

# Using Digital Media to Communicate Fisheries Science

Dan Isaak - U.S. Forest Service

Jodi Whittier - University of Missouri

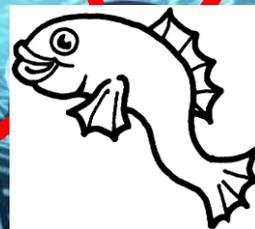
Julie Defilippi - Atlantic Coastal Cooperative Statistics Program



Computer



Phone



Internet

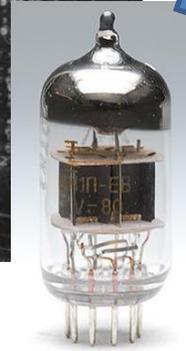
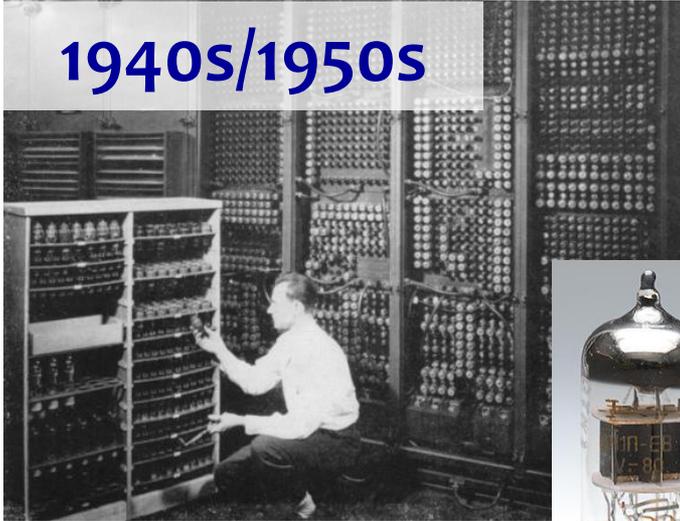


Phone

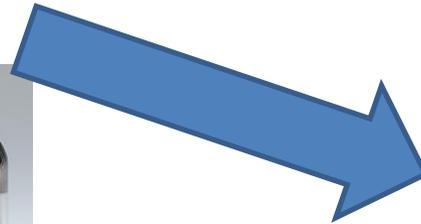
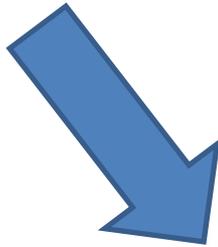


# “Digital” First Had to Be Invented

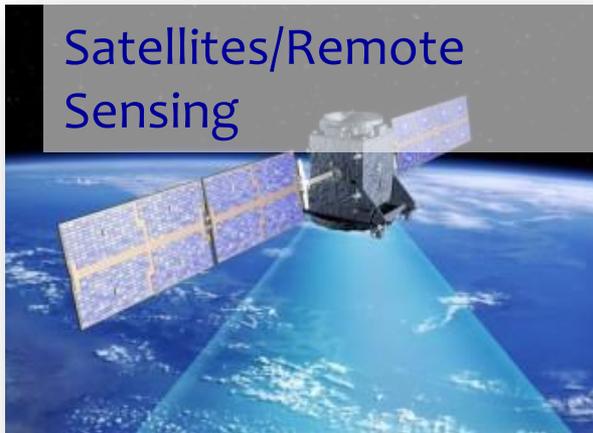
1940s/1950s



1980s/1990s



Satellites/Remote Sensing



1990s

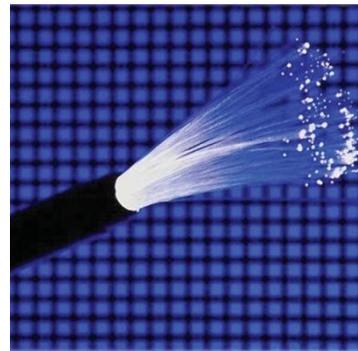
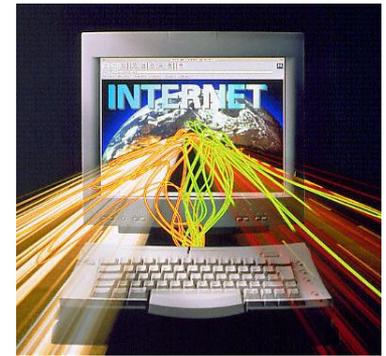
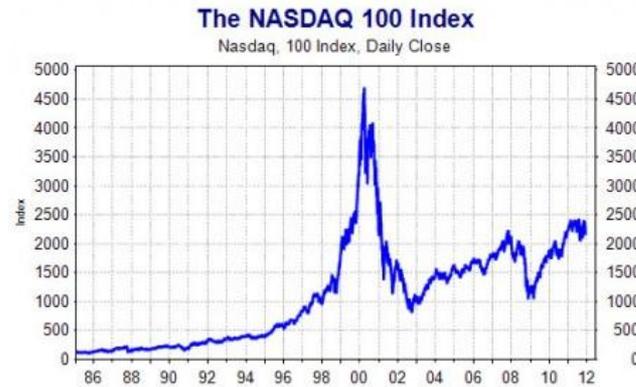
Miniature digital sensors



# Computers Started Talking to Each Other

## NASDAQ Tech Bubble Creates Massive Digital Infrastructure

### “InterNet” & WWW Emerge



Fiber optic cable

# Digital Becomes Pervasive & Portable

## Killer Apps, Social Networking, & Smartphones

Early drivers



Widespread adoption  
(billions of users)



Everywhere, all the time



Online shopping!

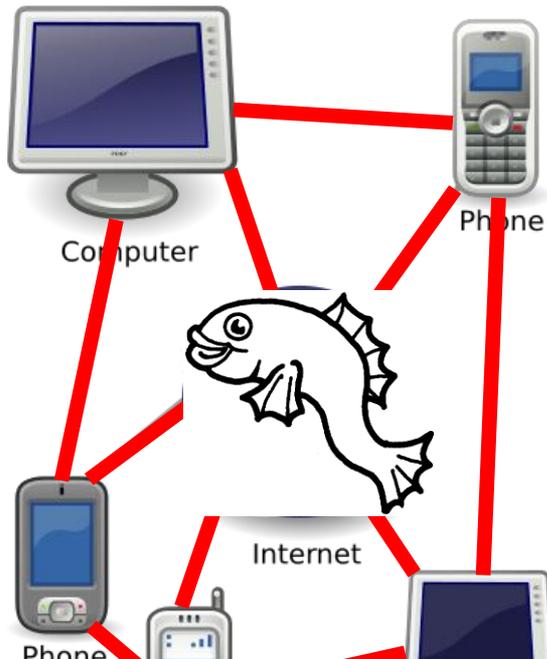
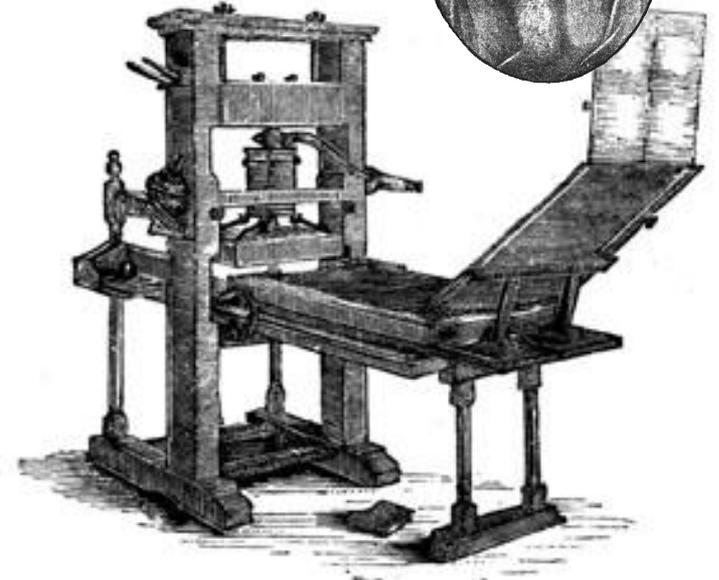


Tree cell phone towers



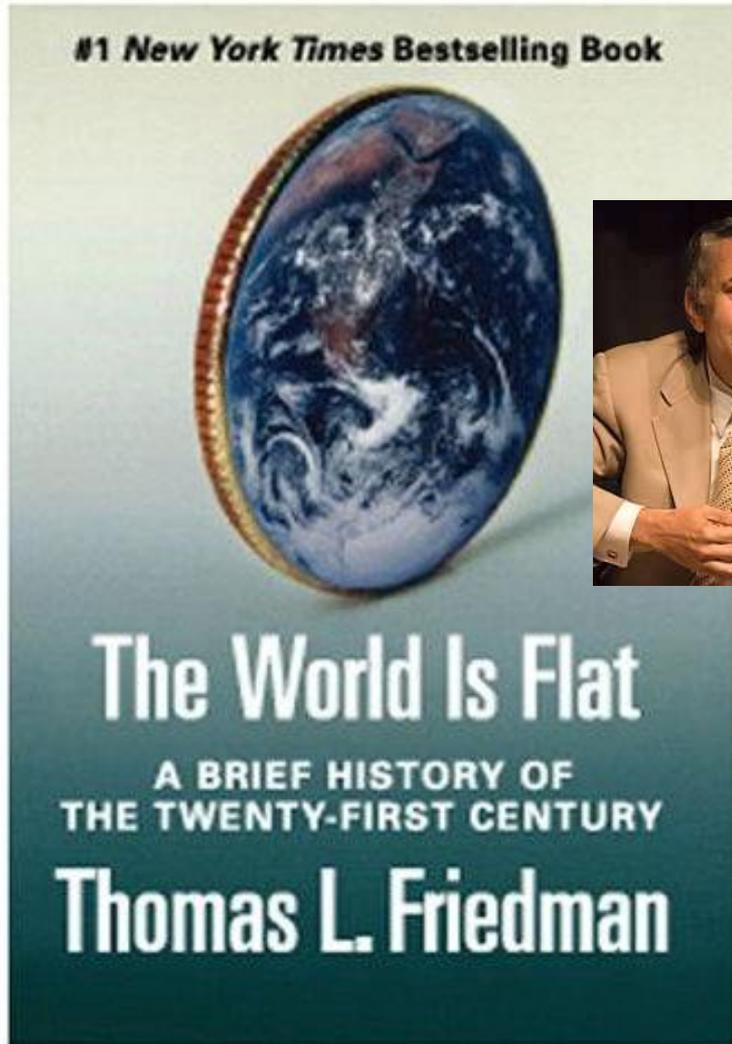
# Information Dissemination is Revolutionized

Top-Down Control Evolves to Open Networks



Access to "Free" & Ubiquitous Information is a Game Changer

# Good Ideas & Tools Can Spread Rapidly



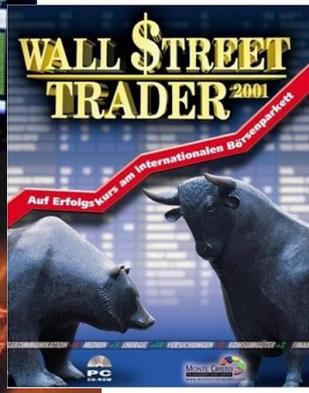
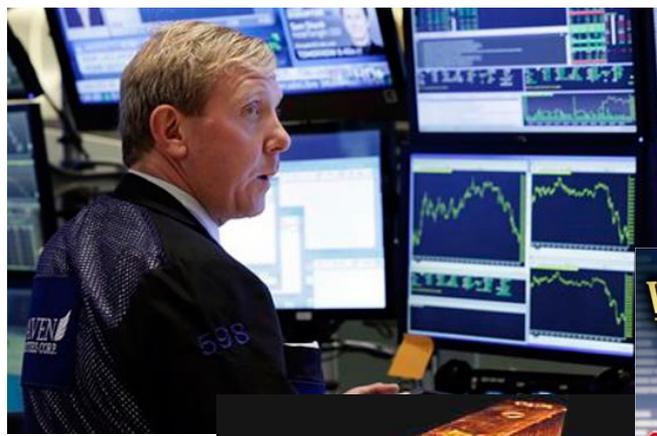
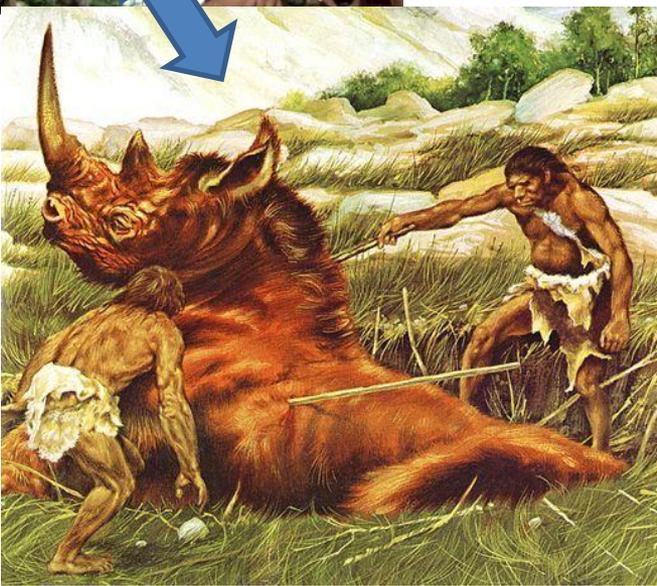
What-else explains  
twenty-something  
billionaires?

A digital meritocracy exists wherein  
barriers to entry are low & the playing  
field is more level

# Revolutions Happen, but There are Some Constants

What (& Who) People Know Affects Their Actions in Pursuit of Goals

Then = Now

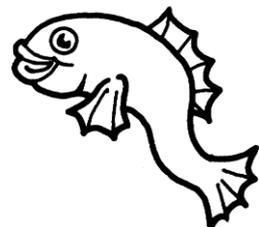


Good information is always a powerful asset

# What Does Digital Mean for Fisheries?

## More & better ways of...

- communicating existing knowledge
- developing new information & predictive tools
- building communities around specific topics (large & small)
- managing and conserving resources
- organizing politically and advocating for aquatics



# Example: Website for Spatial Statistical Stream Network Models

SSN & STARS:  
Tools for Spatial Statistical Modeling

Rocky Mountain Research Station  
RMRS Science Program Areas  
Air, Water and Aquatics

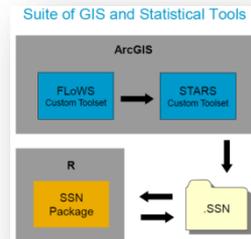
SSN & STARS:  
Tools for Spatial Statistical Modeling on Stream Networks

Google **“SSN/STARS”**



**Spatial Stream Networks Package for R**

**Open Source Statistical Stream Software, Example Datasets, & Applications**



**A Moving Average Approach for Spatial Statistical Models of Stream Networks**

Jay M. VER HOEF and Erin E. PETERSON



*Journal of Statistical Software*

MMMMMM YYYY, Volume VV, Issue II. <http://www.jstatsoft.org/>

**SSN: An R Package for Spatial Statistical Modeling on Stream Networks**

Jay M. Ver Hoef  
NOAA National  
Marine Mammal Laboratory

Erin E. Peterson  
CSIRO, Brisbane

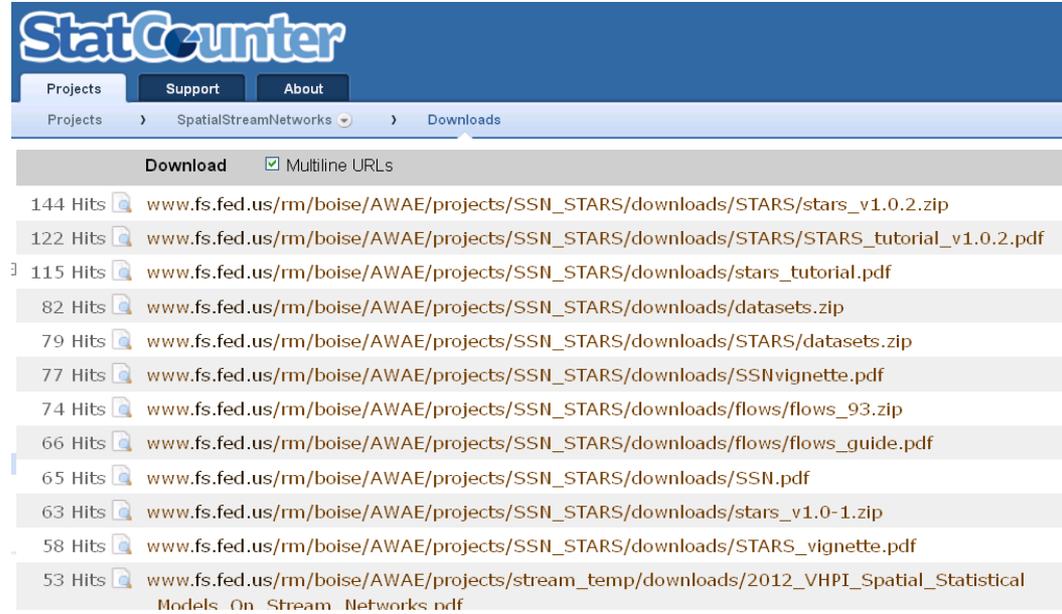
David Clifford  
CSIRO, Brisbane

Rohan Shah  
CSIRO, Brisbane

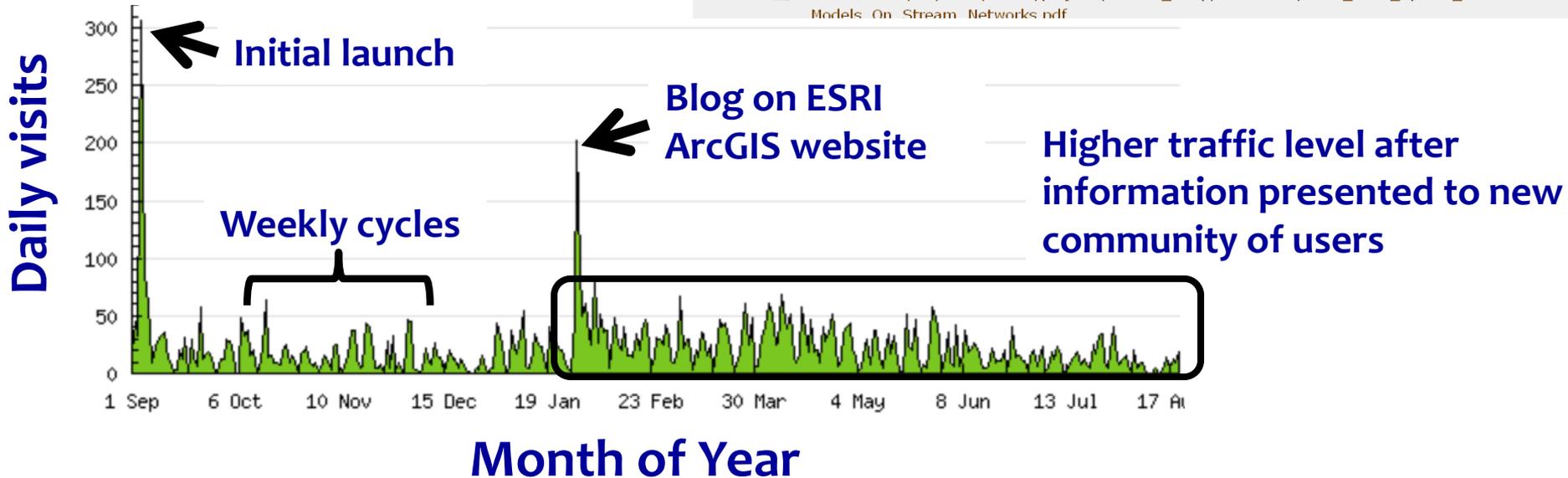
**New class of statistical models developed  
by Erin Peterson & Jay Ver Hoef**

# Website Statistics Provide Valuable Feedback

## What do visitors download & use?



## How many visitors & what causes them to visit the site?



# User Community Rapidly Developing

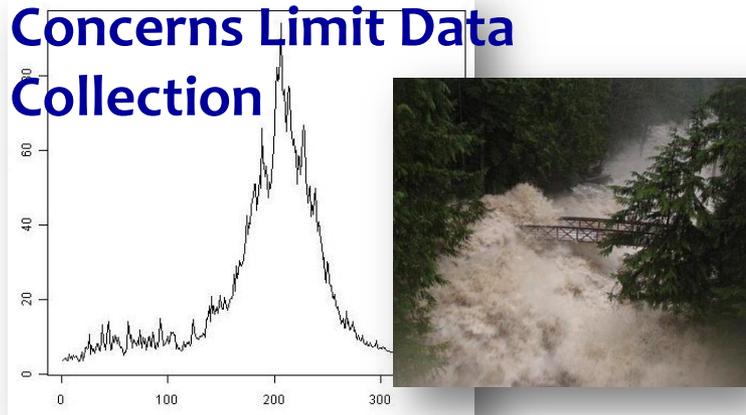
>9,000 Visits to SSN/STARS Website in last year since launch

Map showing locations where website was accessed in last month



# Example: Digital Temperature Sensors & Simple Protocol for Establishing Annual Monitoring Sites

Annual Flooding Concerns Limit Data Collection



Solution: Glue sensors to large boulders & permanent cement structures



**\$130 = 5 years of data**



Isaak & Horan 2011. NAJFM 31:134-137

Stream Temperature Modeling and Monitoring



Website Distributes Information

Stream Temperature Modeling and Monitoring

Thermal regimes are important to aquatic ecosystems because they strongly dictate species distributions, productivity, and abundance. Inexpensive digital temperature loggers, geographic information systems (GIS), remote sensing technologies, and new spatial analyses are facilitating the development of temperature models and monitoring networks applicable at broad spatial scales. This web site provides a mapping tool to help those in the western US organize temperature monitoring efforts. Stream temperature techniques for measuring stream temperatures, and describes several techniques for other types of temperature measurements. This site also includes information on other topics relating to thermal regimes in streams.

Google “Stream temperature Forest Service”

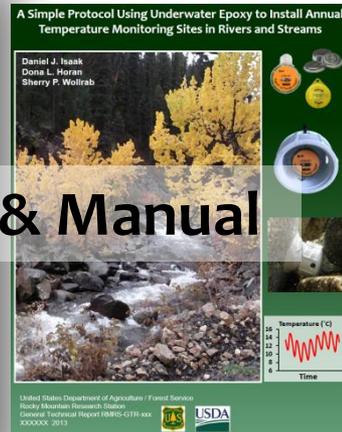
YouTube

FishWeLike + Subscribe 1 video

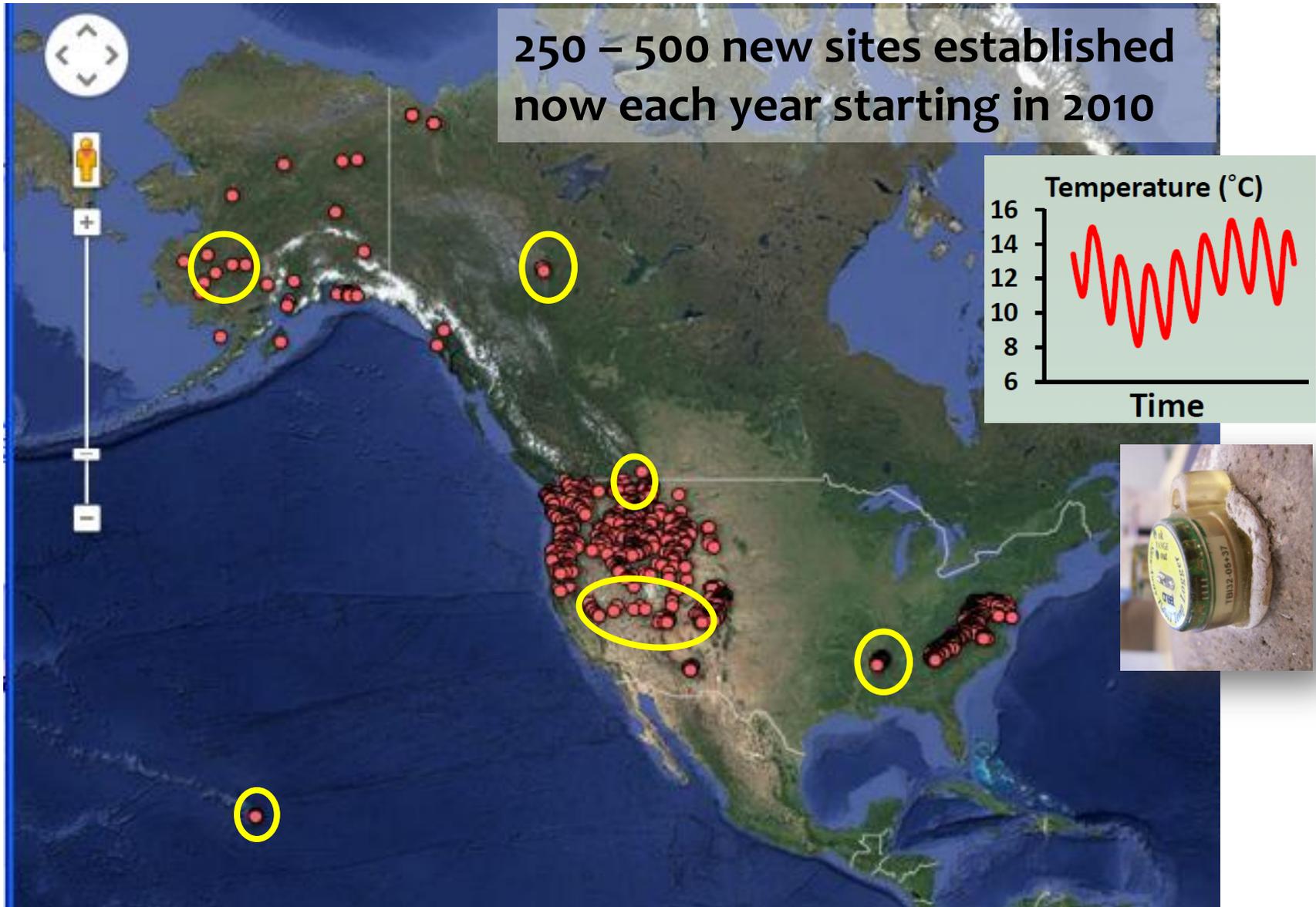
Search

Learn more Dismiss

Temperature Sensors in Streams!

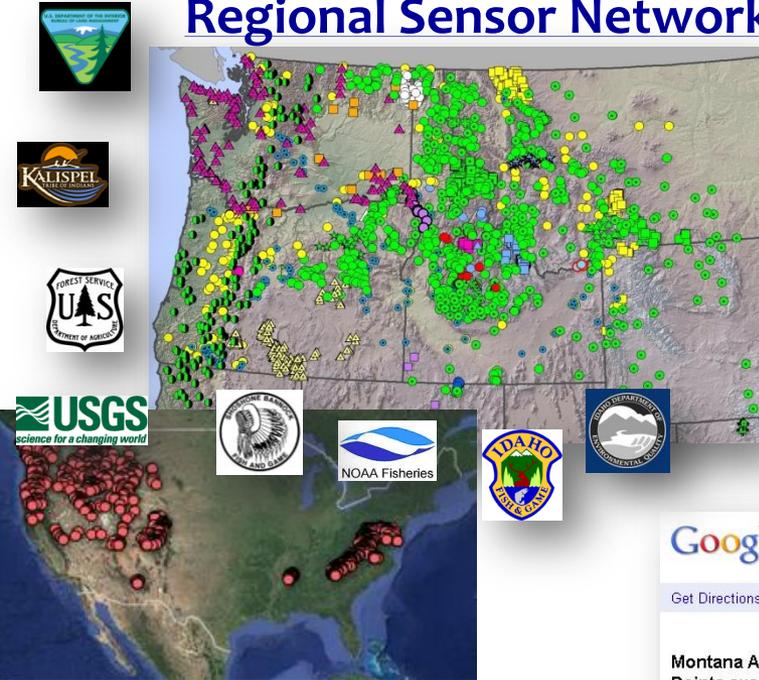


# Rapid Protocol Adoption & Emergence of New Annual Stream Temperature Monitoring Network



# Online GoogleMap Tool Shows Monitoring Site Locations & Helps Agencies Coordinate Efforts

## Regional Sensor Network



## Site Information

- Stream name
- Data steward contact information
- Agency
- Site Initiation Date



Google maps

## Query Individual Sites

The screenshot shows a Google Maps interface with a search bar containing "Cottonwood-Clyde Park- Creek". The search results show a list of stream temperature points available by agency. The first entry is "Adair Creek" with contact information for Clint Muhlfeld. The second entry is "Agassiz Creek" and the third is "Akokala Creek". The map shows the location of these sites in Montana.

**Montana Annual Stream Temperature Points available**  
[http://www.fs.fed.us/rm/boise/AWAE/projects/stream\\_temperature.shtml](http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temperature.shtml)

Stream Temperature Points available by Agency

2/02/2011  
62 views - Public  
Created on Feb 2 - Updated 13 hours ago  
By  
Rate this map - Write a comment

- **Adair Creek**  
Thermograph Location: Adair Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926) USGS, NOROCK
- **Agassiz Creek**  
Thermograph Location: Agassiz Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926) USGS, NOROCK
- **Akokala Creek**  
Thermograph Location: Akokala Creek Contact: Clint Muhlfeld - cmuhlfeld@usgs.gov (406-888-7926) USGS, NOROCK

**Cottonwood-Clyde Park- Creek**  
Updated 2 days ago  
Thermograph Location: Cottonwood-Clyde Park- Creek  
Contact: Robert Al-Chokhachy - ral-chokhachy@usgs.gov (406-994-7842)  
USGS, NOROCK

Directions Search nearby more ▾ 1 of 2 nearby results Next >

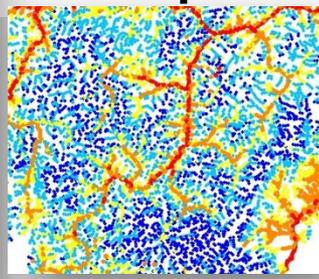
# Access to Temperature Sites & Other Stream Data Anytime, Anywhere on Your Smartphone



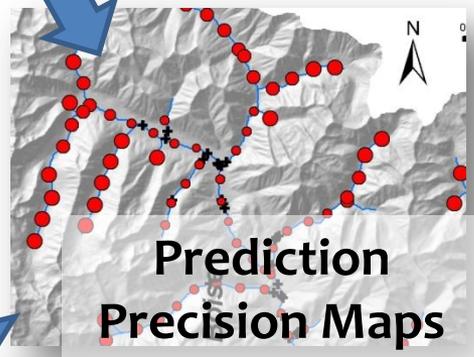
**ArcGIS app**



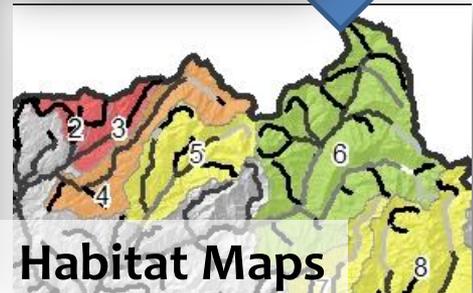
**Temperature Maps**



**Prediction Precision Maps**



**Habitat Maps**

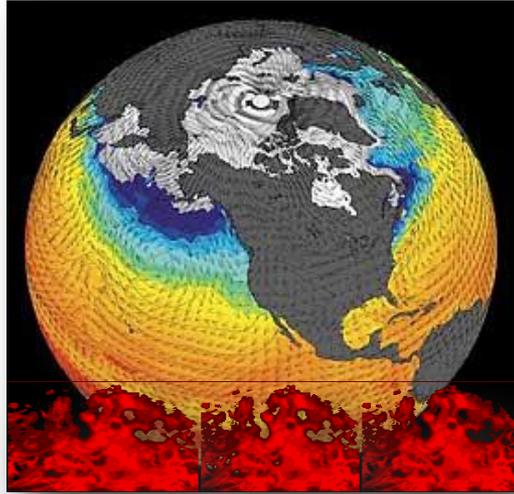


**GoogleMaps**

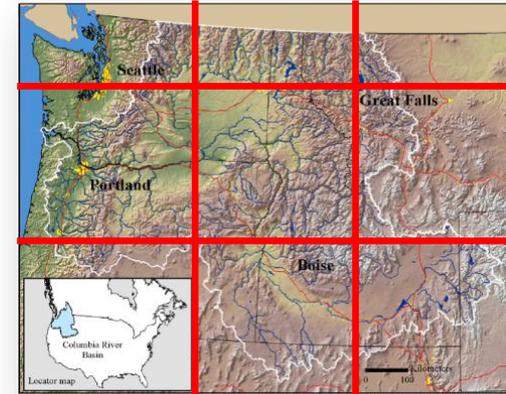


# An Overarching Threat: What Does Global Climate Change Mean for Fisheries?

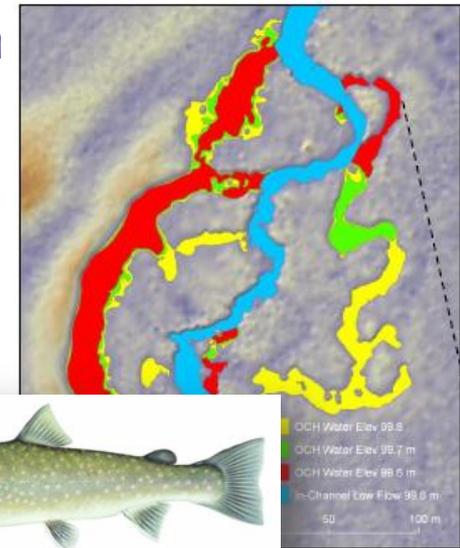
Global climate



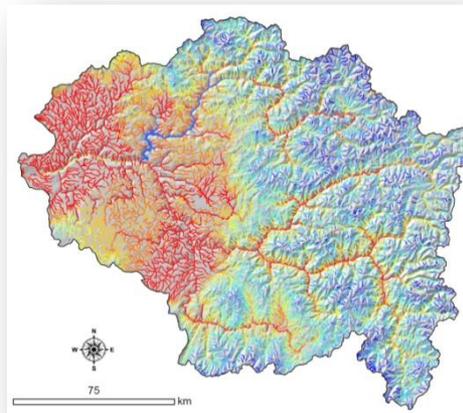
Regional climate



Stream reach



River network temperatures



# First Threat Response: Understand It

- Climate-Aquatics Blog developed to digest & transfer latest/greatest science rapidly & globally
- Blog mailing list grows from <500 to >5,000 in 2.5 years



Google groups  
ClimateAquaticsBlog Discussion site

Home

Discussions All 4 messages view all » + new post

Links to Climate Aquatic webpages

- By Sharon Parkes - Mar 23 - 1 author - 0 replies
- #1 - Climate Aquatics Science Webinar Presentations Available Online
- By Dan Isaak - Mar 22 - 1 author - 0 replies
- #3 - Underwater epoxy technique for full-year stream temperature monitoring
- By Dan Isaak - Mar 22 - 1 author - 0 replies
- #2 - New Climate-Aquatics synthesis report available
- By Dan Isaak - Mar 22 - 1 author - 0 replies

Members 18 members view all » + invite members

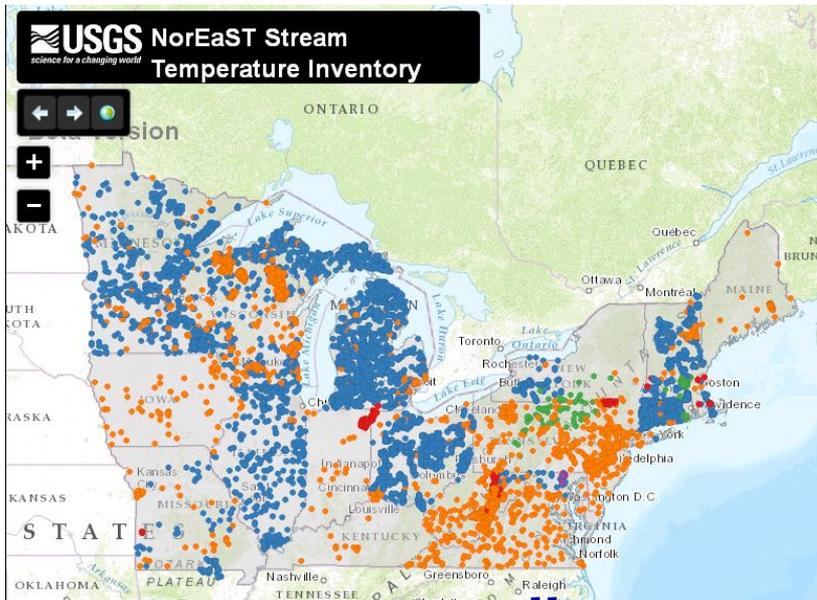
- Andrew Todd Member
- Dale Higgins Member
- Dan Dauwalter Member

Map locations where blog website was accessed in last month

Google "Climate-Aquatics Blog"

# Second Threat Response: Marshal Resources & Rally Troops

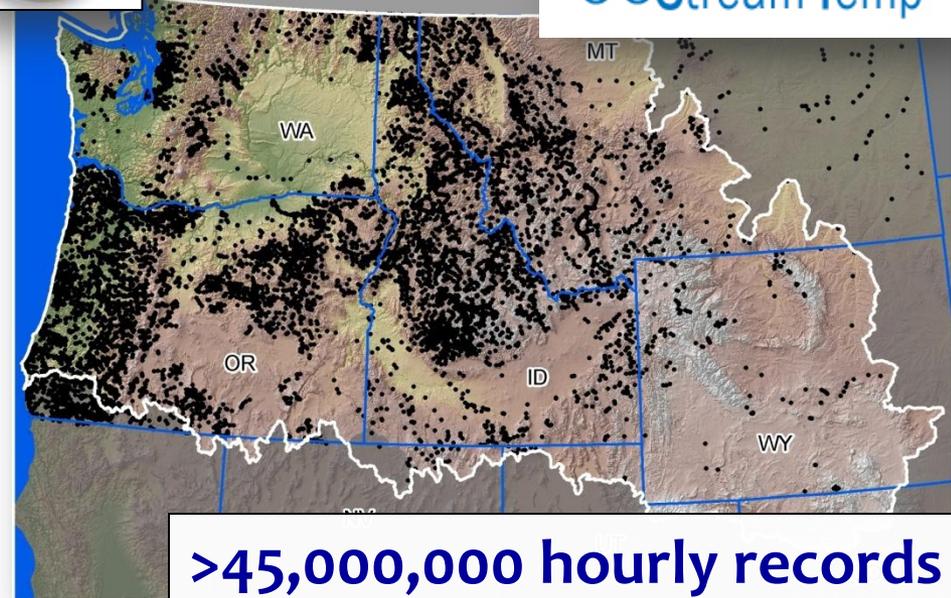
Regional projects underway to develop interagency stream temperature databases & high-resolution climate scenarios



**Jana Stewart & Colleagues**



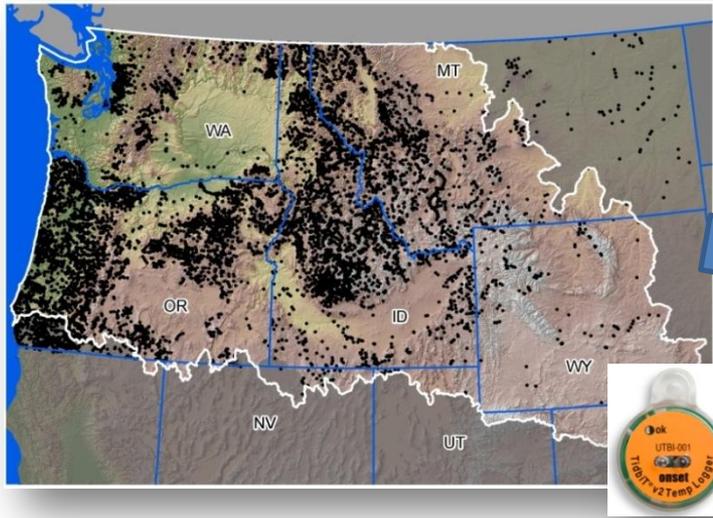
**NorWeST**  
Stream Temp



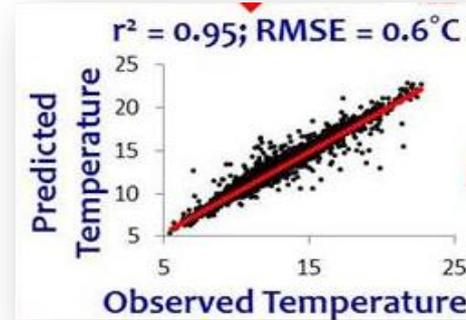
Millions of \$'s of data being organized by small teams linked through virtual networks across multiple institutions

>45,000,000 hourly records  
>15,000 unique stream sites

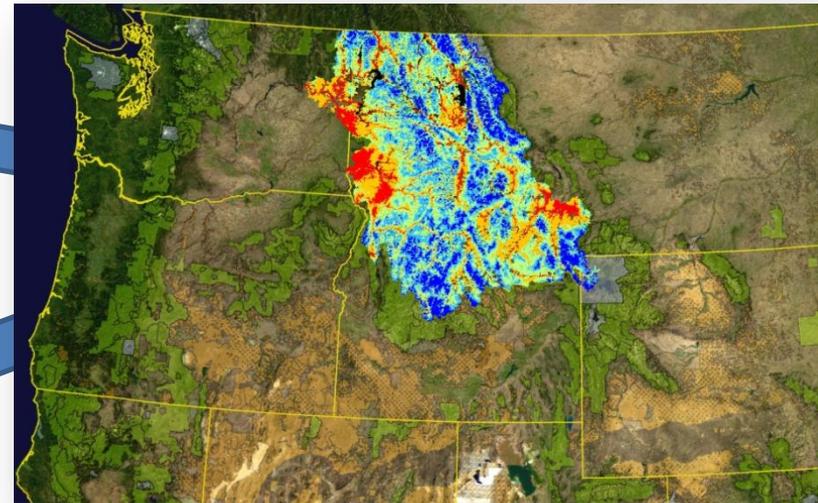
# Third Threat Response: Develop Maps & Strategy



Accurate spatial temperature model



High resolution climate scenarios



**NorWeST**  
Stream Temp

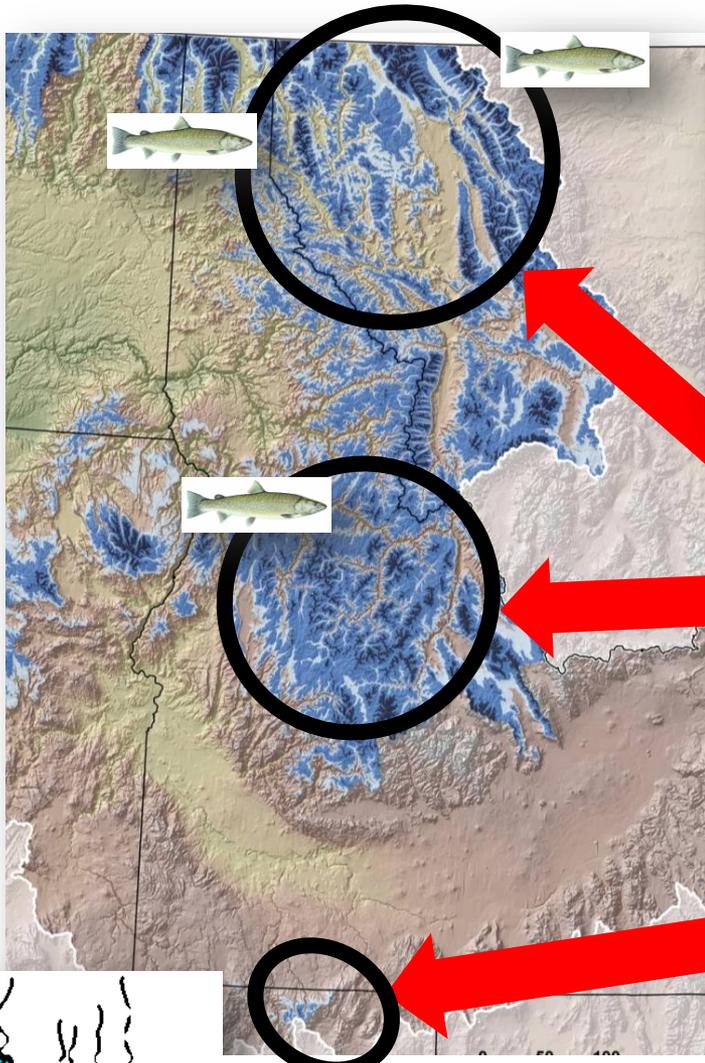
Website distributes temperature GIS layers

*Regional Database and Modeled Stream Temperatures*

Information used to develop climate-smart conservation strategies

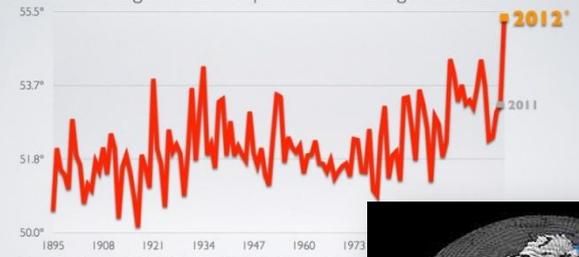


# Fourth Threat Response: Work with Broad Coalitions of Partners to Take Proactive Actions

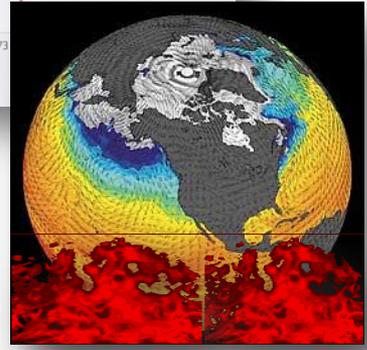


## 2012: HOTTEST YEAR ON RECORD

Average Annual Temperature in Contiguous U.S.



\*Source: Climate Central, compiled from NOAA's National Climatic Data Center and Applied Climate Information Systems based on observed temperatures through December 10, 2012 and an estimate of the Normal distribution of temperatures for the last 21 days of December based on data from the previous 117 years. (See methodology)



Invest Here

Not here

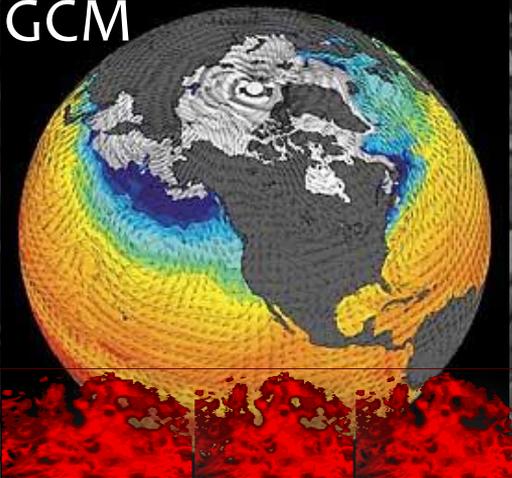
# Sorry Charlie



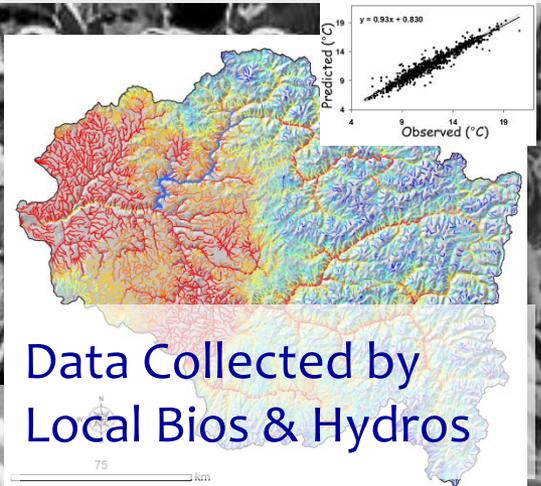
# Digital & Social Media Enable Crowd-Sourced Science With Grassroots Support



GCM



**Coordinated,  
Interagency  
Responses**

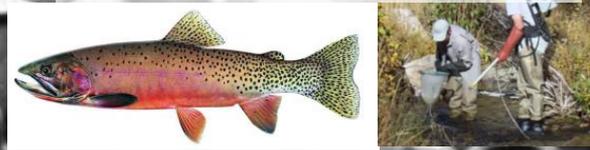


Data Collected by  
Local Bios & Hydros

75 km



**Efficient  
Management Actions**





*stream*