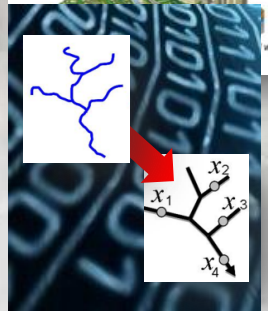
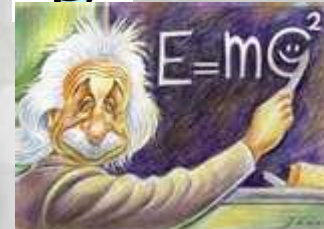
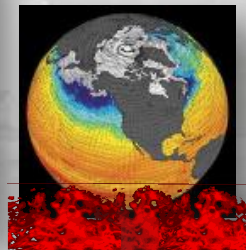
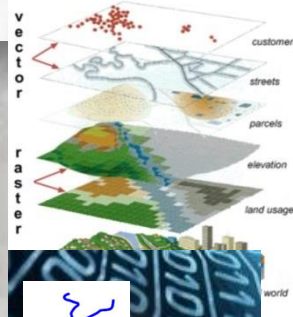
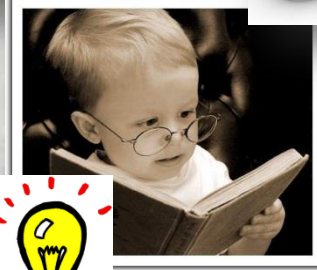
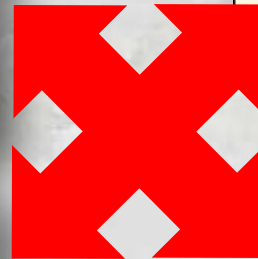
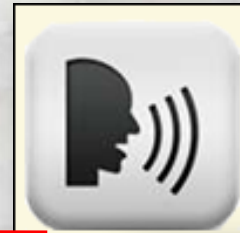
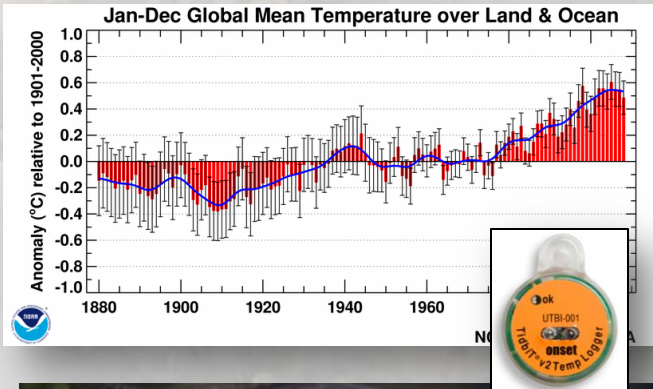
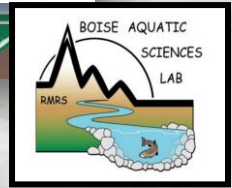


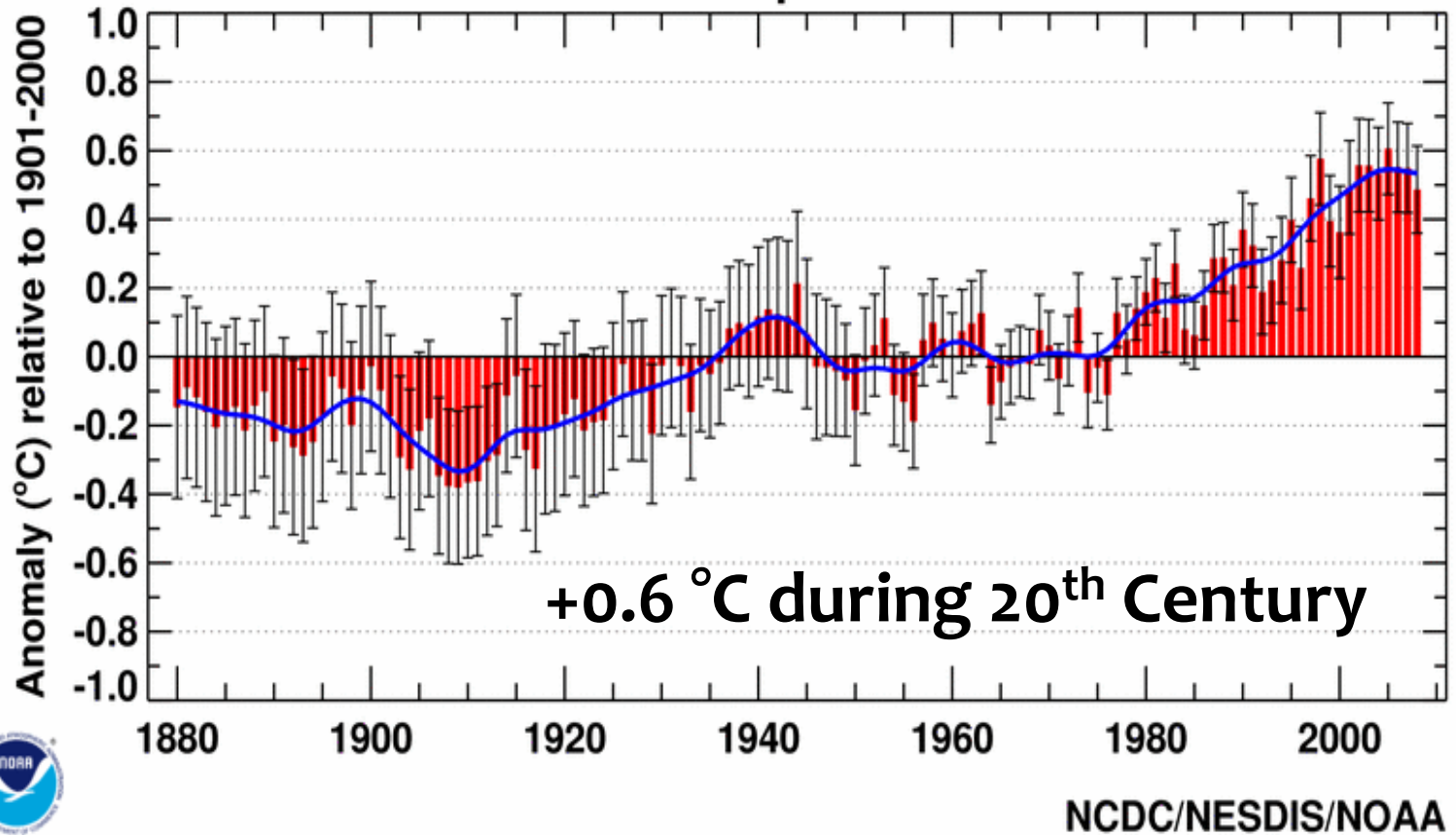
Climate Change & the Future of Freshwater Fisheries

Dan Isaak, US Forest Service
Rocky Mountain Research Station



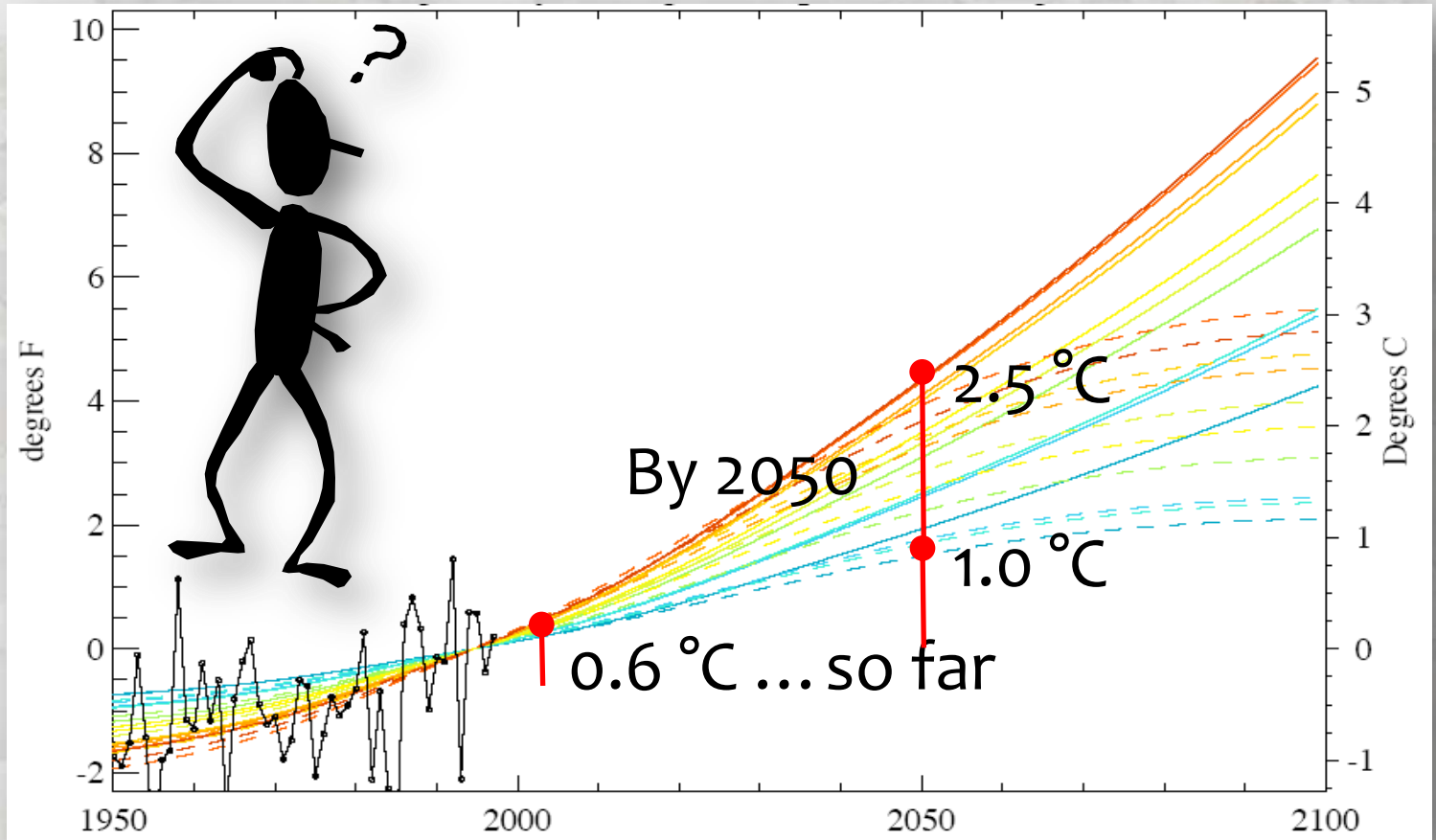
The New Reality

20th Century Observed Trend

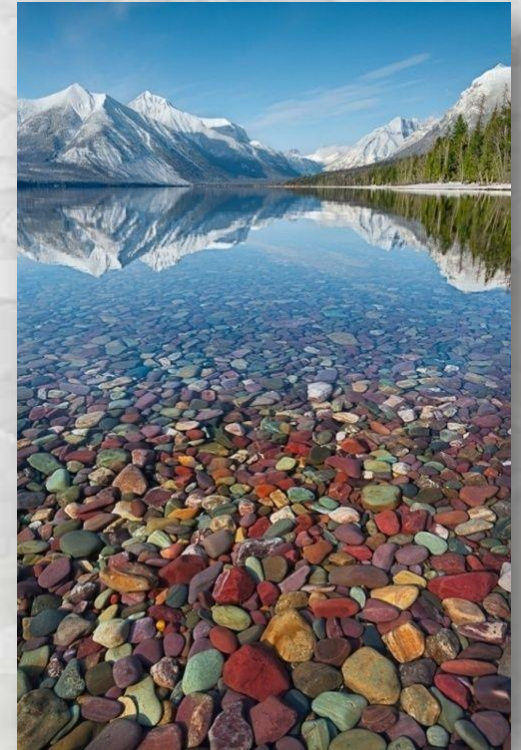
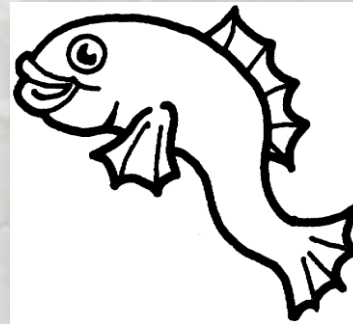
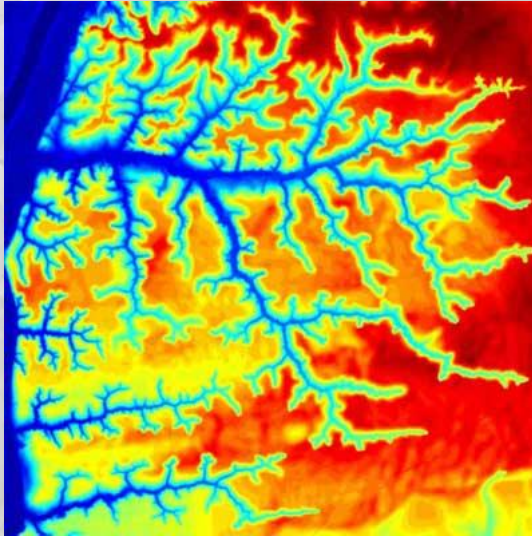


The Probable Future Reality

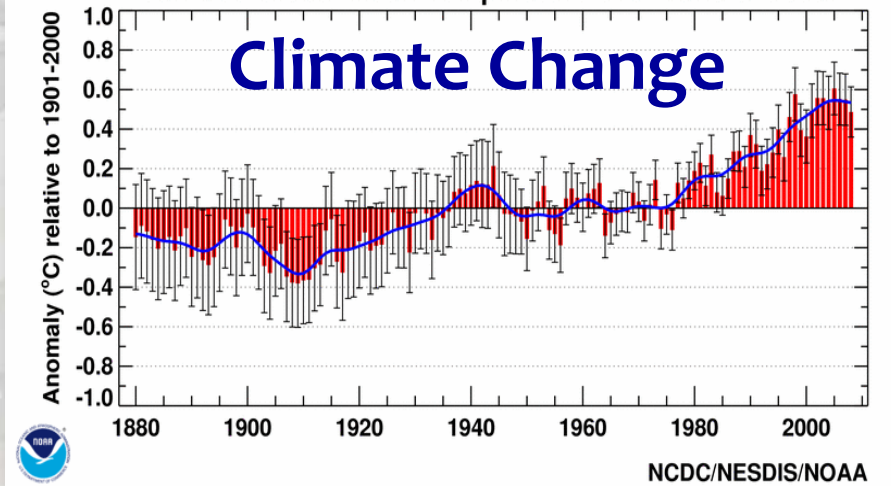
21st Century Projected Trend



Our Constituents are Cold-Blooded & Confined...



Faster Changes Will be the “New Normal”



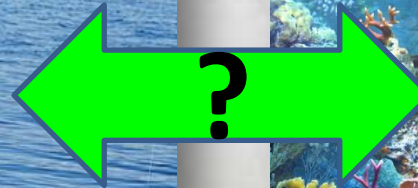
Urbanization & Population Growth



Fisheries

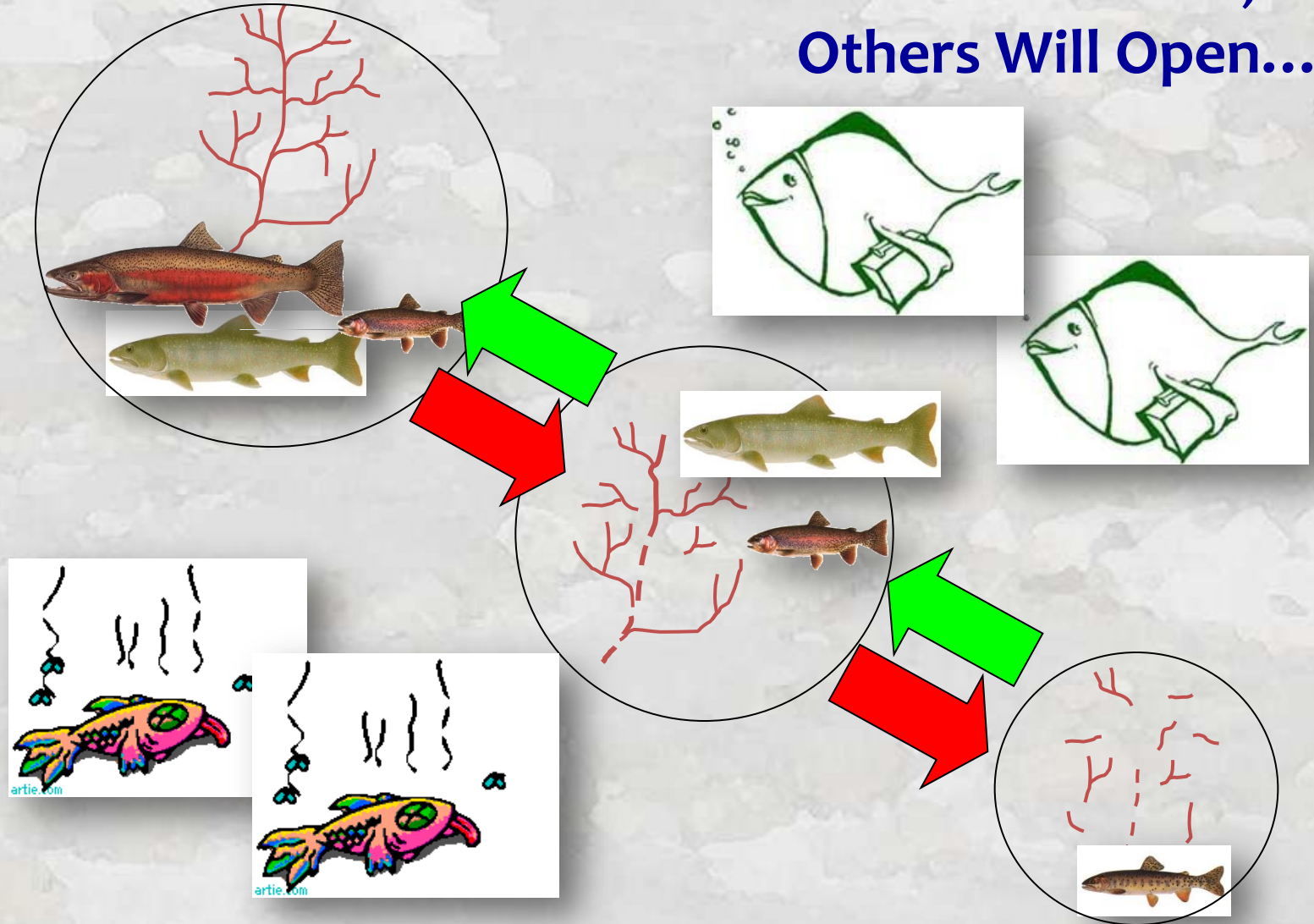


Biodiversity



Navigating Uncharted Waters Takes Vision, Adaptability, & Teamwork

Some Doors Will Close,
Others Will Open...



Creative/Innovative/Out-of-the-Box Thinkers & Leaders



Novel solutions
come from
synergies among
disparate things



“Read & think broadly”

- Important fish questions/issues
- What does new technology make possible?
- World & natural history
- Human nature/psychology
- How does the world around you operate?



Super Communicators

Writing/Speaking/Inter-Personal



& Teambuilders/Networkers

Leverage resources/skills
within/among agencies/people

- Climate change is too big for any one, or any one agency.



Good Teammates & Selfless Role Players



Someone throws the ball, someone catches the ball

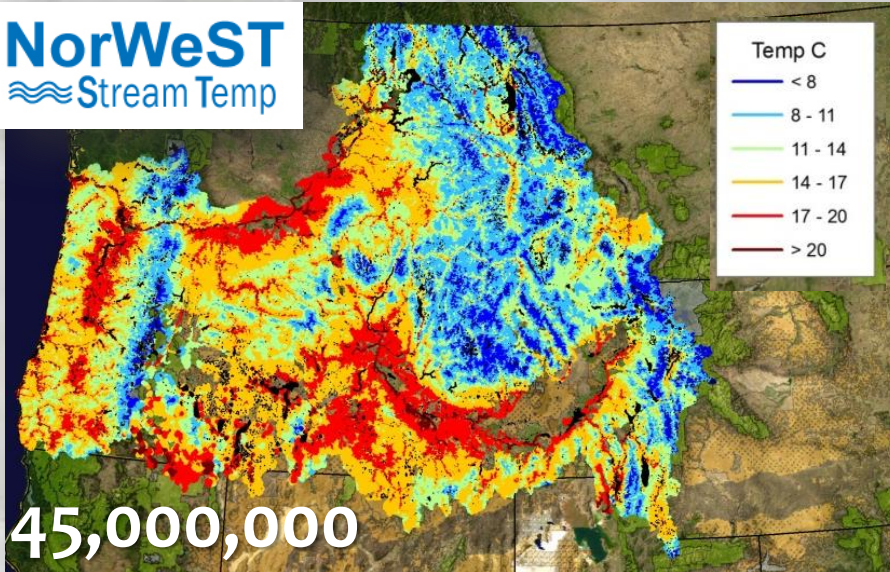
Digital revolution enables hyperconnectivity & precise workflow



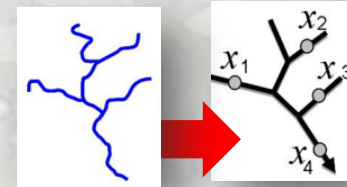
Information Creation is Required at Unprecedented Scales & Resolution

Regional stream temperature model

NorWeST
Stream Temp

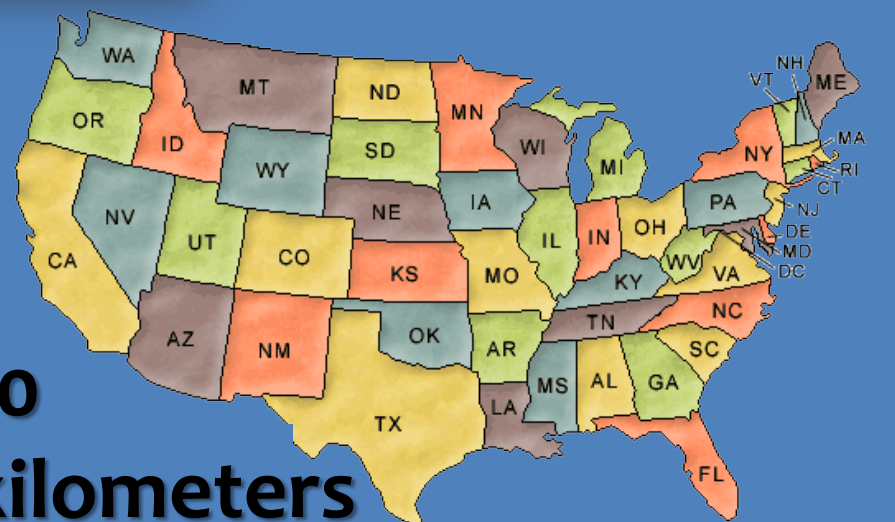


45,000,000
temperature records



**National Stream Internet
Network Geostatistics**

5,500,000
stream kilometers



Proficiency in Specialized Technical Skills

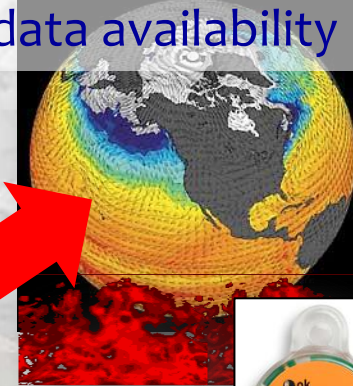
Remote Sensing



High-performance computing



Climate, weather, GCM data availability



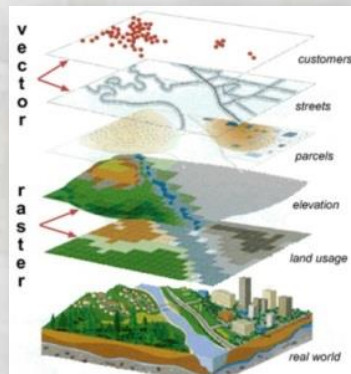
Websites & visualization Tools



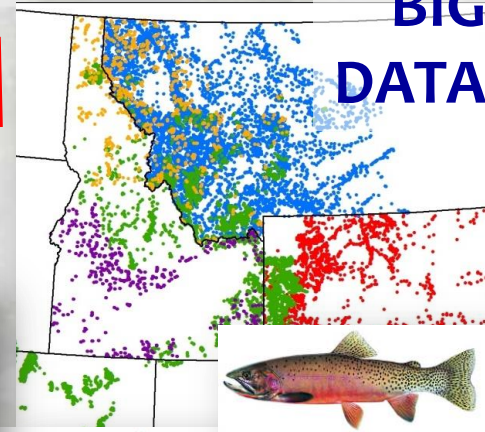
Digital sensors



GeoSpatial analysis



BIG DATA

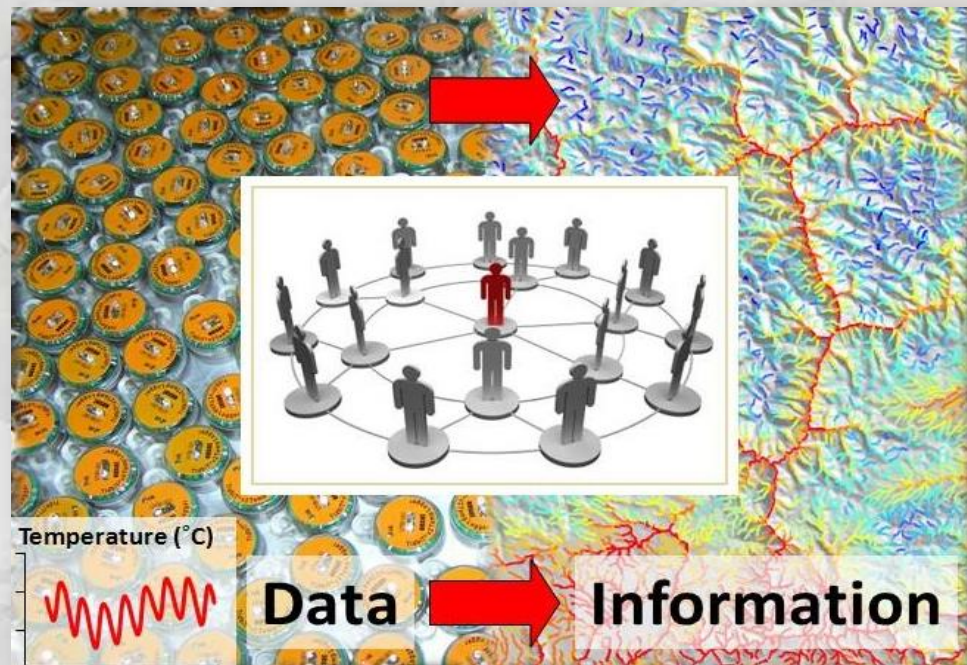


We Don't Hire "fish biologists" Anymore

The other skills are at least as important

Technical teams (4 - 10 people)

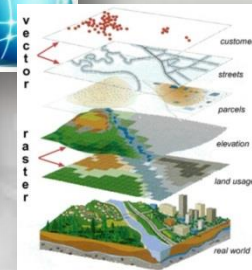
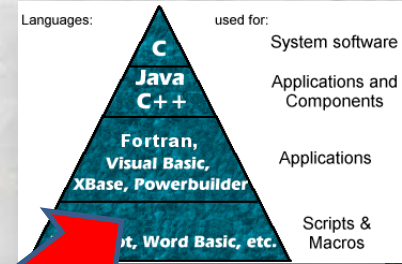
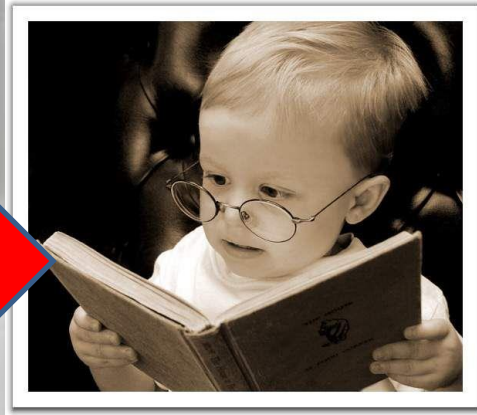
- Fish biologist
- Hydrologist
- Fluvial Geomorphologist
- Database engineer
- Data technicians
- Geospatial analyst
- Web-designer
- Spatial ecologists
- Statisticians



Lifelong, Motivated Learners

Best people often self-taught

Started with traditional skills,
but evolved & diversified...



...harder now if just starting without training

Diversity is Good, but...



...being “Best” at Something Important
Makes you Essential to an Organization

Find & Team With Other “Best” People

“Never doubt that a small group of thoughtful, committed, citizens can change the world. Indeed, it is the only thing that ever has.”

— Margaret Mead



- Many organizations still in denial
- Many organizations feel helpless
- Cultures change from within

Climate Change & Your Career



**Achieving Strategic Goals
Requires Tactical Actions**

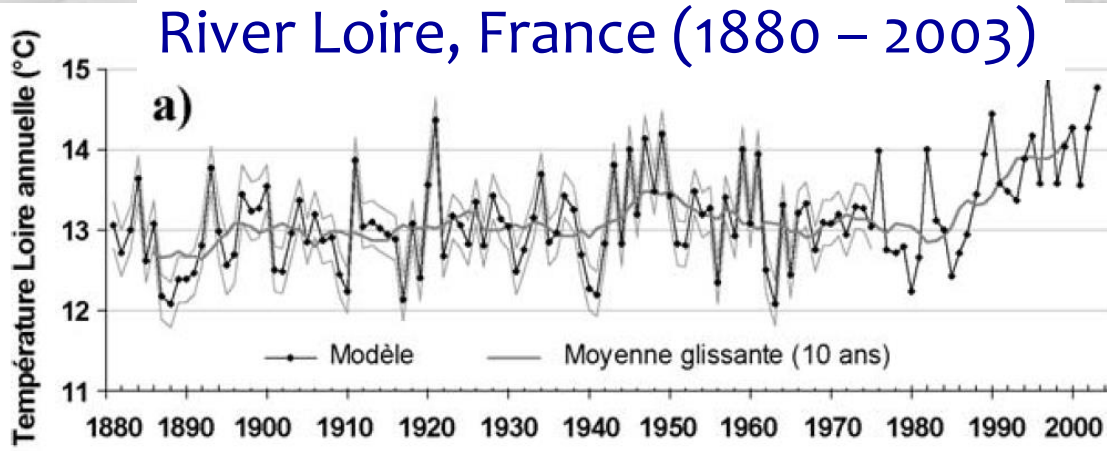


**What do you want to
accomplish in 30 years?
(It goes by quickly...)**



Commit to Quality & Building Something

Long-term Monitoring is Difficult but Essential



Collecting Data is Fun...

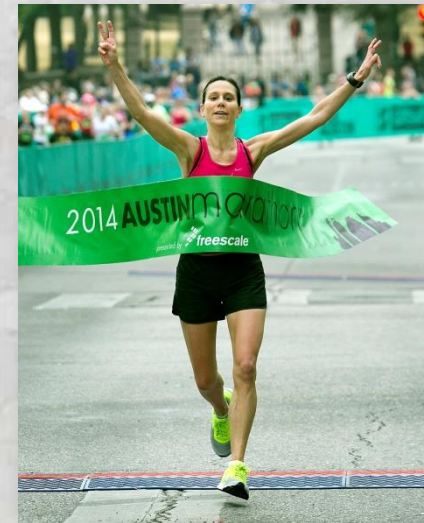
Archiving it & Maintaining a Monitoring Program are Not



Commit to Quality & Building Something

Are you investing in/pushing yourself?

(challenges are how you grow)

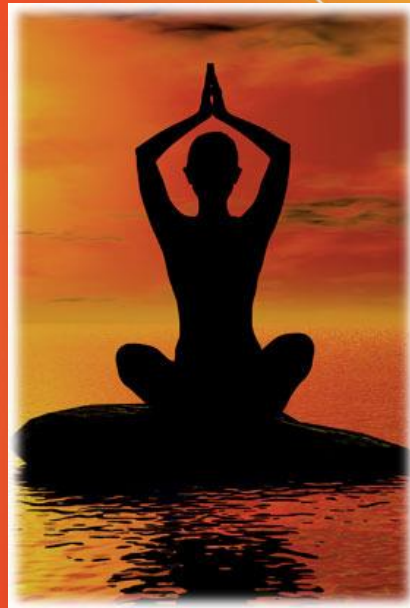


LEADERSHIP
TRAINING
COURSE

Don't let complacency creep in...

Lessons are Universal

Climate Change is Just another Context

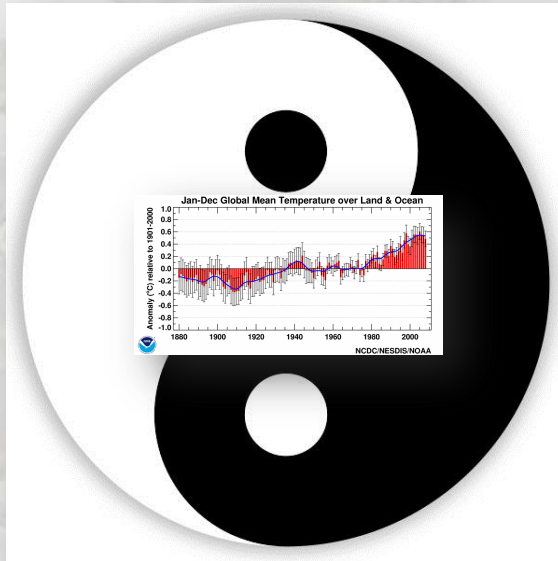


& a Huge Opportunity

Today's Decisions Make Tomorrow's World

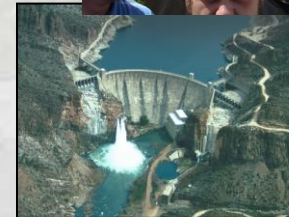
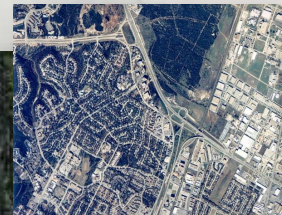
Onus or Opportunity?

Future Fisheries

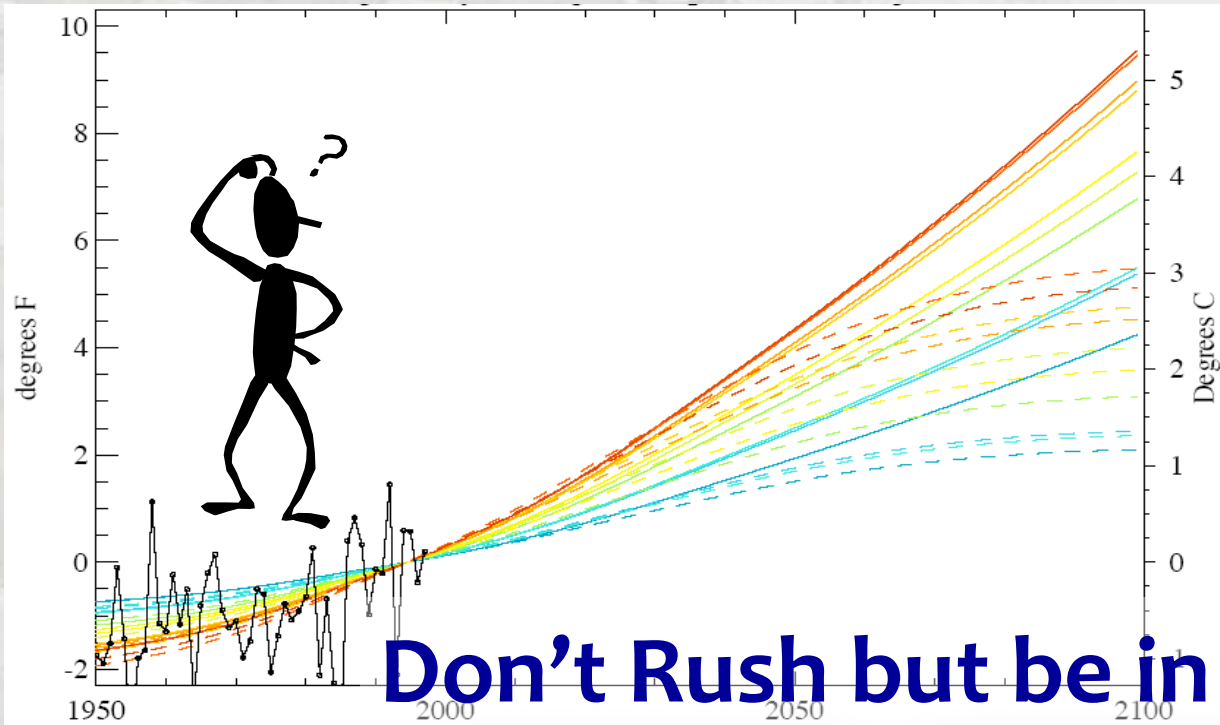


Human Land Use & Water Development

Biodiversity / Life on Earth



Climate Change & Careers Take Time, Commitment to Excellence, & Self-Sacrifice



Don't Rush but be in a Hurry...

