Wetlands to Enhance Drought Resilience on the Coeur d'Alene Reservation

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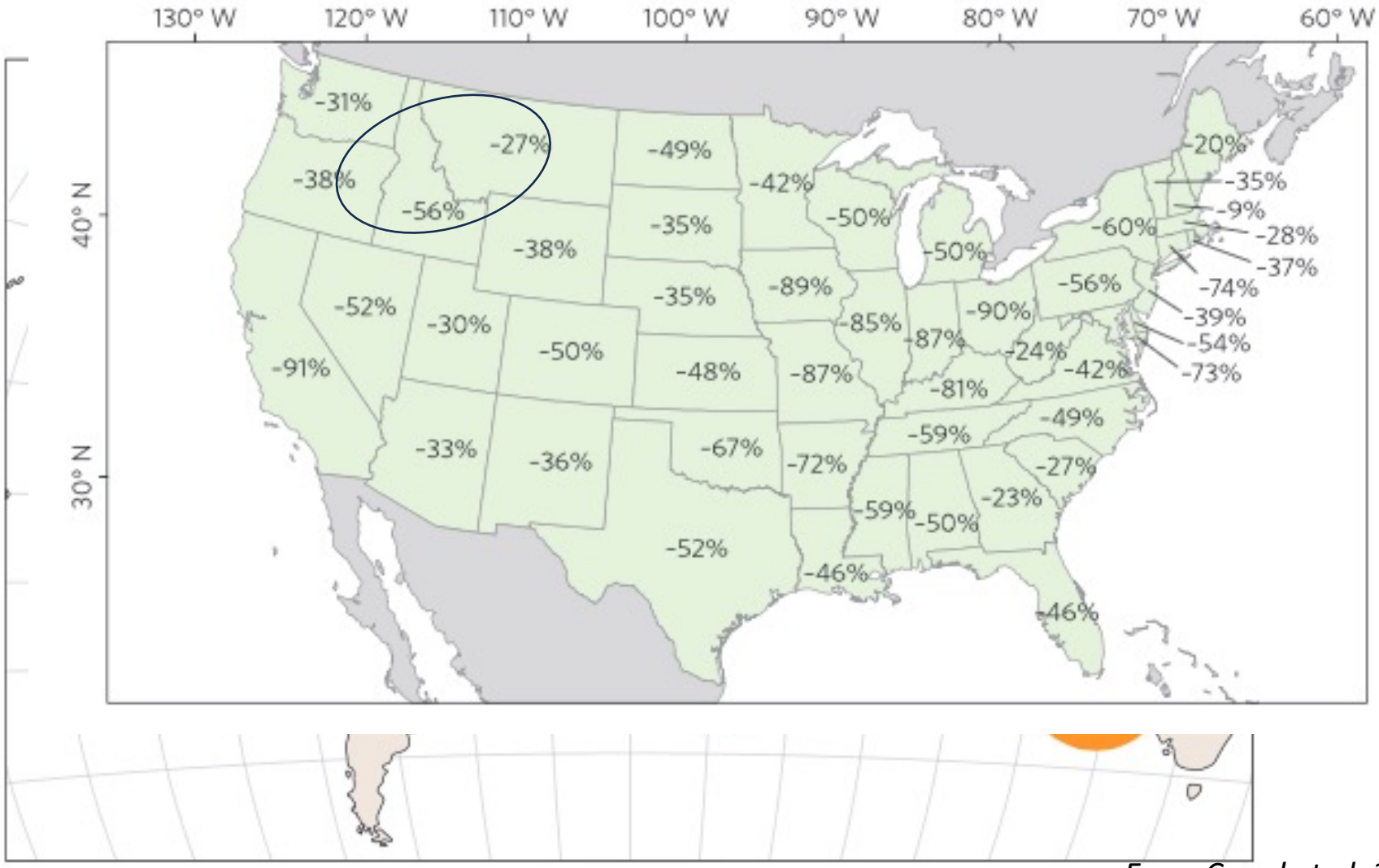
Living Coasts
Watersheds, Wetlands, & Wildlife
Tomorrow's Forests

BARUCH INSTITUTE OF COASTAL ECOLOGY AND FOREST SCIENCE
College of Agriculture, Forestry and Life Sciences

Wetland Loss



From Creed et al. 2017

PROTECTING DOWNSTREAM WATER QUALITY

CONTRIBUTING CLEAN WATER FOR DRINKING, IRRIGATION, RECREATION, COMMERCIAL FISHING, AND

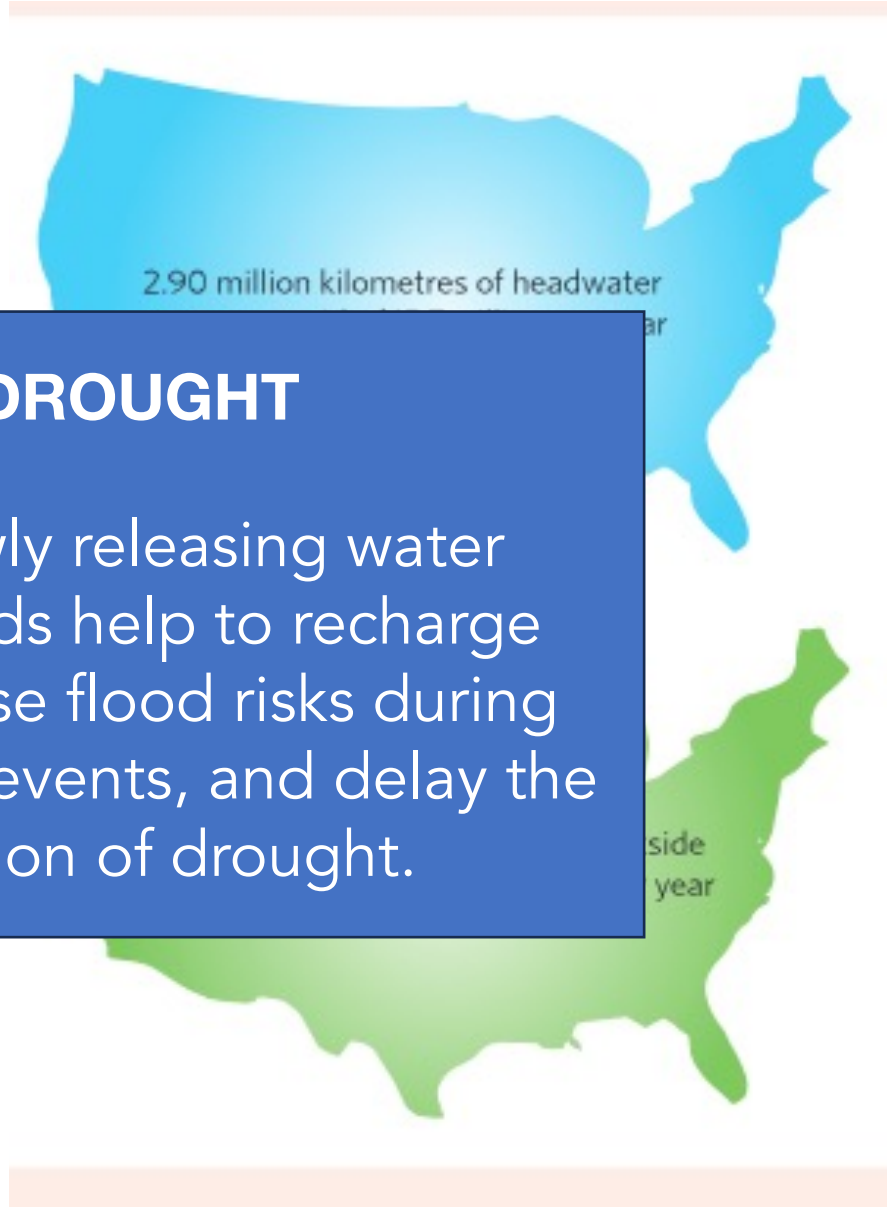
FILTERING POL
REDUCING DO
TREATMEN

REDUCING FLOODING

PROTECTING PROPERTY AND INFRASTRUCTURE

MITIGATE DROUGHT

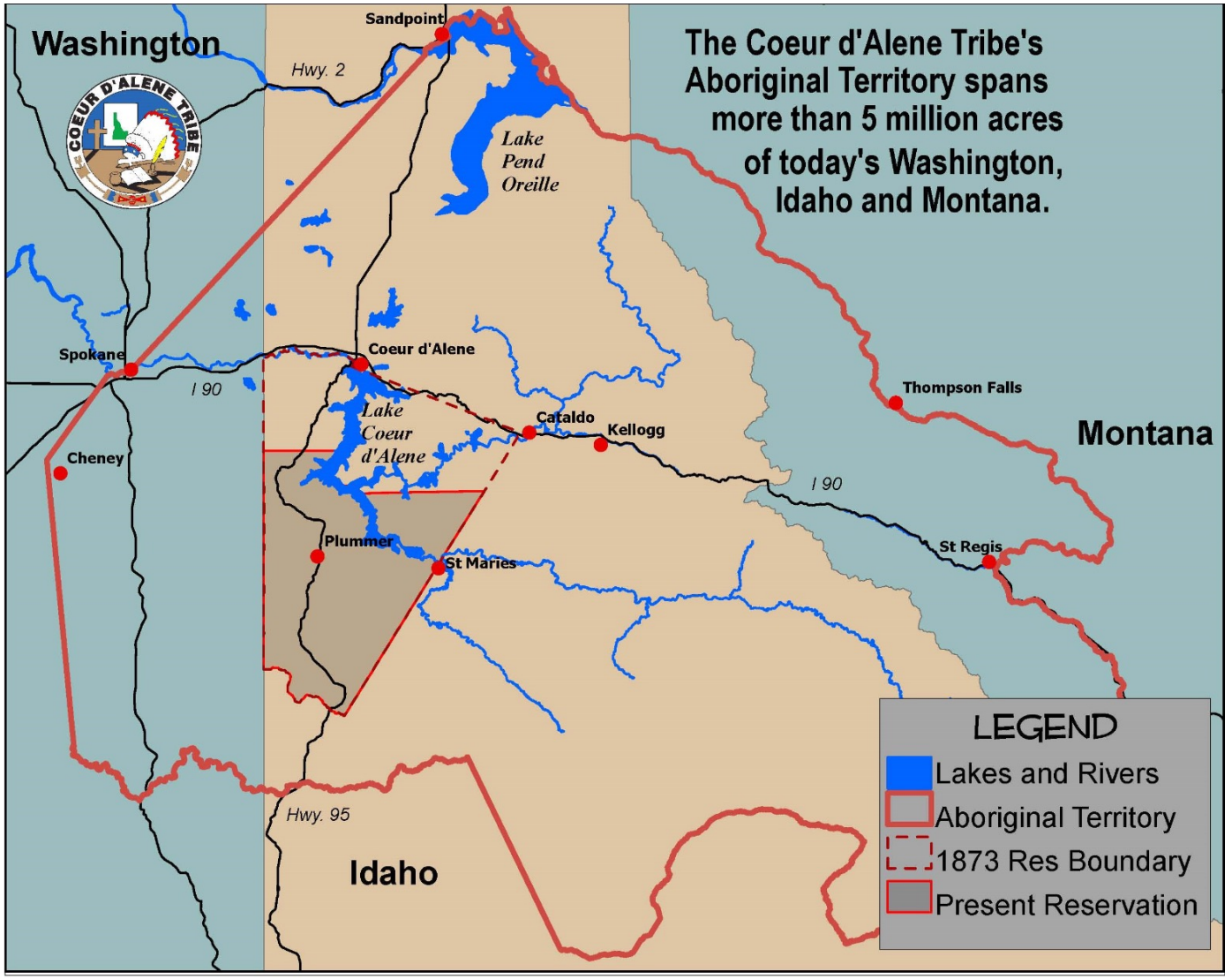
By storing and slowly releasing water downstream, wetlands help to recharge groundwater, decrease flood risks during extreme precipitation events, and delay the onset and duration of drought.



From Creed et al. 2017

Coeur d'Alene Reservation

- 345,000 acres
- Shares jurisdiction with State of Idaho, county governments, municipalities, federal agencies

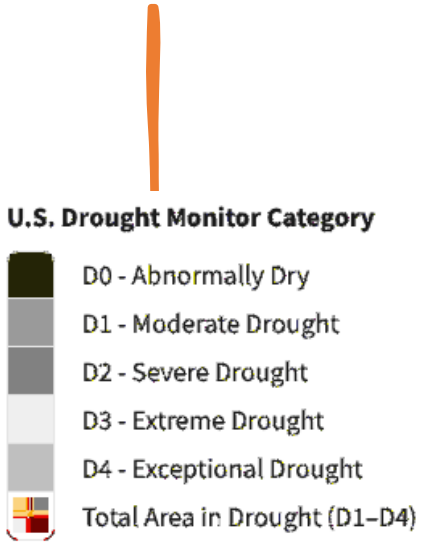


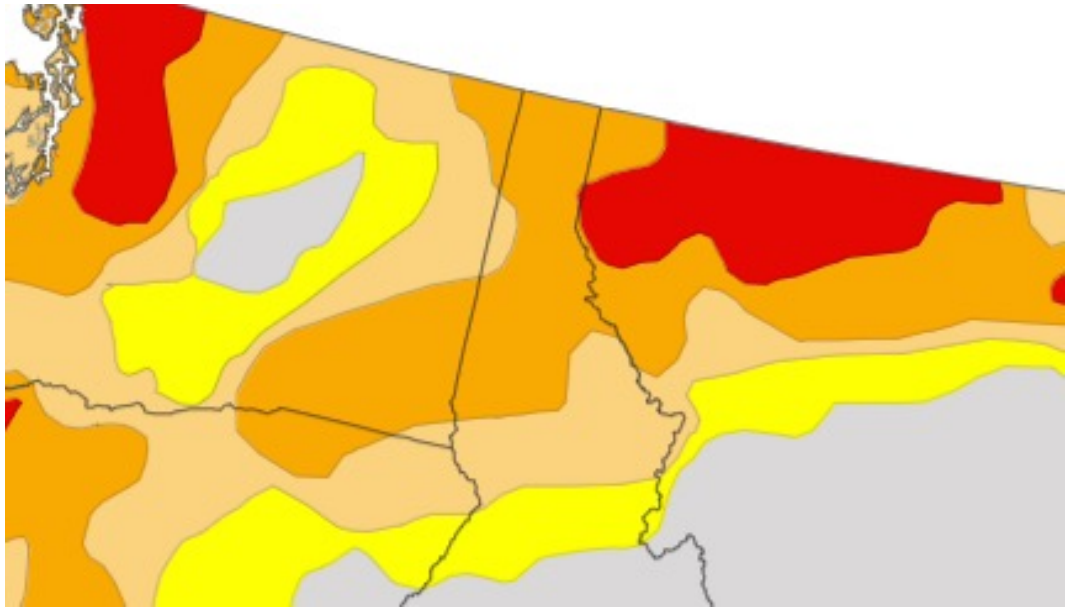
Overview

- 65% of the wetlands once found within the Coeur d'Alene Indian Reservation boundaries have been lost since non-Indian settlement of the area began in the 1800's.
- Project focused on implementing constructed and restored wetlands to build Tribal capacity around drought resilience
- Integrate Tribal traditional knowledge and cultural values with the evolving science of constructed and restored wetlands

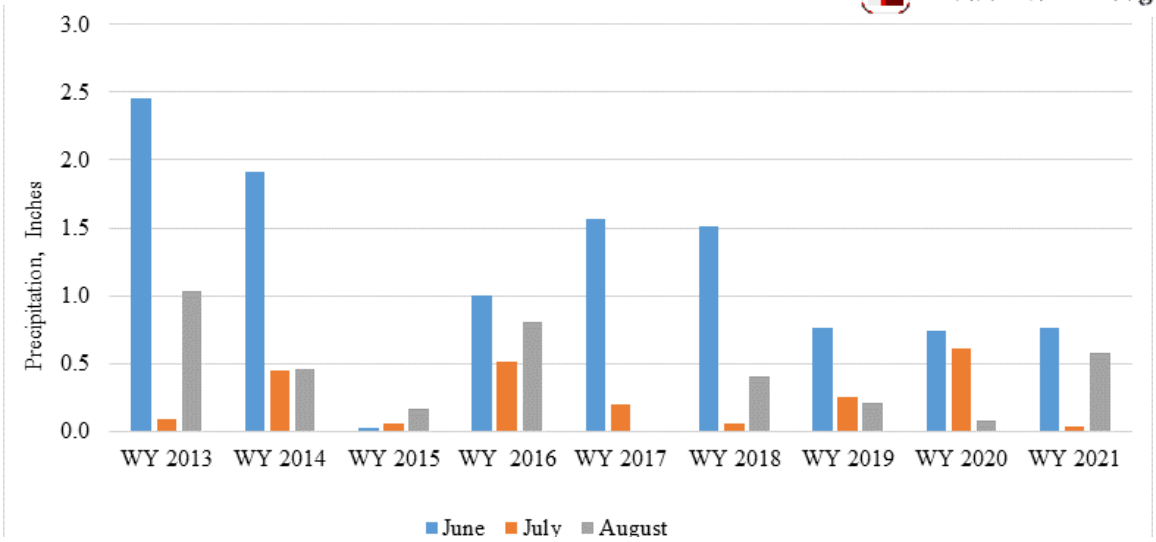
Conceptual image of riverine wetland on the Coeur d'Alene Indian Reservation, Idaho. Wetlands mitigate drought through multiple mechanisms, such as by storing water and supplying stream baseflows. Wetlands also provide additional ecosystem services, including providing habitat and refuge from drought for culturally important plants and animals. Examples provided here with English and Coeur d'Alene names (of the 21 plants and 65 animals associated with streams and wetlands identified as culturally important by the CDA Tribe). Cultural services relate to interactions of Tribal members with the wetlands such as hunting, gathering, and education/transmission of knowledge. (Sulliván et al. 2021)

Increasing indicators of drought





Current conditions - U.S. Drought Monitor. Source: https://www.drought.gov/



Summer precipitation on the CDA Reservation, showing a general decline since 2013. Source: Coeur d'Alene Tribe Public Works.

Time series of drought conditions on the Coeur d'Alene Reservation 2000-2021. Source: National Drought Mitigation Center (2021).

Restoration Plan

Restoration projects will result in functioning floodplain and riparian wetlands (i.e., wetlands found along streams and rivers) that will (1) **enhance fish refugia**, (2) **provide additional habitat for culturally important wetland plants**, and (3**) restore stream-wetland complexes that historically were critical components of the Reservation landscape.**

Methodology will be based on common wetland restoration techniques that reconnect hydrological connectivity with floodplains and adjacent stream and river channels.

Restoration

- Illustration of the Stage 0 restoration process-based approach for stream, floodplain, and wetland restoration that will serve as the basis for wetland-stream complexes on the Coeur d'Alene Reservation. This approach uses landscape controls (unconfined, depositional valleys), watershed-processes, and reach-scale processes to restore and enhance ecological processes.
    - Dashed lines indicate processes that can dynamically change over time and space. Solid lines indicate static controls and effects and responses to changing processes.

Research Plan

Quantify ecosystem and cultural services provisioned by constructed/restored wetlands, including measuring the contribution of wetlands in maintaining baseflow for adjacent streams and rivers.

Compare restored vs. natural riparian wetland functions including metrics on the abundance and distribution of culturally important fish, wildlife, and plant species.

Evaluate how traditional ecological knowledge (e.g., of wetland plants, animal movement, impacts of climate change on wetland ecological processes) can be best used to assess the ability of our wetland restoration projects to improve drought resilience of wetlands and their adjacent stream ecosystems.

Metric	Time-frame (yrs)	Methods	Wetlands	Adjacent Streams
Groundwater				
Temperature	2.5	HOBO Tidbits	X	
Absolute Pressure	2.5		X	
Level	2.5	Piezometers		
Surface Water				
Temperature	10	HOBO Tidbits	X	X
Conductivity	10	HOBO Tidbits	X	X
Level/Dry-downs	10	HOBO Water Level Sensors	X	X
Precipitation				
Quantity	10	Data loggers, IK	X*	X*
Frequency	10	Data loggers, IK	X*	X*
Plants				
Diversity	5	Field surveys	X	
Abundance	5	Drones	X	
Culturally- important species	5	Field surveys, IK	X	
Culturally-important Wildlife				
Waterfowl	5	Drones, IK	X	
Beaver, moose	5	Trail cameras, IK	X	
Fish	5	Field surveys, IK	X	X
Cultural services				
Knowledge transmission/ education	2	Interviews, IK	X†	
Traditional uses	2	Interviews, IK	X†	

Fieldwork

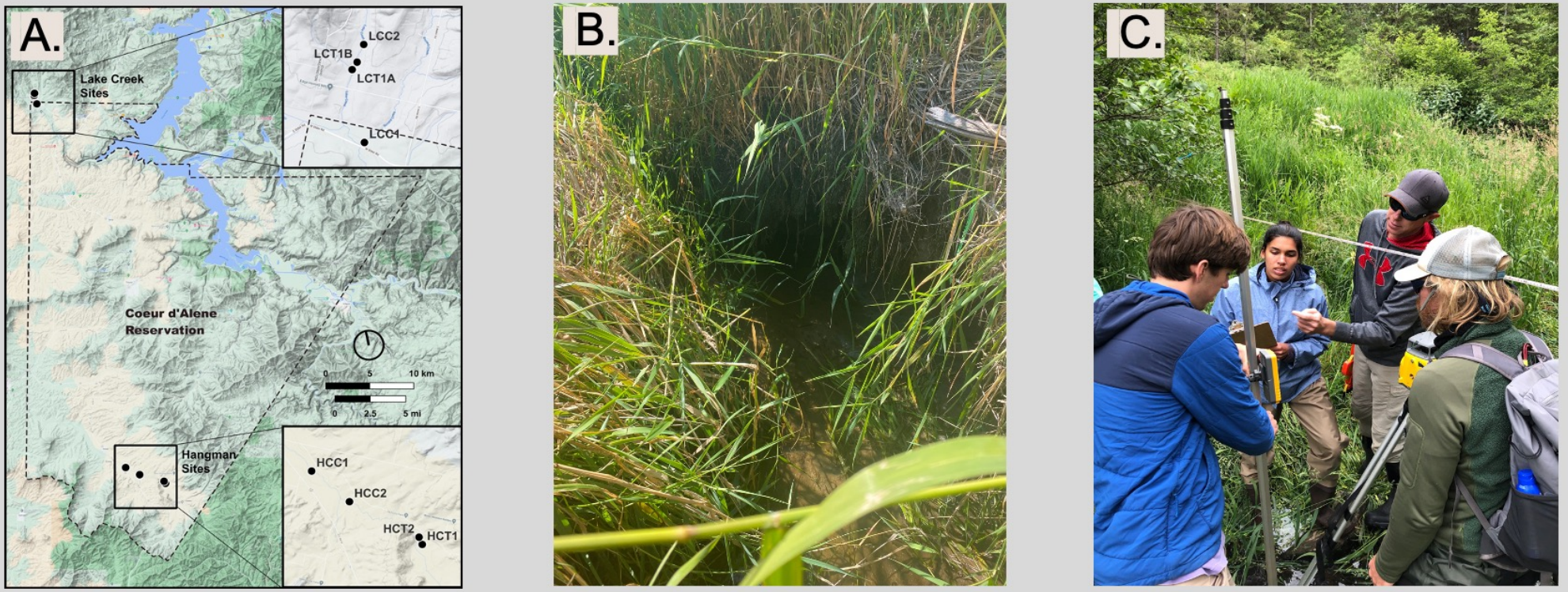


Figure 1. A. Map of study sites (Hangman and Lake Creek) in Northern Idaho. **B.** Incised channel, resulting from agriculture and land use change at the Lake Creek Treatment Site. **C.** The team taking stream slope measurements using a laser level.

Culturally Important Plants

Figure 4. Culturally important plant species found on the Ceour d'Alene reservation: **A.** Camas, **B.** Black hawthorn, and **C.** Red-osier dogwood.

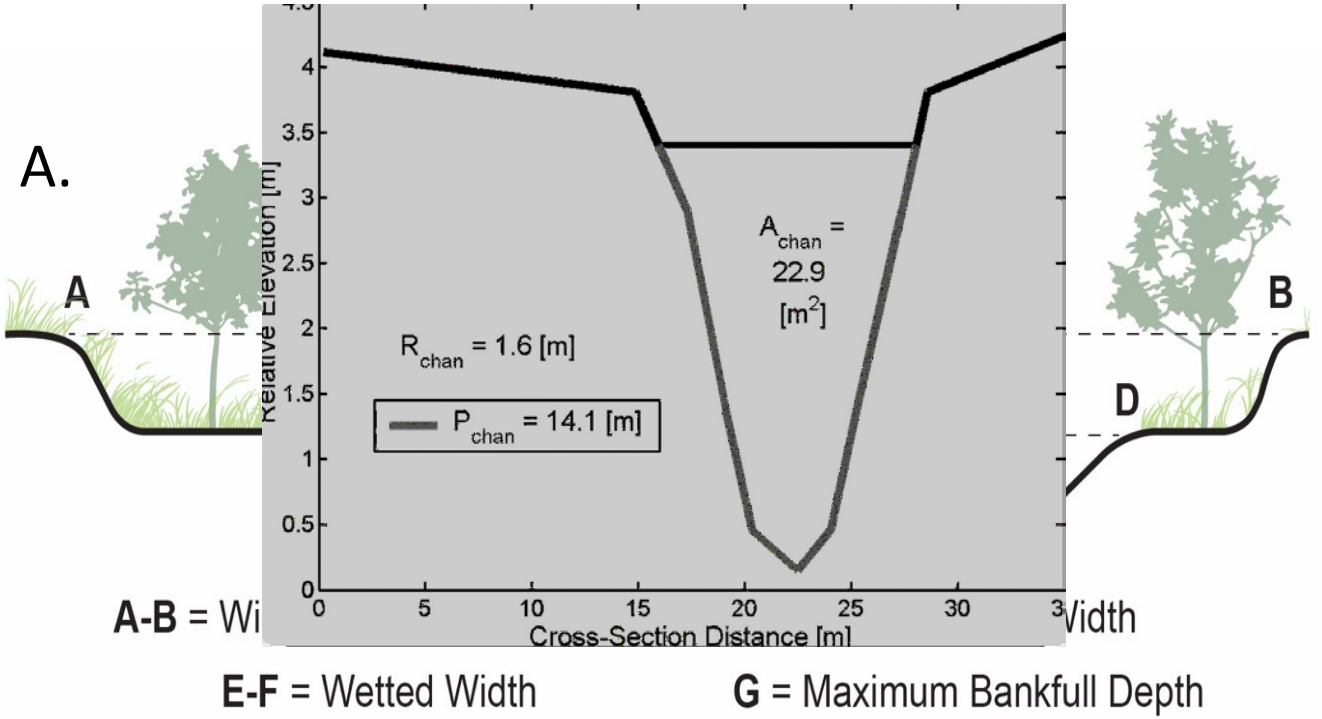
Fluvial Geomorphology

- Only when interactions between streamflow and the riverscape are maintained can diverse ecological processes be sustained over time (Fausch et al. 2002).
  - Fluvial geomorphology key mediator re: riparian plants and animals.

Bankfull discharge: Channel-forming flow with recurrence interval ~1.5 yrs.

Floodprone area: generally includes active floodplain and low terrace.

Floodplain: Flat area adjoining river channel constructed by river in the present climate and overflows during moderate flow events in natural channel.



MacWilliams et al. 2009

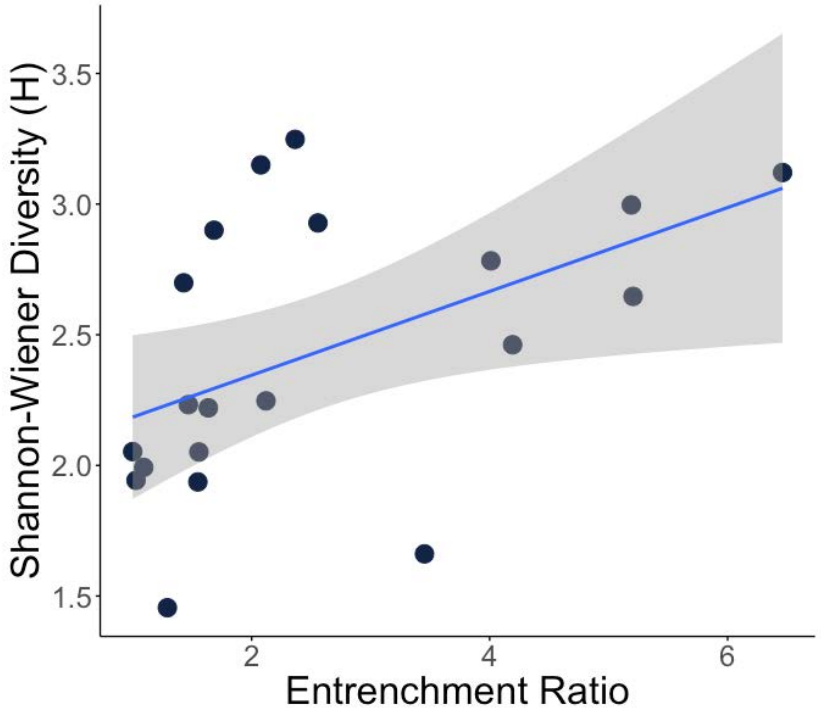
Keast, Sanchez, Sulliván 2023

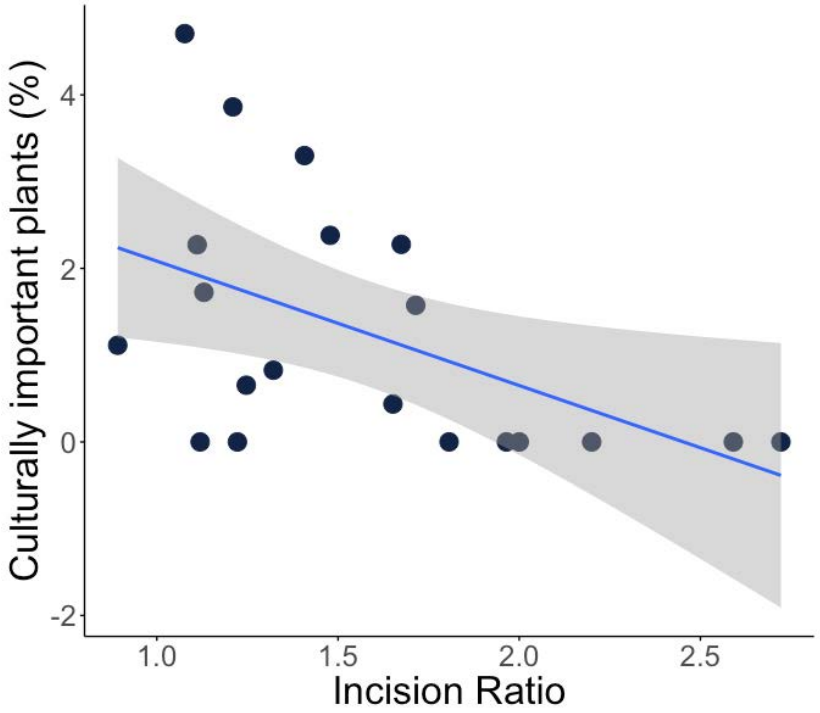
Low – Bankfull – Floodprone Flows

Channel Morphology/Shape

- Incised channel: Bed has dropped in elevation and as a result, the stream is disconnected from its floodplain.

Stream-Floodplain Connectivity Key for Culturally Important Plants





High entrenchment ratios (**A:** $R^2 = 0.24$, $p = 0.028$) and lower incision ratios (**B:** $R^2 = 0.25$, $p = 0.024$) – both indicators of stream- floodplain connectivity – related to greater riparian plant diversity.

Wetlands to Combat Drought Monitoring Program

- Implement a long-term monitoring plan of wetland water storage, plant distributions, and wildlife use that will serve as metrics of drought impacts as well as to further evaluate the efficacy of our project in minimizing the effects of drought.
- Train Tribal citizens to monitor our wetland projects over time.

Coeur d'Alene Wetland Program Plan

- Research findings will be used to enhance Wetland plan with more explicit drought risk and contingency strategies focused on wetlands as both early-indicators of drought as well as mitigators of drought on the Reservation.
- Project will
  - (1) provide a blueprint for future Tribal wetland restorations to increase drought resilience and
  - (2) lay the groundwork for additional response options for Tribal natural resource managers to increasing drought severity and frequency.

Broader Impacts: Enhancing Water Protection on Tribal Lands

- Federal water protection/CWA-WOTUS:
  - Many if not most drought-prone waterbodies not federally protected
- The rule-making process has incorporated American Indian tribes as "stakeholders" rather than sovereign peoples, compounding a colonial legacy that limits Indigenous peoples' ability to choose appropriate strategies for water protection on tribal lands.
- Although its scope remains in flux, as part of the promise to recognize tribal homelands, the U.S. undertook a trust responsibility to protect tribal rights and resources.
- Water-quality standards must recognize culturally-distinct uses of waters and account for place-based Indigenous knowledge.
- Current scientific grounding of determining WOTUS fails to adequately protect water resources on tribal lands in multiple ways
  - Connectivity
  - Permanence
  - Groundwater

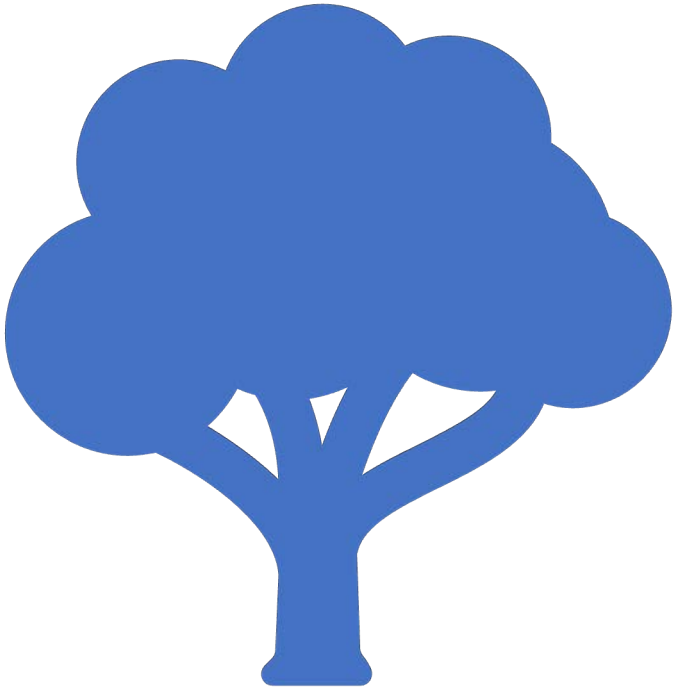
(a)

	Role of Science	How to Implement	Examples of Tribal Waters Potentially Afforded Additional Protection
Connectivity	Quantify patterns and degrees of connectivity important to tribal beneficial uses and ways of knowing including ecological connectivity and historical movement patterns linking waterbodies.	Consult with tribes to develop and codify appropriate standards for WOTUS under "significant nexus" (or similar) test on tribal lands. These criteria will differ by tribes based on their historic, geographic, and cultural contexts.	Prairie potholes, vernal pools, arroyos/ephemeral streams, natural ponds, sloughs, playa lakes.
Permanence	Document tribal uses of in situ aquatic resources from non-permanent waters, such as seasonal trapping and gathering of culturally-important plants.	Modify WOTUS review process on tribal lands to integrate in situ beneficial uses of non-permanent waters based on Indigenous context/perspectives as standards for discretionary determinations of jurisdiction.	Wet meadows and other seasonal wetlands, mudflats, sandflats, intermittent and ephemeral streams.
Groundwater	Map critical groundwater resources and measure effects of groundwater extraction and pollution on culturally-important surface waters.	Include groundwater as potential WOTUS on tribal lands. In consultation with tribes, prioritize groundwater resources based on either in situ (ie, springs) uses or as potential "functional equivalents" for point-source discharges.	Seeps, springs, hyporheic zones (ie, boundary zone under and around stream channels where ground-surface water mix), subsurface flows.

NSF – EVOLVED GRANT

- Consortium of Aquatic Science Societies
  - Society for Freshwater Science

- Minority Serving Partnership Program – Tribal Partners
  - Collaboration
  - Mentoring and Networking
  - Strengthening Relationships and Science
    - Drought and Flooding
    - Environmental Justice
    - Ecosystem Services/Beneficial Uses



Questions?

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- Thanks NOAA-NIDIS for supporting this work!