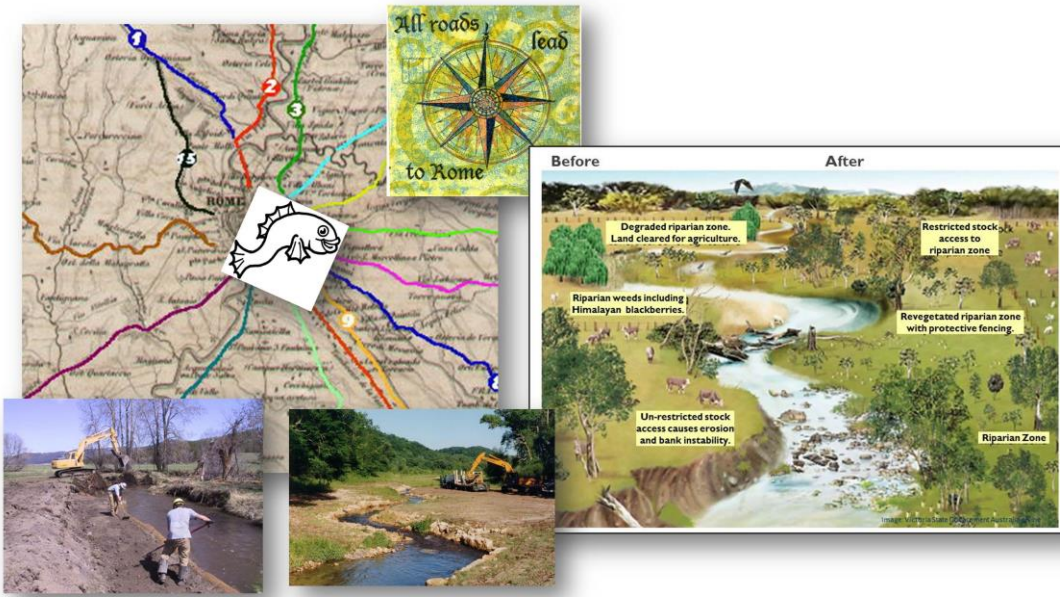
Climate-Aquatics Blog #70: Restoration success stories that improve population resilience to climate change

Multiple fish paths to the same happy place…



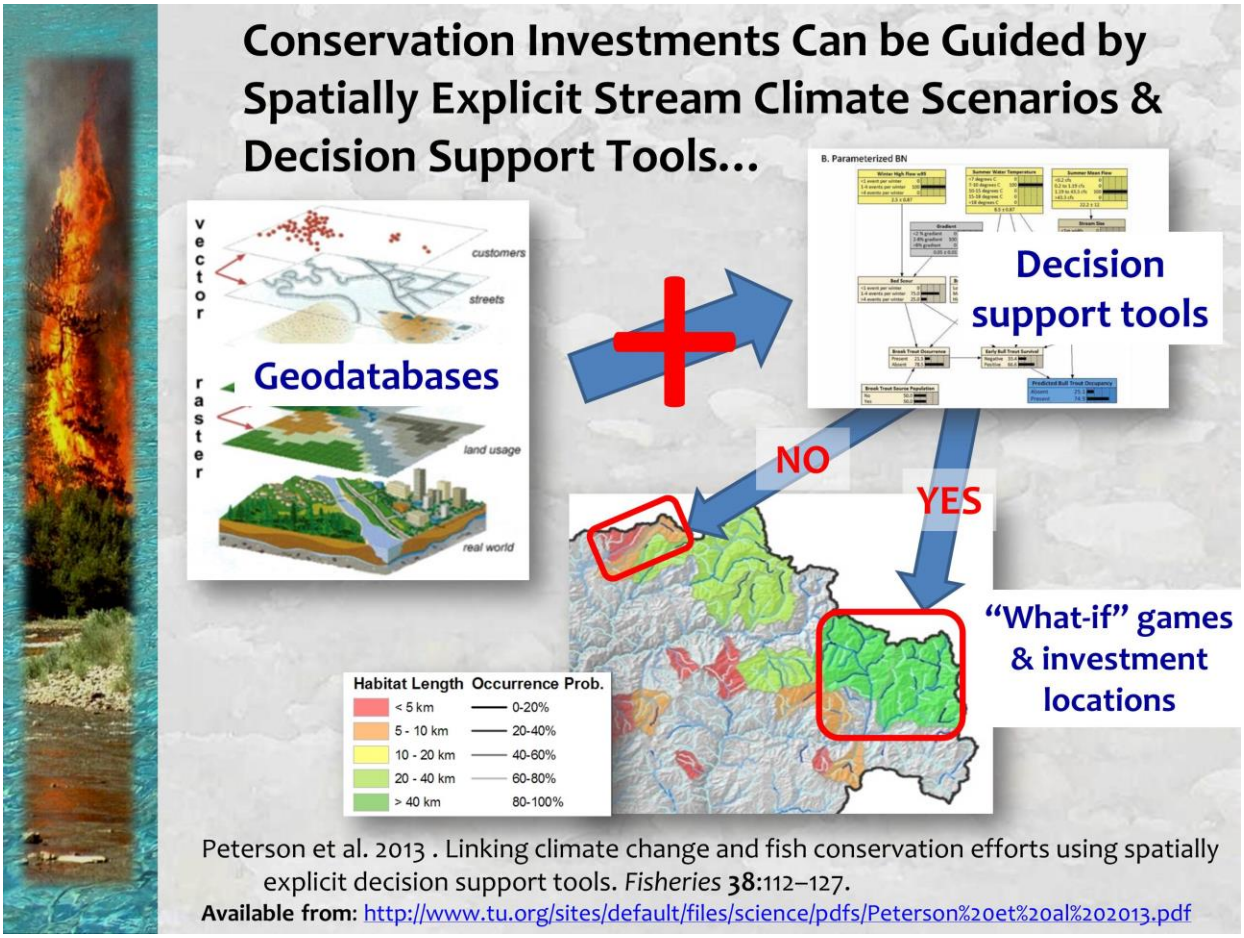
So as the fisheries community continues to develop better databases, climate scenarios, environmental descriptors, and predictive models about when & where fish species and populations occur on the landscape, information overload becomes a real possibility. In those cases, it can be beneficial to develop decision support tools that help integrate multiple sources of information & enable "what-if" games to assess potential benefits of different conservation strategies prior to making real investments. An example of how far those efforts can go is provided by Peterson & colleagues (graphic 1; study hyperlinked here: http://www.tu.org/sites/default/files/science/pdfs/Peterson%20et%20al%202013.pdf), who integrate spatially explicit stream climate scenarios into decision structures concerning common management issues associated with spatial prioritization and the placement/removal of fish barriers (blog #66).

But in many places that level of sophistication may be years away from realization, & it also often takes significant amounts of time for restoration and conservation investments to start bearing fish fruit, so we don't want to fall captive to an "inertia of inaction" as we wait for the perfect models (which we'll never have). A better strategy is to advance in parallel on multiple fronts—let the researchers continue playing in their corner to build better models and information for decision making, but also "move dirt" when & where it makes sense to do so. So today I just wanted to highlight a few success stories with regards to building climate resilience into aquatic ecosystems. The first set of successes is described by Williams & colleagues, who highlight several different case histories in different parts of country (graphic 2; study hyperlinked here: https://www.researchgate.net/profile/Jack_Williams13). The second set of successes is described by Pierce and colleagues regarding work done in the upper Blackfoot River of Montana (graphic 3**;** study attached).

One thing that's obvious from both is that there's nothing fancy about improving the climate resilience of fish populations to climate change, it's basically about improving habitat conditions and moving systems towards greater complexity by restoring natural regimes of flow, temperature, sediment, and connectivity (blogs #22, #58, #59, #62). When fish are given better habitats, they've proven time & again that they're more than happy to propagate themselves into it. The other common thread among these case histories is that the successes often took decades of work by dedicated people who oftentimes called those landscapes home, or were willing to work closely with those who do. That's fitting, because although it's cliché to say "global problem, local solution" that's exactly what it is. Climate adaptation and making a big difference can & will emerge from 1000s of similar case histories being replicated by people that care in watersheds around the globe that they call home.

Until next time, best regards. Dan

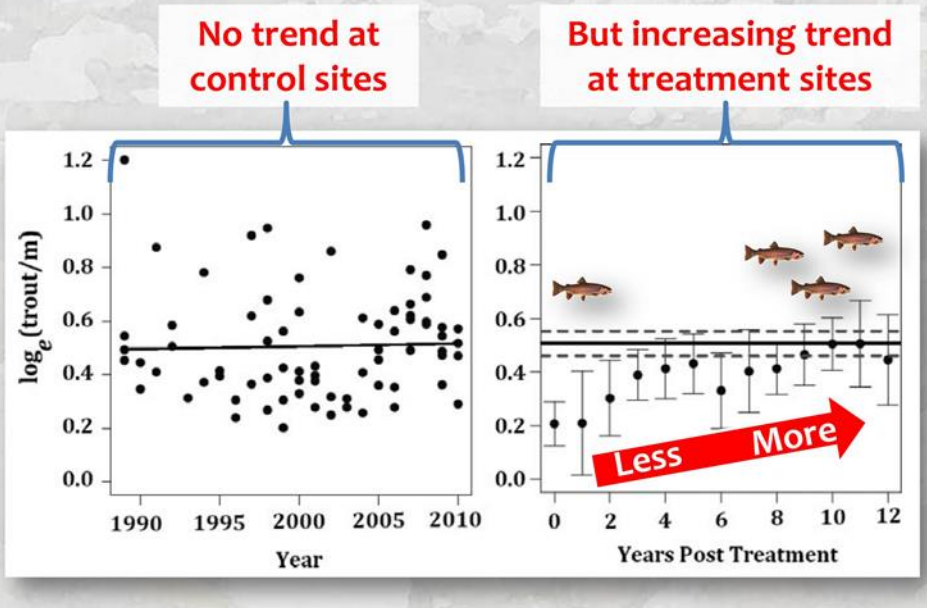
Tweeting at Dan Isaak@DanIsaak



… or Common Sense Based on General Concepts of Improving Habitat Access & Complexity…

Williams et al. 2015. Climate change adaptation and restoration of western trout streams: Opportunities and strategies. *Fisheries* **40**:304-317.
Available from: https://www.researchgate.net/profile/Jack_Williams13

… The Fish Will Do Their Part in Quality Habitat



Pierce et al. 2013. Response of wild trout to stream restoration over two decades in the Blackfoot River basin, Montana. *Transactions of the American Fisheries Society* **142**:68–81.
Available from: http://www.tandfonline.com/doi/abs/10.1080/00028487.2012.720626

Welcome to the Climate-Aquatics Blog. For those new to the blog, previous posts with embedded graphics can be seen by clicking on the hyperlinks at the bottom or by navigating to the blog archive webpage here: (http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temp/stream_temperature_climate_aquatics_blog.html). The intent of the Climate-Aquatics Blog is to provide a means for the 9,214 (& growing) field biologists, hydrologists, anglers, students, managers, and researchers currently on this mailing list across North America, South America, Europe, and Asia to more broadly and rapidly discuss topical issues associated with aquatic ecosystems and climate change. Messages periodically posted to the blog highlight new peer-reviewed research and science tools that may be useful in addressing this global phenomenon. Admittedly, many of the ideas for postings have their roots in studies my colleagues & I have been conducting in the Rocky Mountain region, but attempts will be made to present topics & tools in ways that highlight their broader, global relevance. I acknowledge that the studies, tools, and techniques highlighted in these missives are by no means the only, or perhaps even the best, science products in existence on particular topics, so the hope is that this discussion group engages others doing, or interested in, similar work and that healthy debates & information exchanges occur to facilitate the rapid dissemination of knowledge among those concerned about climate change and its effects on aquatic ecosystems.

If you know others interested in climate change and aquatic ecosystems, please forward this message to them. If you do not want to be contacted again in the future, please reply to that effect and you will be de-blogged.

Previous Blogs…

Climate-Aquatics Overviews

Blog #1: Climate-aquatics workshop science presentations available online
Blog #2: A new climate-aquatics synthesis report

Climate-Aquatics Thermal Module

Blog #3: Underwater epoxy technique for full-year stream temperature monitoring
Blog #4: A GoogleMap tool for interagency coordination of regional stream temperature monitoring
Blog #5: Massive air & stream sensor networks for ecologically relevant climate downscaling
Blog #6: Thoughts on monitoring air temperatures in complex, forested terrain
Blog #7: Downscaling of climate change effects on river network temperatures using inter-agency temperature databases with new spatial statistical stream network models
Blog #8: Thoughts on monitoring designs for temperature sensor networks across river and stream basins
Blog #9: Assessing climate sensitivity of aquatic habitats by direct measurement of stream & air temperatures
Blog #10: Long-term monitoring shows climate change effects on river & stream temperatures
Blog #11: Long-term monitoring shows climate change effects on lake temperatures
Blog #12: Climate trends & climate cycles & weather weirdness
Blog #13: Tools for visualizing local historical climate trends
Blog #14: Leveraging short-term stream temperature records to describe long-term trends
Blog #15: Wildfire & riparian vegetation change as the wildcards in climate warming of streams
Blog #23: New studies describe historic & future rates of warming in Northwest US streams
Blog #24: NoRRTN: An inexpensive regional river temperature monitoring network
Blog #25: NorWeST: A massive regional stream temperature database
Blog #26: Mapping thermal heterogeneity & climate in riverine environments
Blog #40: Crowd-sourcing a BIG DATA regional stream temperature model
Blog #60: Bonus Blog: New report describes data collection protocols for continuous monitoring of temperature & flow in wadeable streams
Blog #61: Significant new non-American stream temperature climate change studies

Blog #62: More Bits about the How, What, When, & Where of Aquatic Thermalscapes
Blog #63: Navigating stream thermalscapes to thrive or merely survive
Blog #64: Building real-time river network temperature forecasting systems

Climate-Aquatics Hydrology Module
Blog #16: Shrinking snowpacks across the western US associated with climate change
Blog #17: Advances in stream flow runoff and changing flood risks across the western US
Blog #18: Climate change & observed trends toward lower summer flows in the northwest US
Blog #19: Groundwater mediation of stream flow responses to climate change
Blog #20: GIS tools for mapping flow responses of western U.S. streams to climate change
Blog #21: More discharge data to address more hydroclimate questions
Blog #22: Climate change effects on sediment delivery to stream channels

Climate-Aquatics Cool Stuff Module
Blog #27: Part 1, Spatial statistical models for stream networks: context & conceptual foundations
Blog #28: Part 2, Spatial statistical models for stream networks: applications and inference
Blog #29: Part 3, Spatial statistical models for stream networks: freeware tools for model implementation
Blog #30: Recording and mapping Earth's stream biodiversity from genetic samples of critters
Blog #53: DNA Barcoding & Fish Biodiversity Mapping

Climate-Aquatics Biology Module
Blog #31: Global trends in species shifts caused by climate change
Blog #32: Empirical evidence of fish phenology shifts related to climate change
Blog #33: Part 1, Fish distribution shifts from climate change: Predicted patterns
Blog #34: Part 2, Fish distribution shifts from climate change: Empirical evidence for range contractions
Blog #35: Part 3, Fish distribution shifts from climate change: Empirical evidence for range expansions
Blog #36: The "velocity" of climate change in rivers & streams
Blog #37: Part 1, Monitoring to detect climate effects on fish distributions: Sampling design and length of time
Blog #38: Part 2, Monitoring to detect climate effects on fish distributions: Resurveys of historical stream transects
Blog #39: Part 3, Monitoring to detect climate effects on fish distributions: BIG DATA regional resurveys
Blog #41: Part 1, Mechanisms of change in fish populations: Patterns in common trend monitoring data
Blog #42: BREAKING ALERT! New study confirms broad-scale fish distribution shifts associated with climate change
Blog #56: New studies provide additional evidence for climate-induced fish distribution shifts
Blog #43: Part 2, Mechanisms of change in fish populations: Floods and streambed scour during incubation & emergence
Blog #44: Part 3, Mechanisms of change in fish populations: Lower summer flows & drought effects on growth & survival
Blog #45: Part 4, Mechanisms of change in fish populations: Temperature effects on growth & survival
Blog #46: Part 5, Mechanisms of change in fish populations: Exceedance of thermal thresholds
Blog #47: Part 6, Mechanisms of change in fish populations: Interacting effects of flow and temperature
Blog #48: Part 7, Mechanisms of change in fish populations: Changing food resources
Blog #49: Part 8, Mechanisms of change in fish populations: Non-native species invasions
Blog #50: Part 9, Mechanisms of change in fish populations: Evolutionary responses
Blog #51: Part 10, Mechanisms of change in fish populations: Extinction
Blog #52: Review & Key Knowable Unknowns
Blog #65: The Fish Jumble as they Stumble along with the Shifting ThermalScape

Climate-Aquatics Management Module

Blog #54: Part 1, Managing with climate change: Goal setting & decision support tools for climate-smart prioritization

Blog #55: Part 2, Managing with climate change: Streams in channels & fish in streams

Blog #57: Identifying & protecting climate refuge lakes for coldwater fishes

Blog #58: Part 3, Managing with climate change: Maintaining & improving riparian vegetation & stream shade

Blog #59: Part 4, Managing with climate change: Keeping water on the landscape for fish (beaverin' up the bottoms)

Blog #66: Part 5, Managing with climate change: Barrier placements to facilitate fish flows across landscapes

Blog #67: Part 6, Managing with climate change: Assisted migration to facilitate fish flows across landscapes

Blog #68: Identifying & protecting climate refugia as a strategy for long-term species conservation

Blog #69: Building climate-smart conservation networks (metapopulations + biodiversity + refugia)