THRESHOLDS IN FISH VULNERABILITY TO CLIMATE CHANGE - INDUCED STREAMFLOW ALTERATION

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USGS science for a changing world

ECOLOGY

USGS Ecosystem Mission Area
Priority Ecosystem Studies Large Landscapes program

REGIONAL FISH DATASETS

Local ***fish assemblage*** data experts
Link fish data to streams & stream gages
Identify stakeholders & associated ***science needs***
Facilitate ***stakeholder connections***

Priority Ecosystem Studies landscapes

COLUMBIA RIVER BASIN

Tim Counihan
WFRC

Identify flow requirements for ***fish hosts of native mussels***
Effects of altered ***precipitation regimes & hydropower*** on streams

native trout species




△ *stream gages*
● *nation-wide fish survey sites*

Photo credits: Ryan Hagerty, Tom Koerner, Doug Springer, USFWS

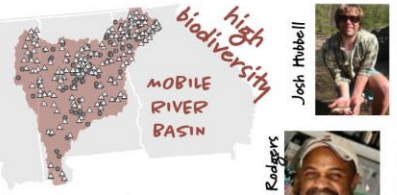
UPPER COLORADO RIVER BASIN

Maintain flow conditions for ***river recreation***
Protect ***water resources*** for fishes and human water use demands

Bob Zuellig
CO WSC

imperiled endemics


Photo credits: Ryan Hagerty, USFWS



Josh Hubbell

Kirk Rodgers

Effects of ***growing water use demand*** on low streamflow conditions
Understand suitable streamflow habitat conditions for state-listed ***fish species of conservation need***

LMG WSC


Photo credits: Ryan Hagerty, Eric Engbretson, Brett Billings, USFWS

tributary spawning habitat

Identify hyrdologic conditions to ***control the spread of invasive species***
Preserve stream habitat for ***economically important game fishes***

Jim McKenna
GLSC


headwater refugia

Kelly Maloney

Taylor Woods
EESC

Effects of human ***population growth and developed land-use*** on streams
Restoring stream health in 10% of watershed
Maintain and restore ***connectivity for migratory fishes***

NATIONAL

Conserve functioning streams
Identify ***optimal hydrologic regimes*** for fish production

Daniel Wieferich
CSS SAS

HYDROLOGY

CONUS HYDROLOGY

Identify process-based predictor variables
Develop ***modelling framework***
Model ***streamflow alteration*** metrics at all reaches in ***contemporary & future periods***

Ken
Eng
WMA

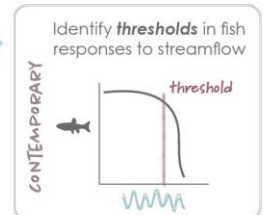
Jared
Smith
WMA

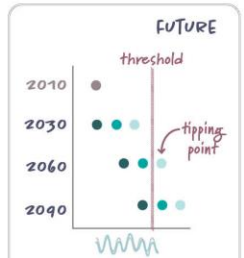
Tanja
Williamson
OH-KY-IN
WSC

MODELS

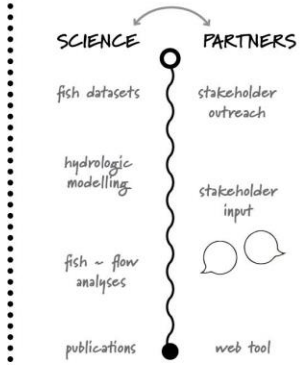
ECOHYDROLOGY

Identify ***thresholds*** in fish responses to streamflow





Risk assessment of fish responses to projected streamflow alteration



Background

- USGS Priority Ecosystems Studies (PES) Large Landscapes (land management research program)
- Solicited RFP in FY23
- Our team was selected as the inland project

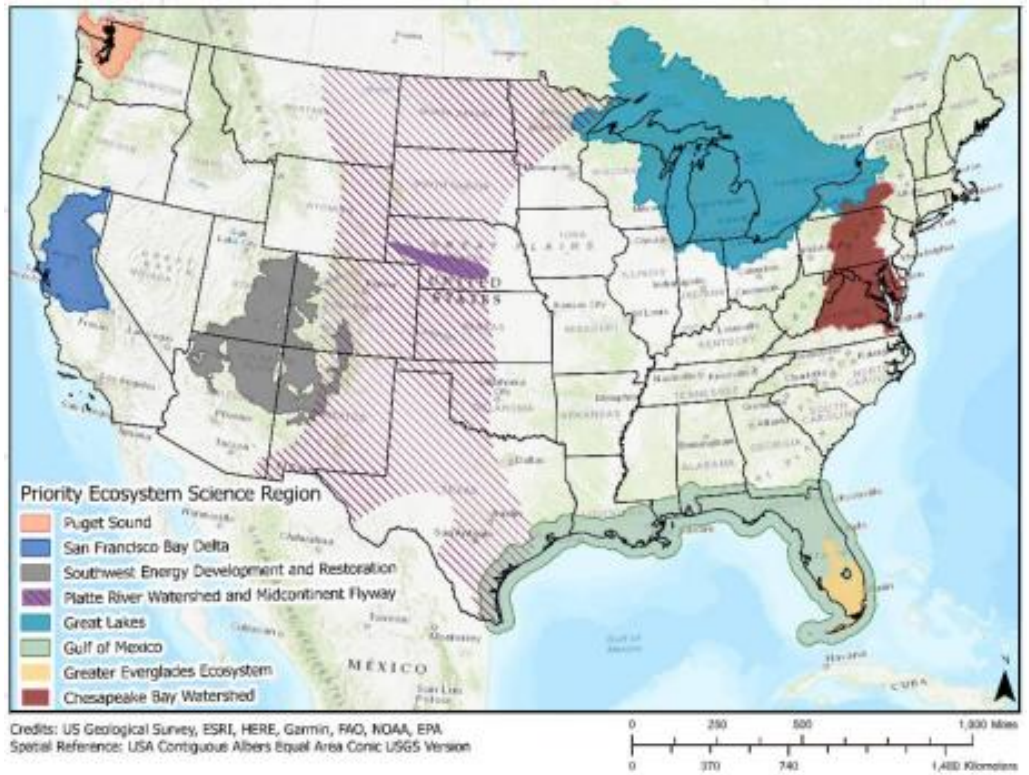
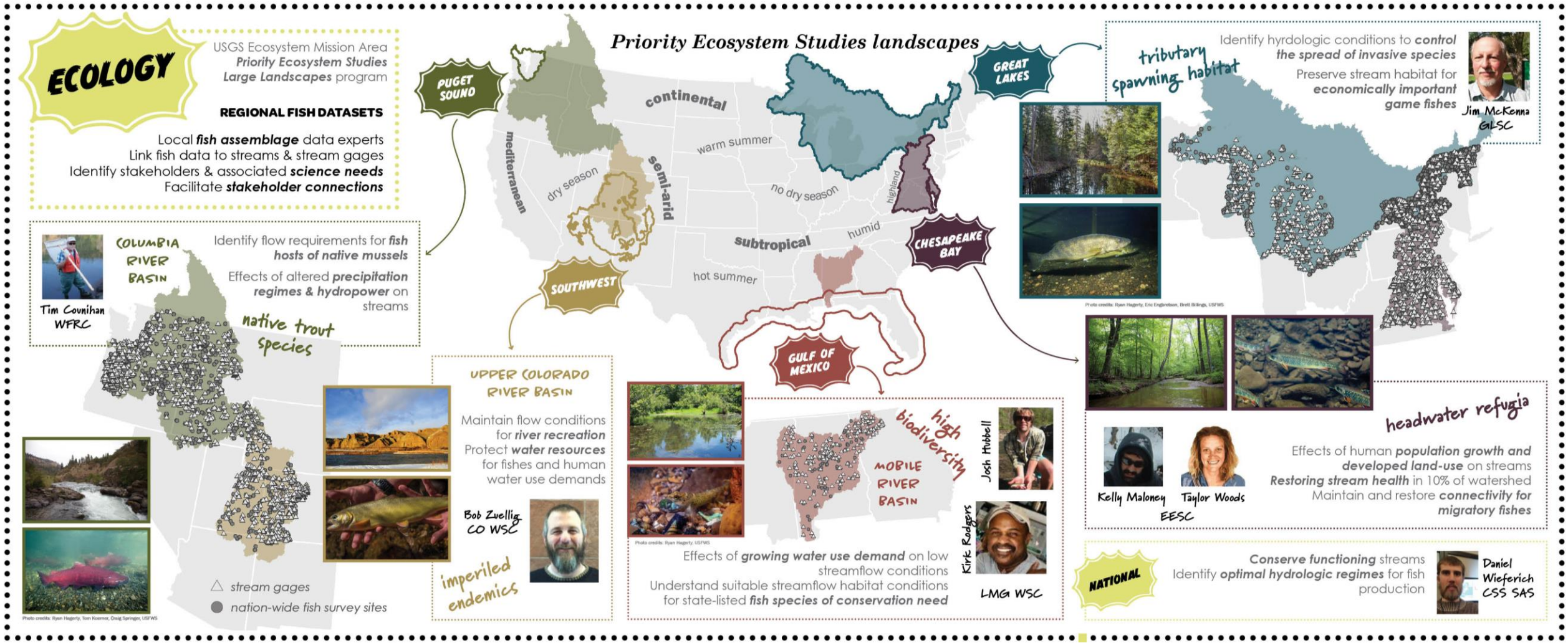


Figure 1. Map of the large-landscape efforts that are collaborating to advance USGS and stakeholder priorities.

https://www.usgs.gov/programs/land-management-research-program/priority-landscapes



- From each region: compile **fish datasets**, identify **science needs & collaborative partnerships**

Goals

- Understand potential similarities and differences in stream fish vulnerability to climate change across regions
- Learn what tools and techniques are used for vulnerability assessments in each region
- Apply lessons learned in one region to other regions

- Modeling **flow regime metrics** at all National Hydrography Dataset version 2.1 (1:100K) streams in each region
- 1980-2020: contemporary
- 2021-2100 **projections based on scenarios of climate & land-use/land-cover**

Outcomes: hydrology

- Annual streamflow statistics:
  - High flow (**flood**) – frequency, magnitude, duration
  - Low flow (**drought**) – frequency, magnitude, duration
  - Monthly flows

→ Which streams are most at risk for altered flow regimes from climate & LULC change?

Outcomes: ecology

- Vulnerability assessments of certain biological endpoints (e.g., traits)
- Habitat suitability models for species &/or guilds of interest

→Which fish communities might be most affected by climate, LULC, & shifts in streamflow regimes?

→Differences & similarities among regions, stream types?

Anticipated timeline

September 2024

- Fish dataset preparation
- Summarizing data for hydrologic models
- Hydrologists complete modeling
- Informing modeling needs & project deliverables
- Linking fish to flow data
- Complete biological modeling
- Project deliverables

Vocalize your thoughts, post in chat, or submit via the linked form

Seeking feedback ….

Credit: Ryan Hagerty, USFWS

- What are your biggest concerns about the potential impacts of climate and land use change on stream flows and fish communities?

Contact
Taylor Woods tewoods@usgs.gov
Sean Emmons semmons@usgs.gov
Kelly Maloney kmaloney@usgs.gov

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Seeking feedback ….

Credit: Ryan Hagerty, USFWS

- What information would be most valuable to you in addressing these concerns about the impacts of climate and land use change on stream flows and fish communities?

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- How would you prefer to receive and access outcomes/data/deliverables?

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