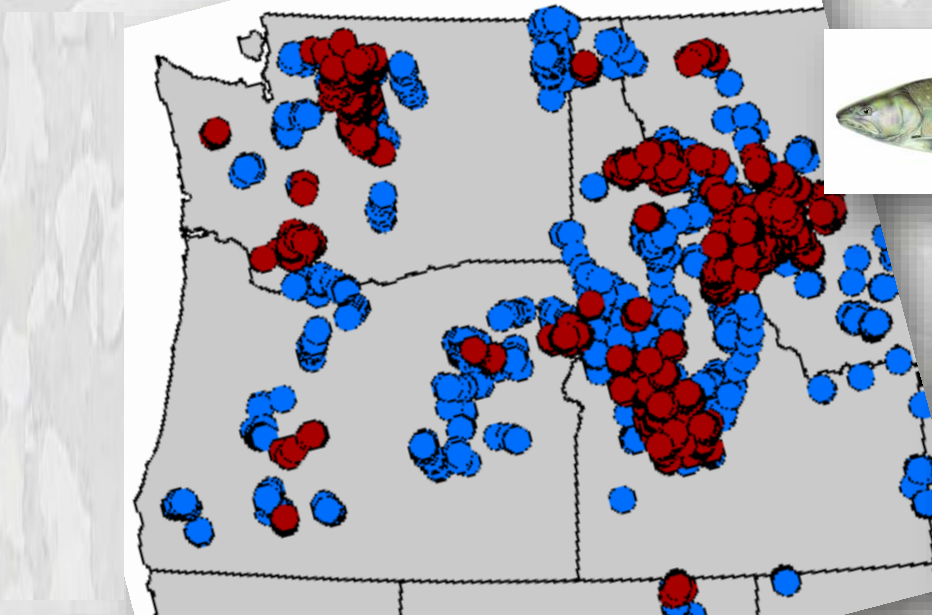
Partners sampled…

2016: 3,000 stream sites

2016-2018: ~10,000 stream sites

Sample sites are already part of an organized database!
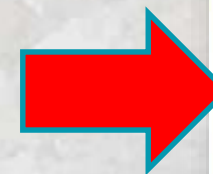
Website: Rangewide eDNA Bull Trout Project

The Rangewide Bull Trout eDNA Project

Many Resources

Supporting Science

Protocols
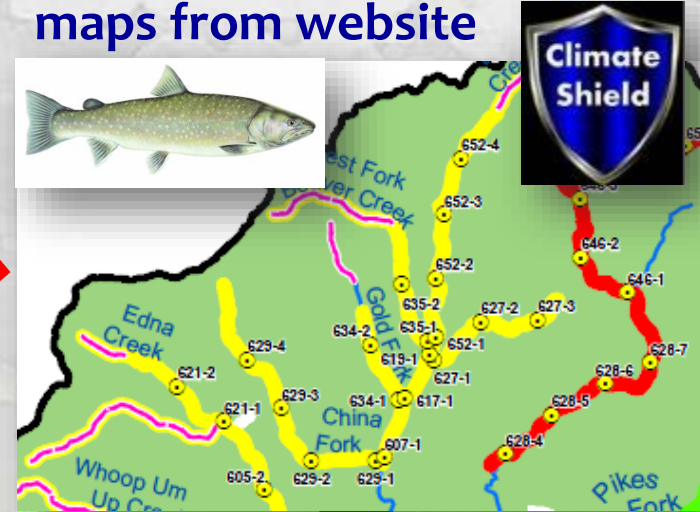
Sampling maps

Results

Participation is an Easy 4 Step Process

Contact NGC for field gear

Download bull trout hunting maps from website

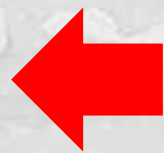## Mail samples & gear back to NGC

Go for a nice sampling hike
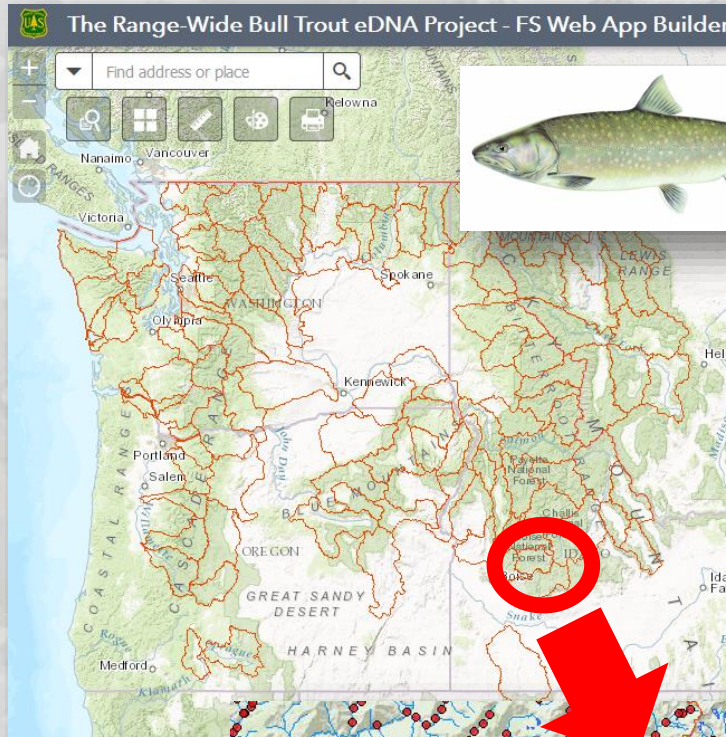
Results Received Back from NGC Lab

FOR YOUR EYES ONLY

OR

OPEN ACCESS

ORACLE DATABASE

ArcGIS ESRI

ArcGIS Online esri

Browser
- Web apps built with ArcGIS APIs
- ArcGIS.com
- ArcGIS Explorer Online

Mobile
- ArcPad
- ArcGIS Mobile
- iOS
- Windows Phone 7 (future)
- Android (future)

Desktop
- ArcGIS Desktop
- ArcGIS Explorer

ArcGIS Online
- Use
- Share
- Organize

Developer Tools
Web:
- JavaScript
- Silverlight
- Flex

Mobile:
- iOS
- Windows Phone 7 (future)
- Android (future)
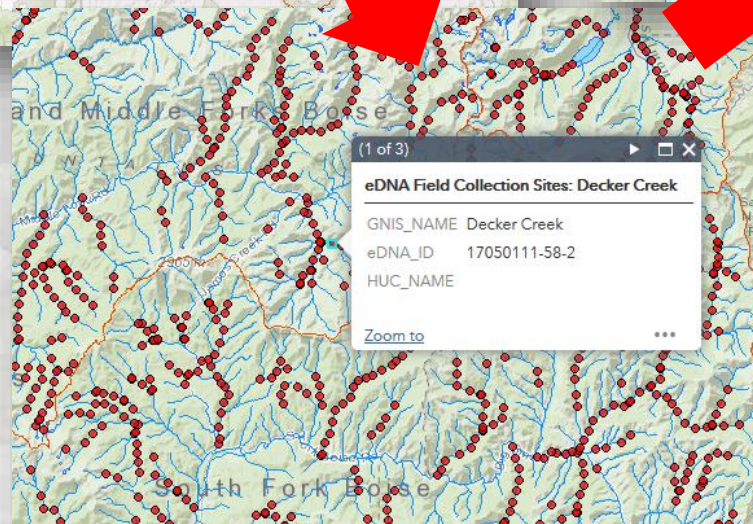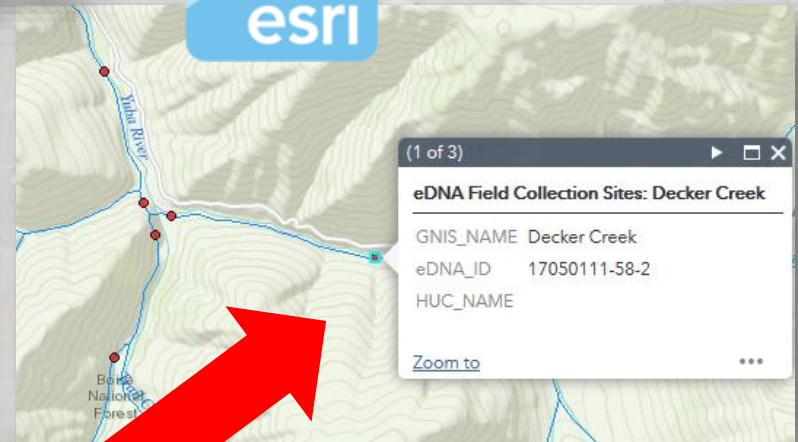
Dynamic Web-data portal Deliver Results at Website

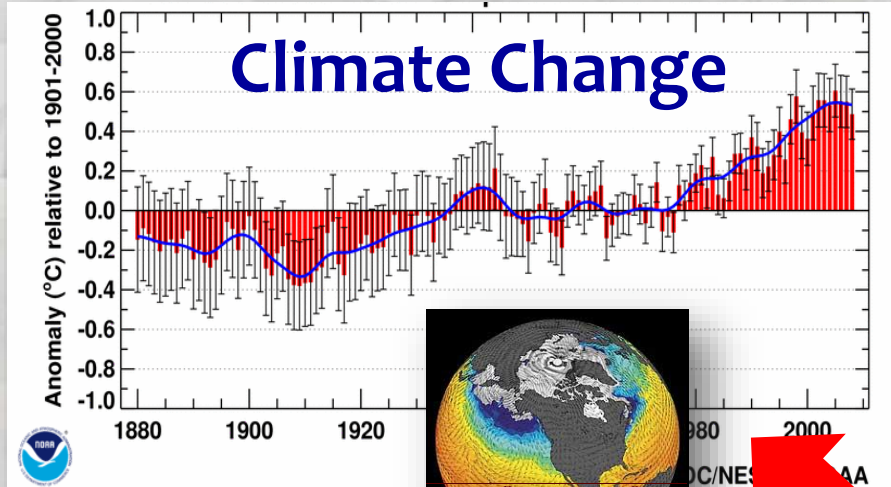Query data for downloading by site, stream, HUC, region, species range

Crowd-Sourced Database Advantages

1) Efficiencies of scale (i.e., you become part of a massive biological sensing network)
2) System gains efficiency as database size increases each year
3) System coevolves & improves from close collaborations between researchers & managers
4) Consistent data format & documentation facilitates communication within & among agencies
5) Samples archived at NGC can be reused in the future
6) No reinventing of technical wheels (i.e., website/database design, geospatial stuff, etc.)

More With Less, but…
It Can be A LOT More!

Climate Change

Urbanization & Population Growth

Shrinking Budgets

The End