

Dam Removal & The Klamath Basin Integrated Fisheries Restoration And Monitoring Plan (IFRMP)

PART 1: Planning Process & Frameworks

Natascia Tamburello (ntamburello@essa.com); Clint Alexander (calexander@essa.com);
ESSA Technologies Ltd., NCER, Albuquerque, New Mexico, 2024





PROBLEM CONTEXT & FUNDAMENTALS



CONTEXT: THE KLAMATH BASIN

- **40,000 km² river basin**, 13 sub-basin. “Upside-down” basin - flat floodplains up top, steep forested channels below
- **Long history of “water wars”** and litigation across a large, diverse group of residents and resource users (including many Tribes)
- **Numerous anadromous & resident fish populations drastically reduced** (including ESA listings) with significant impacts to local resource users, especially Native American Tribes
- **Declines attributed to human footprint:**
 - Wetland draining & reclamation
 - Agriculture irrigation & ranching (upper basin)
 - Forestry / road development (lower basin)
 - Placer mining (lower basin)
 - Climate change, fire & disease
 - **DAMS (4 slated for removal)**





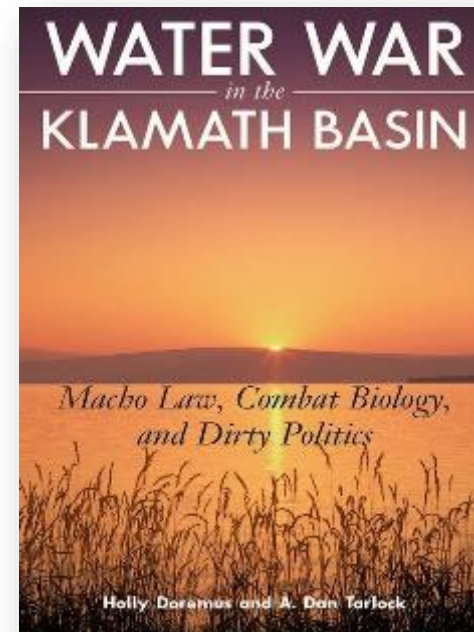
CHALLENGES: HISTORY OF WATERSHED RESTORATION PLANNING



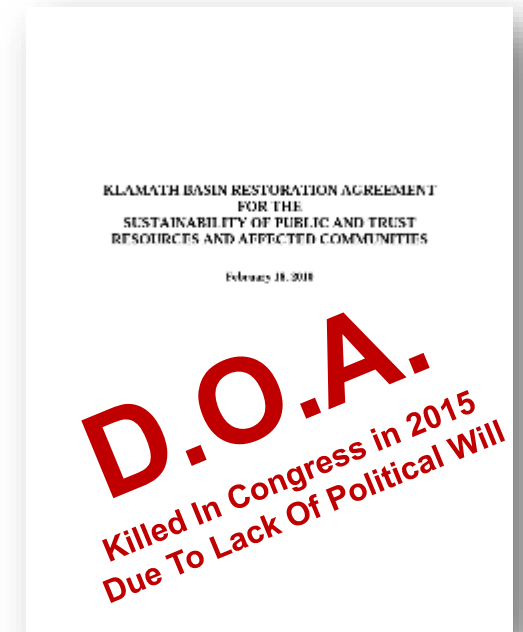
2004



2008



2008



2010

NRC (2008) was critical in suggesting that science in the basin was being done by “bits and pieces” with inadequate linkage to the many studies underway in the Klamath Basin.

The authors also emphasized the **need for an impartial body to define the vision for science and restoration needs**, made up by neutral scientists who do not represent the values of a particular management agency or tribal government (NRC 2008).



OPPORTUNITY: THE PLANETS ALIGN...

- FERC Licenses coming up due on 4 largest dams - cost to upgrade to meet current engineering standards exceeds cost of decommissioning
- Government decides to try again in 2016 with **impartial science and planning advisors to support a collaborative restoration planning process**



- **AND 2022 US Infrastructure Bill turns on the funding tap** just in time for plan completion, providing further incentive for participation in planning.

Largest-Ever US Dam Removal Project Gets Federal Agencies' Nod

Undertaking is considered a proof-of-concept for similar large efforts

By Mary B. Powers



JC Boyle



Copco 1



Copco 2



Iron Gate



Historic Funding from President Biden's Bipartisan Infrastructure Law Headed to Klamath Basin

Funding builds on proven projects, expands partnerships, and develops sustainable solutions

8/23/2022



TASK: DEVELOP PLAN TO RESTORE KLAMATH BASIN NATIVE FISH

Prime Directive: Determine which habitat restoration actions will provide the broadest possible benefits to achieve basin-wide recovery for 10 native Klamath Basin fish species, and how to track recovery over time.

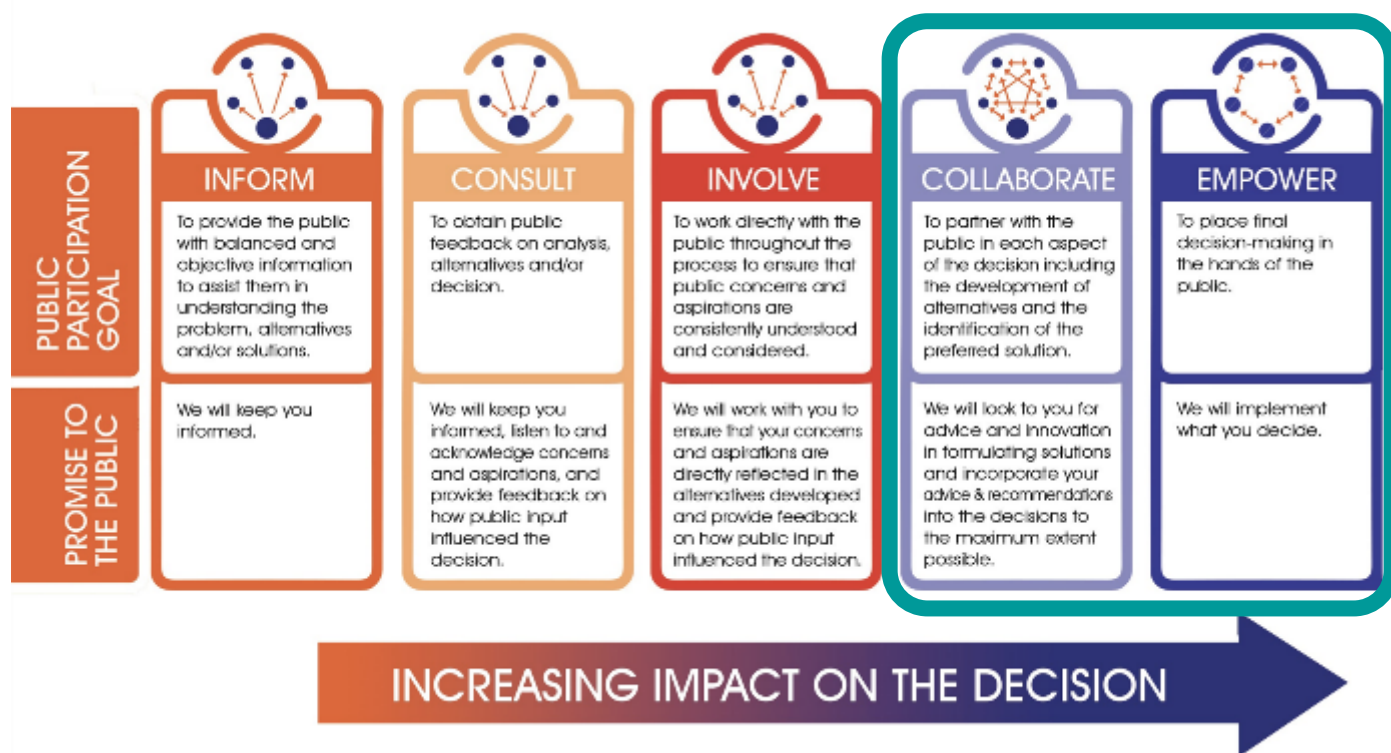


*ESA Listed Species



TASK: DEVELOP PLAN TO RESTORE KLAMATH BASIN NATIVE FISH

Secondary Directive: How can we make this process as participatory and inclusive as possible for the complex network of stakeholders and rightsholders in this basin to foster buy-in and successful outcomes?



DELIVERING ON A PARTICIPATORY PROCESS

- Plan developed iteratively over 5 phases & 7 years with logistical wrangling of participatory input across...



– **134** participants



– **38** technical working group participants



– **30** 1:1 interviews

– **46** diverse organizations represented



– **45** workshops (5 live/hybrid & 40 virtual)

– **4** surveys



– **1,000+** references consulted

– **many** rounds of written peer-review



THE IFRMP JOURNEY (2016-2022)...

HOW DID WE DO IT?
And what did we learn along the way?

Phase 1: Synthesis Report (2016-2017)

IFRMP web site,
doc library,
interviews,

Phase 1
Synthesis
Report

Phase 2: Vision, Frameworks, Draft (2018-2019)

Objectives,
Conceptual Models,
Stressors, Actions,
Mon + Prioritization
Frameworks

Plan Framework
Document

Phase 3: Prioritizing Restoration Actions (2019-2021)

Refine CPIs
Build Prioritization Tool
Iterative Prioritization
(sub-basin scale)

Provisional Draft
Plan Document

Phase 4: Tuning Nov 2020 – Feb 2022

Cost Ranges for Restoration Actions
Monitoring to Track Basin-wide
Recovery (gaps)
Alignment w other plans,
Stakeholder Review

Phase 5: Implementation Prep Nov 2021 - Dec 2022

Cost ranges for monitoring gaps
IFRMP Prioritization Tool
IFRMP Implementation workshop
Implementation recommendations
Final Plan Document

IMPLEMENTATION

Copco 2 Deconstruction Begins on Klamath River



PHASE 1: KLAMATH SYNTHESIS REPORT

- **Did not want to risk disenfranchisement by starting from scratch**
- **Klamath Synthesis Report** - monumental effort to synthesis 50+ years of prior restoration and monitoring efforts via
 - Prior planning at smaller scales, fragmented
 - Collation and cross-walk of restoration goals from 20+ prior species, site, and subbasin plans
 - Science synthesis on state of fish and their stressors
 - Quantitative rollups of past restoration and monitoring efforts from restoration databases
 - Qualitative summaries of restoration effectiveness
 - Case studies of key projects of each type that had been implemented in the region

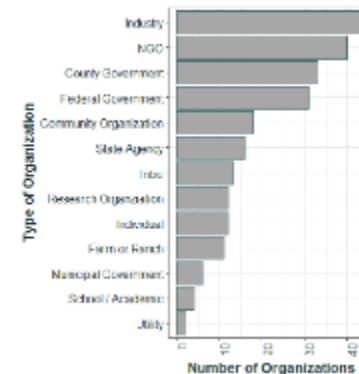
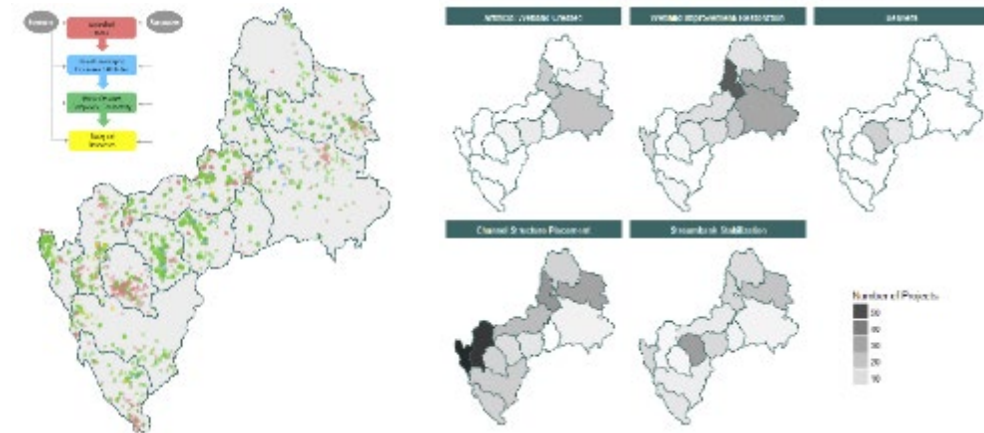
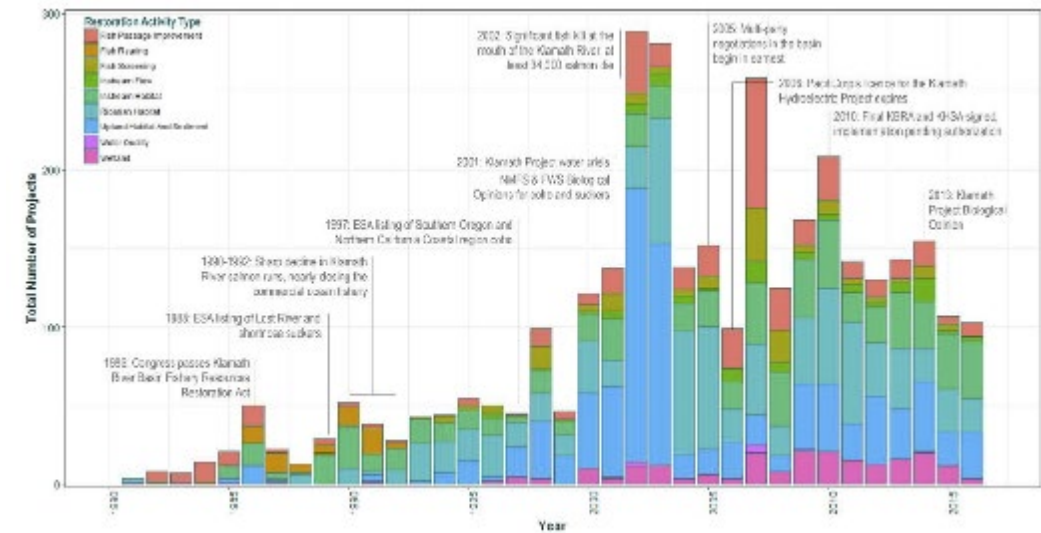
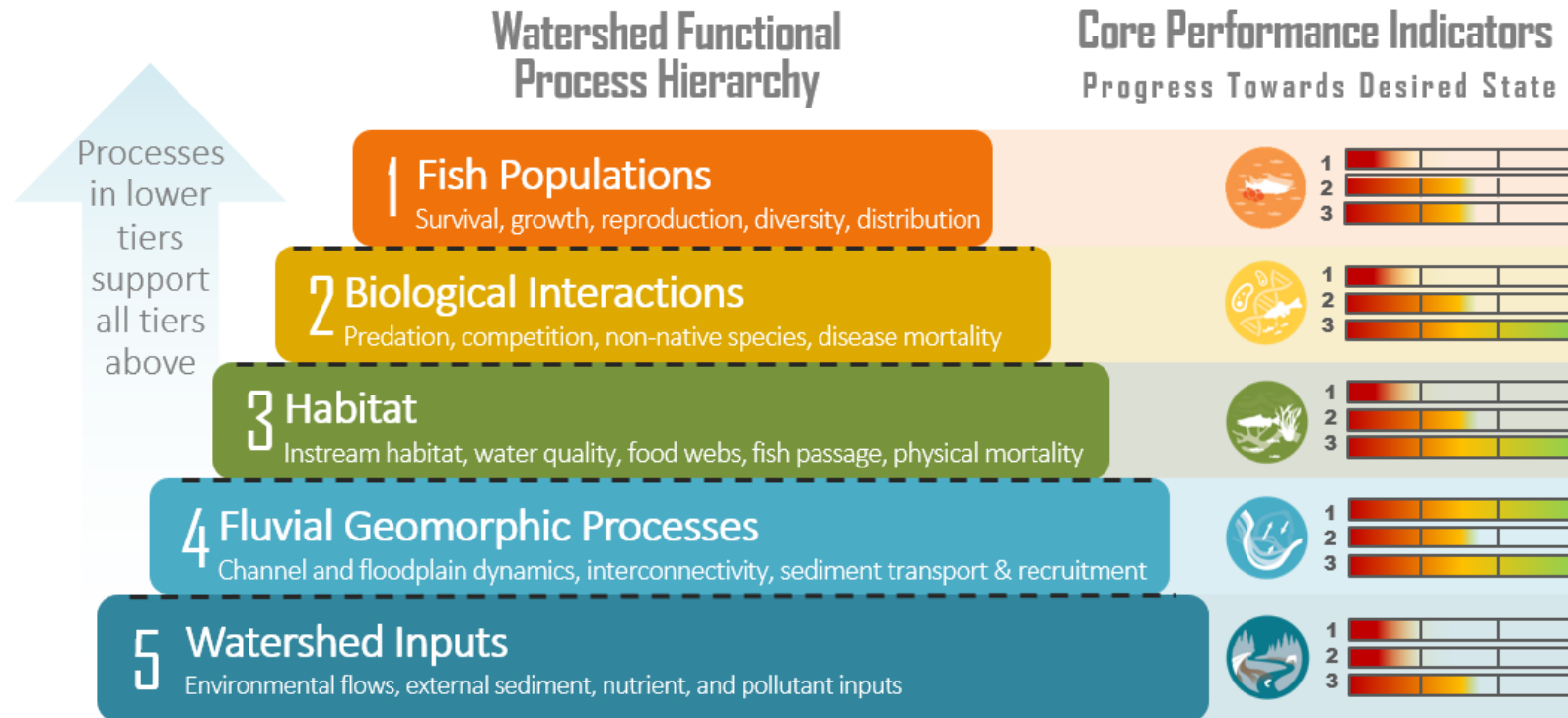


Figure 9-16: Photos of the river site showing the main channel diversion before construction (A) and to allow its replacement with a rock wall during the project (B), as well as showing the entire main channel before construction (C) and following replacement of diversion structure, channel roughening, and the addition of a fish bypass on the left following construction (D). Photos reproduced with permission from Trout Unlimited.



PHASE 2: INITIAL PLAN VISION & FRAMEWORK

- Planning approach followed **process-based restoration** principles
- Information on ecosystem **STATE / IMPACT / RESPONSE** linked to these functional tiers, baking in a first level of prioritization



Focus is on root causes of watershed impairment, not just “in-channel” symptoms

PHASE 2: INITIAL PLAN VISION & CONCEPTUAL MODELS



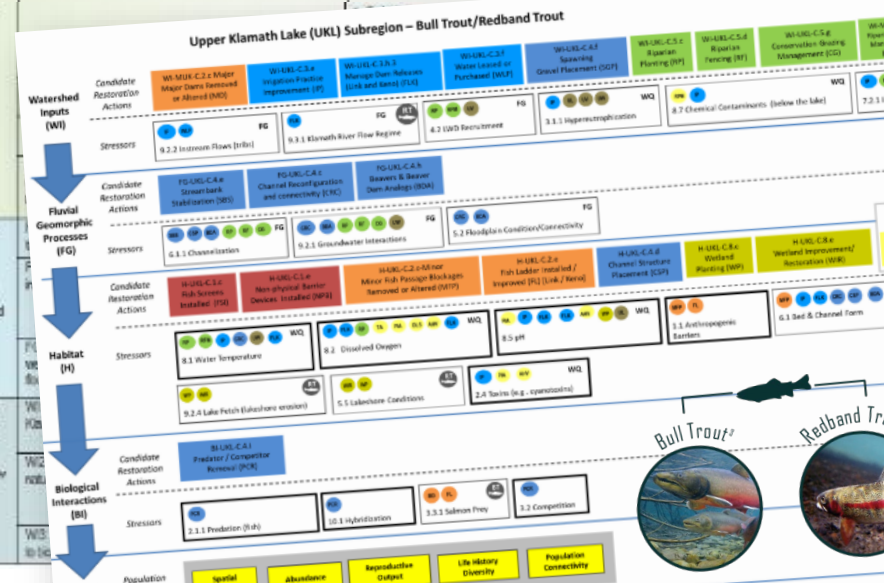
- **Goals and Objectives:** Defined for each functional tier, building on objectives of past plans
- **Conceptual Models:** Developed for each species group to identify key stressors and restoration interventions
- **Core Performance Indicators (CPIs):** Critical, informative indicators of **STATE** to keep monitoring regularly, even when resources are limited, to reliably track overall system status, selected to align with objectives.

VITAL SIGNS → Core Performance Indicators (CPIs)



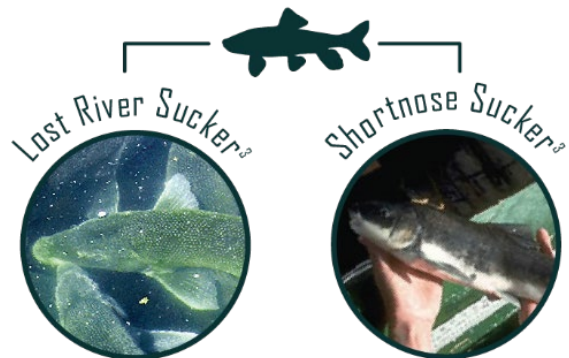
Table 2.2. IFRMP Core Performance Indicators (CPIs) selected by Working Group participants across goals and relevant objectives and associated CPI proxies used currently within the IFRMP Restoration Prioritization Tool.

Goal	Objectives	CPIs	CPI proxies
Fish Populations (FP) 1. Achieve naturally self-sustaining native fish populations.	FP1: Maintain or increase spatial distributions	<ul style="list-style-type: none"> Focal species presence/absence % of historical habitat occupied 	<ul style="list-style-type: none"> Mapped current distributions of focal fish species in the Basin Mapped current distributions of focal fish species in the Basin vs. mapped known historical distributions of focal fish species
	FP2: Increase juvenile production	<ul style="list-style-type: none"> Presence of spawning Presence of rearing Productivity 	None identified
	FP3: Increase juvenile survival and recruitment to spawning populations	<ul style="list-style-type: none"> Recruitment 	None identified
	FP4: Increase overall population abundance and productivity, particularly in areas of high existing abundance or potential future abundance or in special or unique populations	<ul style="list-style-type: none"> Abundance 	None identified
	FP5: Maintain or increase life history and genetic diversity	<ul style="list-style-type: none"> Life history diversity Age structure/longevity Genetic diversity 	None identified
Biological Interactions (BI) 3. Reduce biotic interactions that could have negative effects on native fish pops.	BI1: Do not generate adverse competitive or genetic consequences for native fish when carrying out conservation-oriented hatchery supplementation as needed (Outside of scope of IFRMP)	NA	NA
	BI2: Minimize disease-related mortality by reducing vectors and factors known to lead to fish disease outbreaks	<ul style="list-style-type: none"> Prevalence of disease pathogens Prevalence of disease-related mortality 	None identified
	BI3: Reduce impacts of non-native plant and animal species on native fish	<ul style="list-style-type: none"> Presence of invasive aquatic species 	<ul style="list-style-type: none"> Trot Unlimited - Number of aquatic invasive species per subwatershed
Habitat (H) 4. Improve freshwater habitat access and suitability for fish and the quality and quantity of habitat used	H1: Restore fish passage and re-establish channel and other habitat connectivity, particularly in high-value habitats (e.g., thermal refuge)	<ul style="list-style-type: none"> See FP 1 	<ul style="list-style-type: none"> EPA - Density Road Stream Crossing Trot Unlimited - Ratio current/mas. stream network connectivity to historical (Inland)
	H2: Improve water temperatures and other local water quality conditions and processes for fish growth and survival	<ul style="list-style-type: none"> Thermal refuge Water temperature Water chemistry 	<ul style="list-style-type: none"> NorWest Mean Aug. Stream Temperatures - 2040s



MEANWHILE... THE TRAGEDY OF THE SUCKER SUMMIT

Around this time, Democratic Senator of Oregon (Jeff Merkley) hosts a summit in the basin to act on decline of two endangered and ESA-listed suckers...



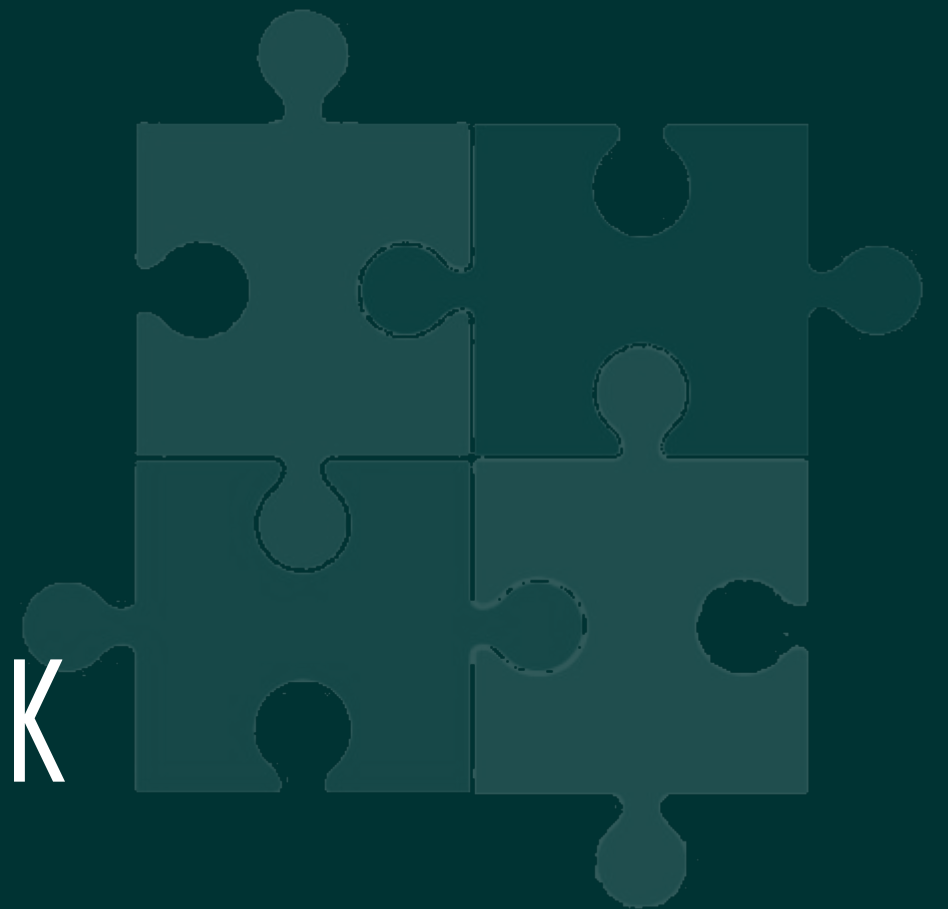
"Hmm, it depends... so many driving factors... we're not 100% sure what the top things are...need more data..."

"I have \$10 million I can appropriate right now – can you **tell me the top 10 things we can do and how much they cost?**"

...

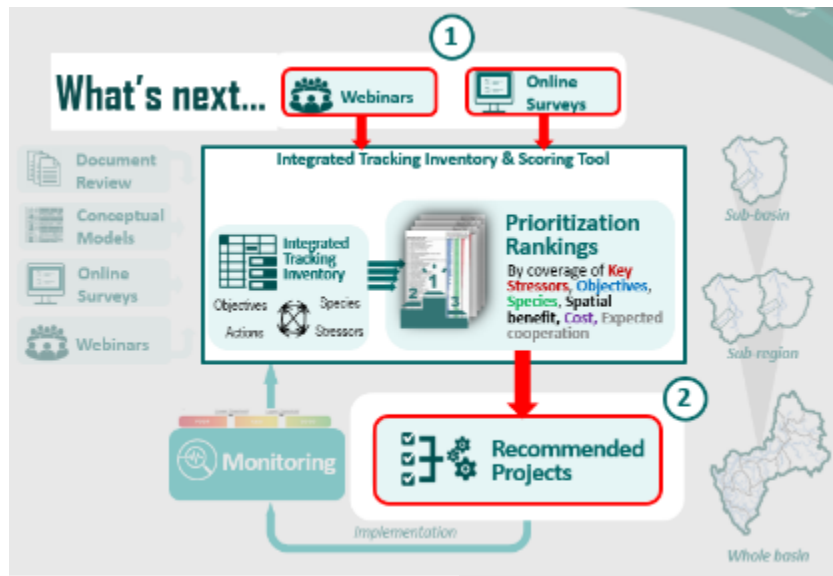


DEVELOPING PRIORITIZATION FRAMEWORK

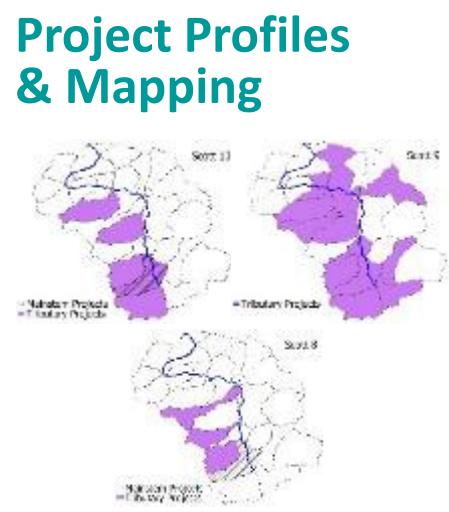
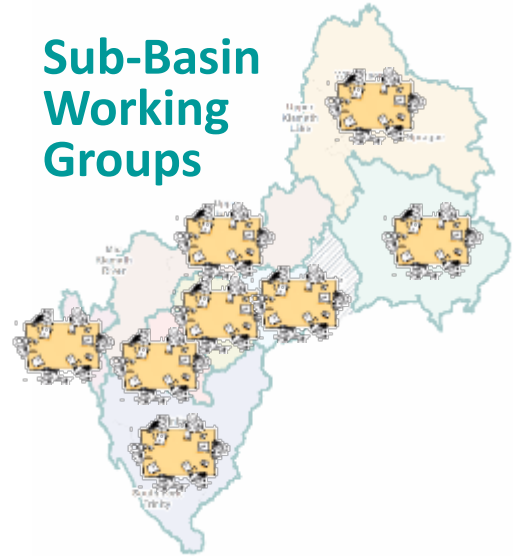




PHASE 3: IDENTIFY ACTIONS & BUILD PRIORITIZATION TOOL



- Convene working groups to:
 - Identify candidate project concepts and areas (many harvested from prior efforts) and
 - develop **spatially-explicit prioritization tool for repeated application of framework**
- Developed with input from:



87 Sub-Basin working group participants from **43 orgs.** (Fed, State, Tribal, NGO, Consultants, other)
27 Technical Working Group participants.



20 interactive webinars



3 online surveys

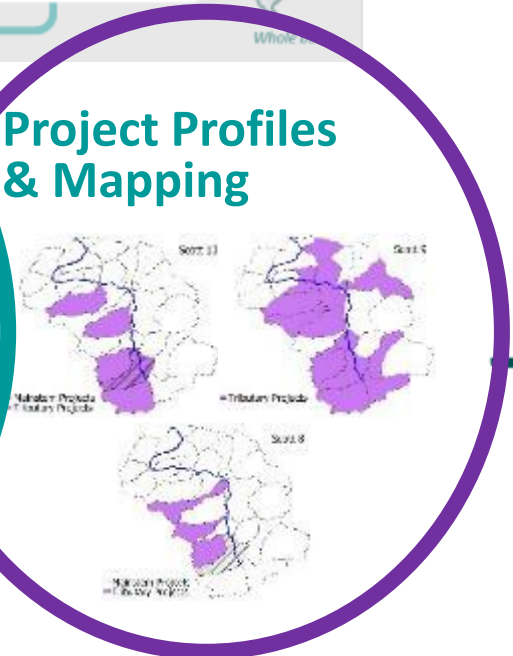
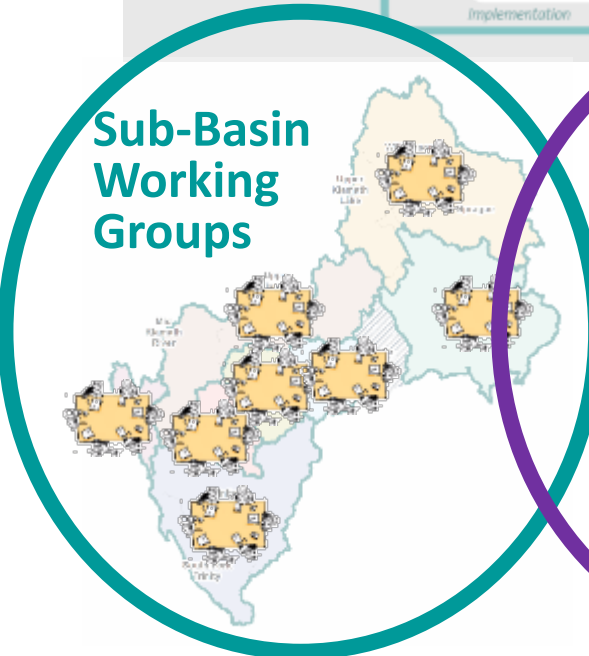
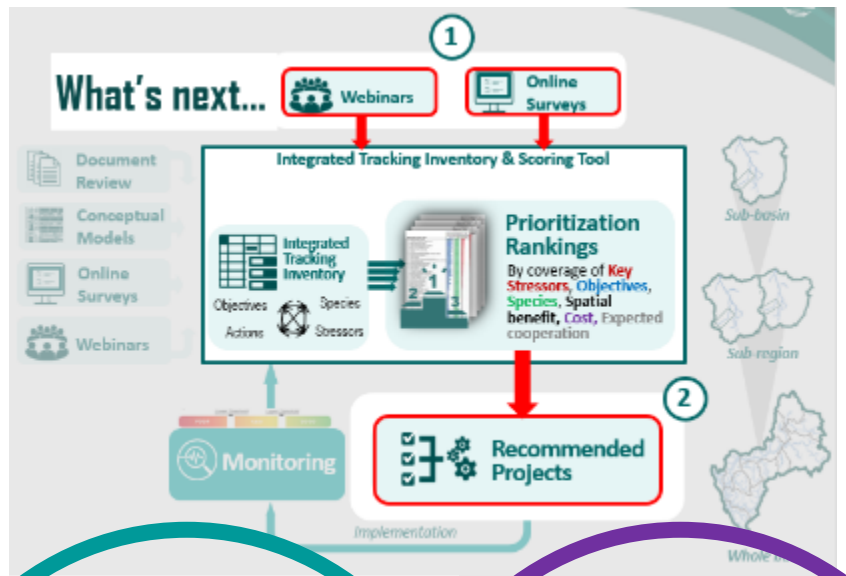


222 references
276 pp



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PHASE 2: PRIORITIZATION FRAMEWORK

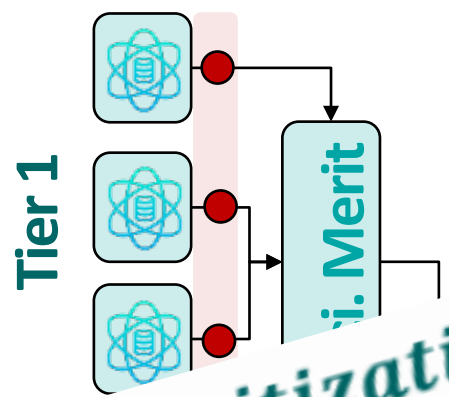
Based on location, **6 big questions to ask** about any project being considered in prioritization:

1. ***Are focal fish present*** in the place it's being proposed?
2. ***How impaired is the watershed*** in the place it's being proposed (how much is restoration needed)?
3. ***How many stressors*** is this project going to address?
4. ***How far and wide*** will project benefits be felt?
5. ***Is it feasible*** to implement this project in this place?
6. ***How much do we care about the answers to each question?***





PHASE 3: MULTI-CRITERIA SCORING TOOL



Tier 1 – Breadth of potential

1. Species range

Prioritization Scores =

$$\begin{aligned}
 & (W_1 * \text{Range Overlap}) \\
 & + (W_2 * \text{CPI Status}) \\
 & + (W_3 * \text{Stressors Addressed}) \\
 & + (W_4 * \text{Scale}) \\
 & + (W_5 * \text{Implementability})
 \end{aligned}$$

as range maps

ely-sensed
re scale
data

Species-stressor-action
relational database
informed by prior work,
conceptual models



Participant elicitation

Tier 2



Tier 2 – Feasibility considerations

5. Implementability / Feasibility
6. Criteria Weightings


are benefits of the restoration
on for focal species



Participant elicitation

Participant elicitation

EXAMPLE - Q1. ARE FOCAL SPECIES THERE?

Prioritization Scores = $(W_1 * \text{Range Overlap})$ 

+ $(W_2 * \text{CPI Status})$

+ $(W_3 * \text{Stressors Addressed})$

+ $(W_4 * \text{Scale})$

+ $(W_5 * \text{Implementability})$

Important Note: As with all criteria, the raw Range Overlap scores determined from the point assignments below are normalized to a common 0 to 10 point scale.

EXAMPLE








0 points
(no record of ever being present)

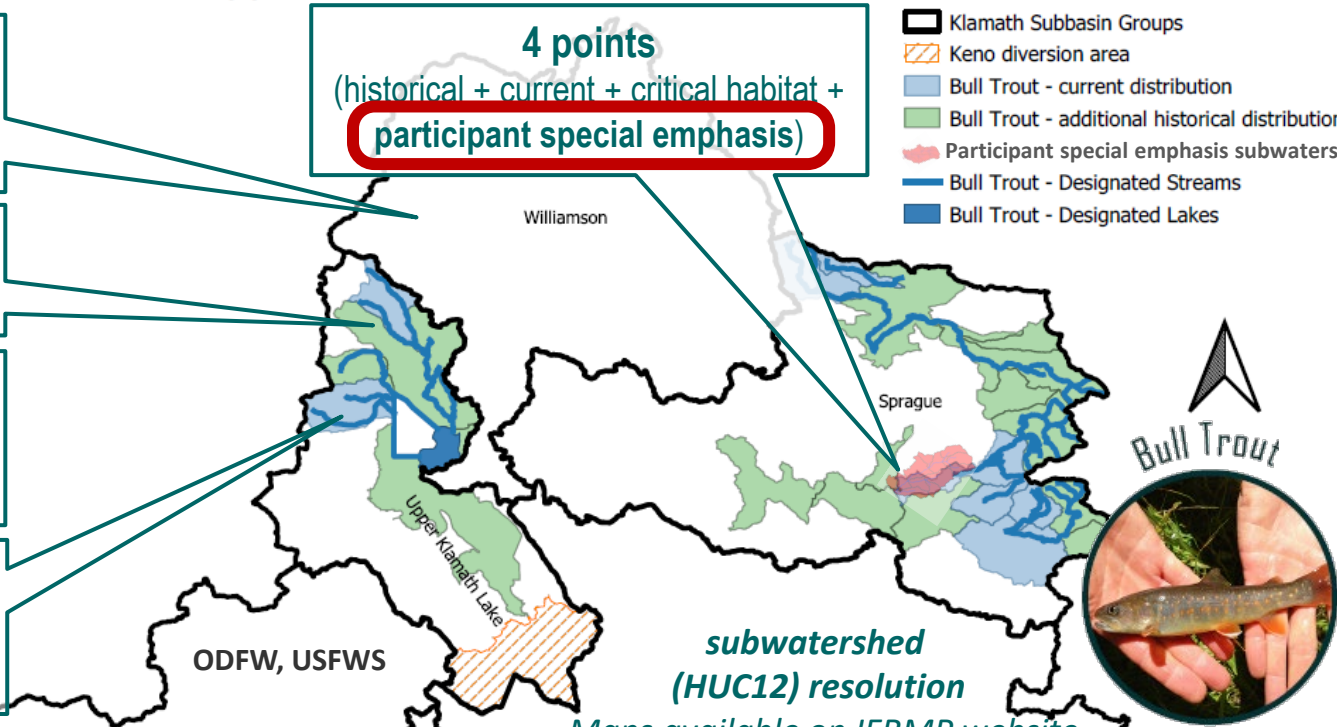
1 points
(historical only)

2 points
(historical + current only)

3 points
(historical + current + critical habitat)

4 points
(historical + current + critical habitat + **participant special emphasis**)

-  Klamath Subbasin Groups
-  Keno diversion area
-  Bull Trout - current distribution
-  Bull Trout - additional historical distribution
-  Participant special emphasis subwatersheds
-  Bull Trout - Designated Streams
-  Bull Trout - Designated Lakes




subwatershed (HUC12) resolution

Maps available on IFRMP website

ODFW, USFWS

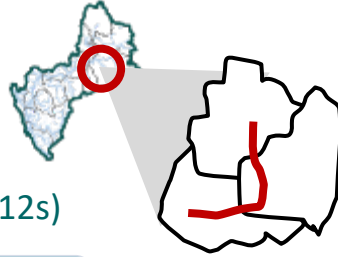
Q2. What Is The Restoration Need?

Prioritization Scores = $(W_1 * \text{Range Overlap})$
 $+(W_2 * \text{CPI Status})$ 
 $+(W_3 * \text{Stressors Addressed})$
 $+(W_4 * \text{Scale})$
 $+(W_5 * \text{Implementability})$

EXAMPLE

Project 1

A riparian fencing project spanning 3 sub-watersheds (HUC12s)



Impairment Priority Toggle



Grouping by Watershed Goals/Functional Tiers

Goal
Fish Populations (by species)  1. Achieve naturally self-sustaining native fish populations...
Biological Interactions (BI)  3. Reduce biotic interactions that could have negative effects on native fish pops.
Habitat (H)  4. Improve freshwater habitat access and suitability for fish and the quality and quantity of habitat used by all freshwater life stages
Fluvial Geomorphic Processes (FG)  5. Create and maintain spatially connected and diverse channel and floodplain morphologies
Watershed Inputs (WI)  6. Improve water quality, quantity, and ecological flow regimes

STEP 1 AVERAGE
CPI 1: 8/10
CPI 2: 2/10
CPI 3: 8/10
CPI 4: 7/10
CPI 5: 9/10
CPI 6: 1/10
CPI 7: 3/10
CPI 8: 2/10
CPI 9: 5/10
CPI 10: 5/10
CPI 11: 6/10
CPI 12: 1/10
CPI 13: 2/10
CPI 14: 4/10
CPI 15: 9/10

STEP 2 AVERAGE
Average Fish Population CPI: 6/10
Average Biological Interaction CPI: 8/10
Average Habitat CPI: 2.75/10
Average Fluvial Geomorphic CPI: 5.5/10
Average Watershed Inputs CPI: 4/10

STEP 3 WEIGHT
x WEIGHT
x WEIGHT
x WEIGHT
x WEIGHT
x WEIGHT

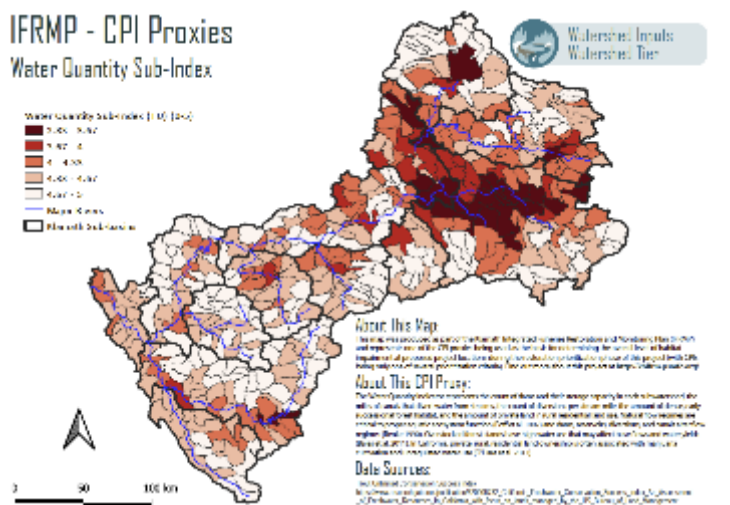
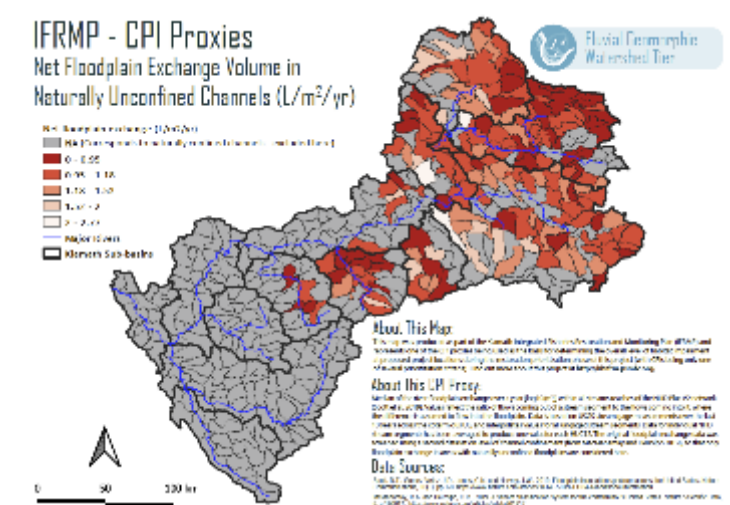
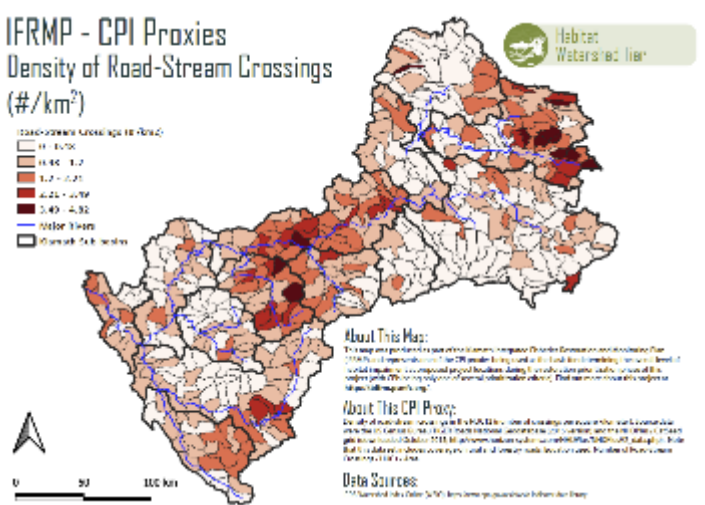
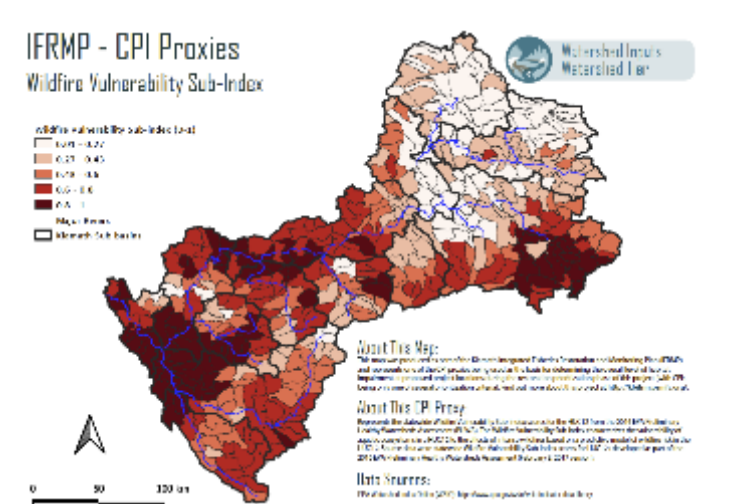
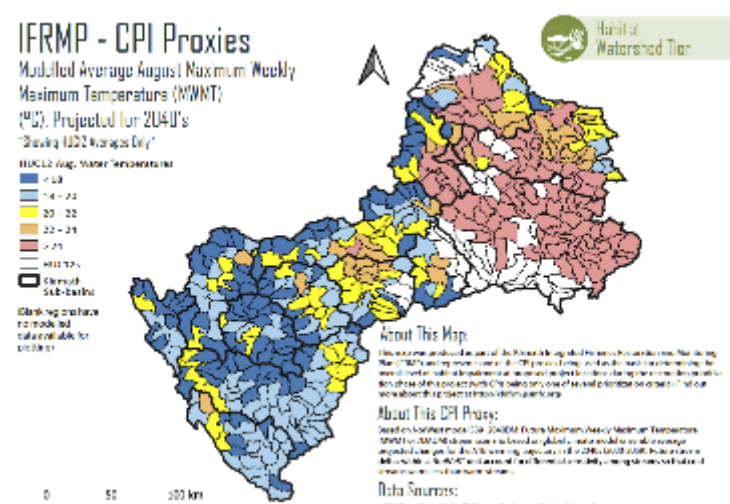
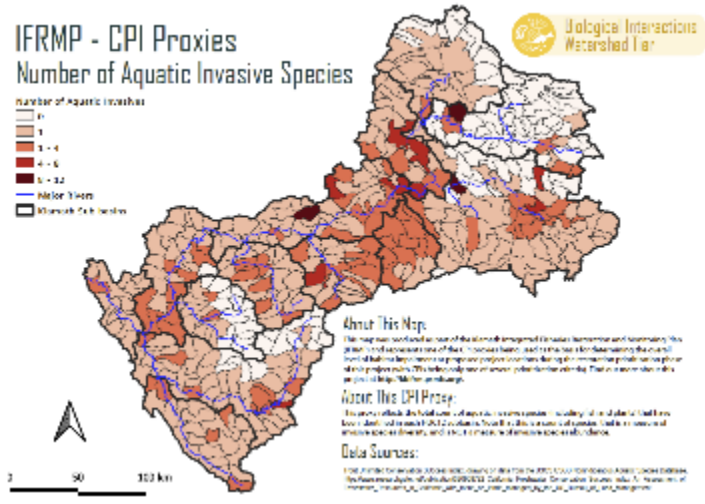
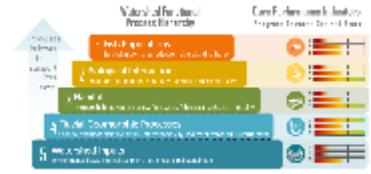
STEP 4 WEIGHTED AVERAGE



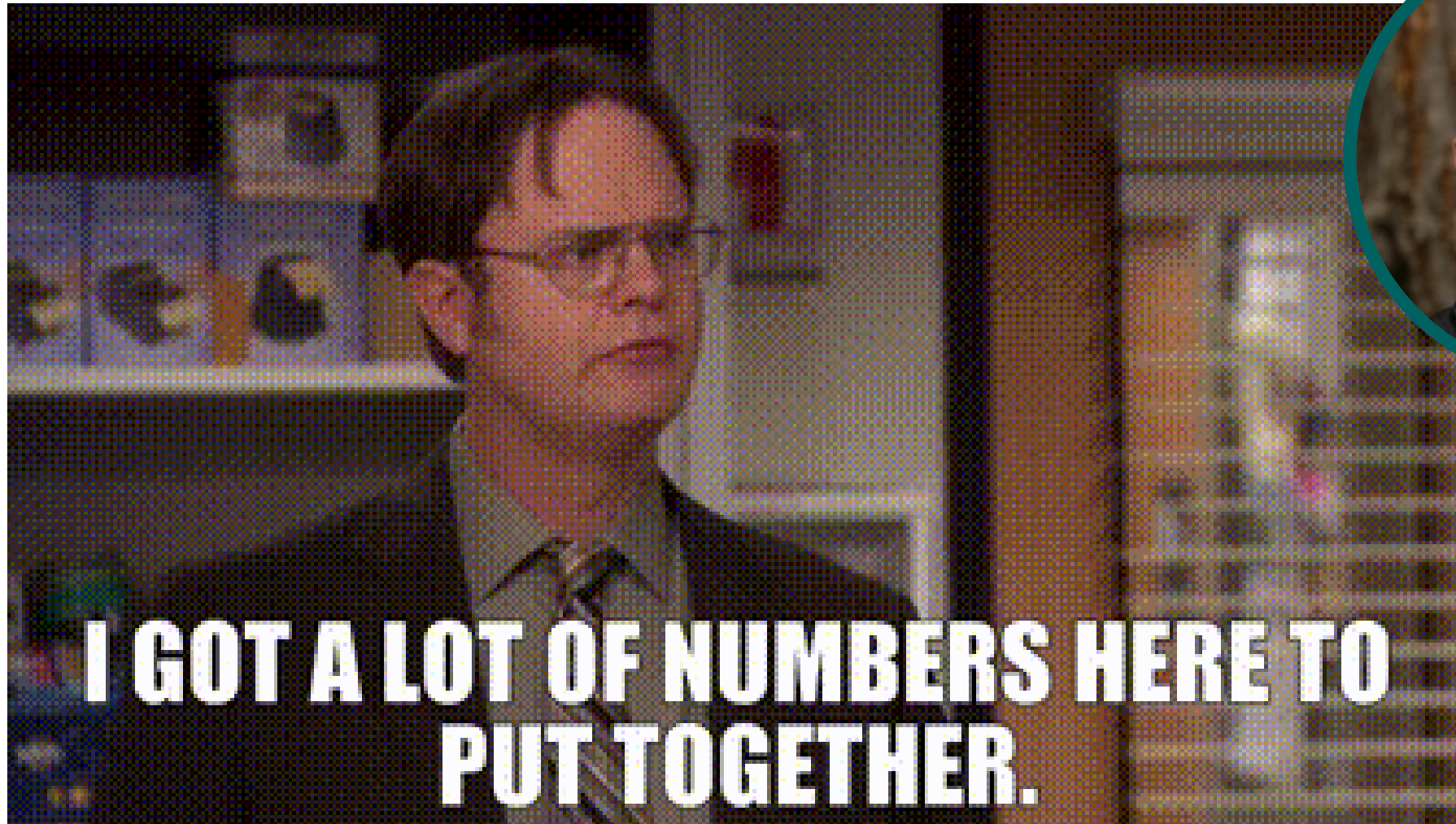
Project 1
CPI Status = **6/10**

Q2. What Is The Restoration Need?

EXAMPLE CPI PROXY LAYERS (showing 6 of 18 selected by participants)



**Simple questions, still many detailed inputs...
what is the road to ongoing implementation?**



PART 2

Clint

Alexander



THE KLAMATH BASIN INTEGRATED FISHERIES RESTORATION AND MONITORING PLAN (IFRMP)

This plan is meant to serve as a dynamic roadmap that describes the highest priority functional watershed restoration and monitoring actions that can help reverse the declines of multiple native Klamath Basin fish populations to help benefit ecosystems and communities.

[Learn More](#)

Thank You!

Contacts

Matt Baun (matt_baun@fws.gov) – USFWS Klamath Coordinator

Nancy Leonard (nleonard@psmfc.org) – lead PSMFC

Clint Alexander (calexander@essa.com) – Co-lead ESSA

Natascia Tamburello (lsantana@essa.com) – Co-lead ESSA

Visit IFRMP Website for Further Information

Documents, videos, and access to prioritization tool:

<https://ifrmp.net/>

