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

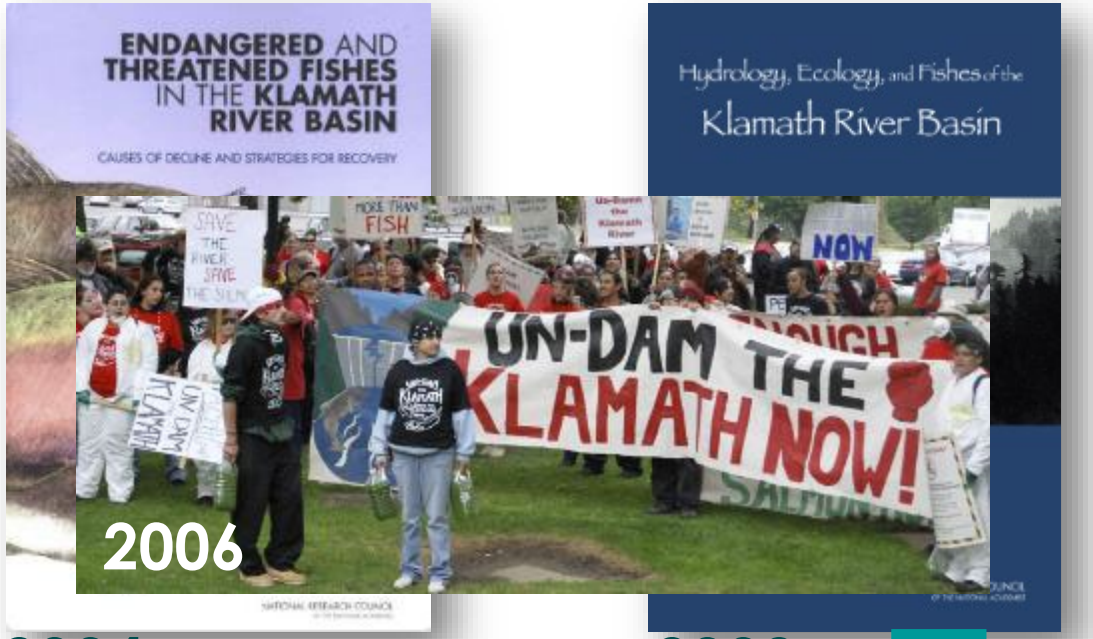
PROBLEM CONTEXT & FUNDAMENTALS


OR
CA
Williamson
Sprague
Upper Klamath Lake
Klamath Falls
LINK RIVER DAM
KENO DAM
Upper Klamath River
Lost
Butte
Yreka
Shasta
Mid Klamath River
Scott
Lower Klamath River
Salmon
Trinity
Weaverville
Arcata
Eureka
Redding
South Fork Trinity
Legend
Miles
0
10
20
30
Copco 1 Dam
J.C.Boyle Dam
Copco 2 Dam
Iron Gate Dam

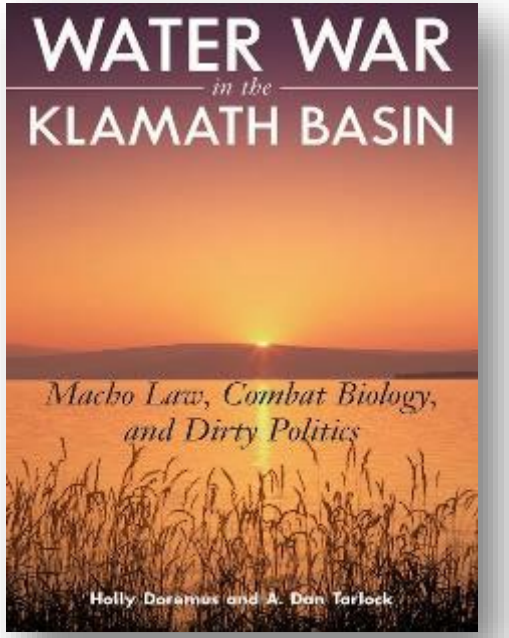
CONTEXT: THE KLAMATH BASIN

- **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)**

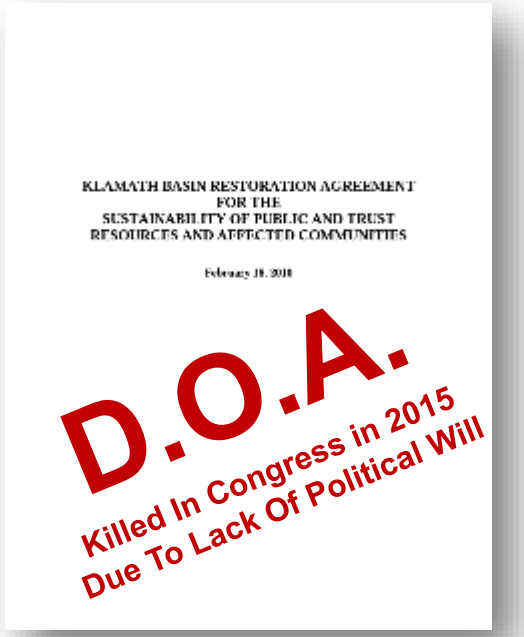
CHALLENGES: HISTORY OF WATERSHED RESTORATION PLANNING



2004 2008



2008



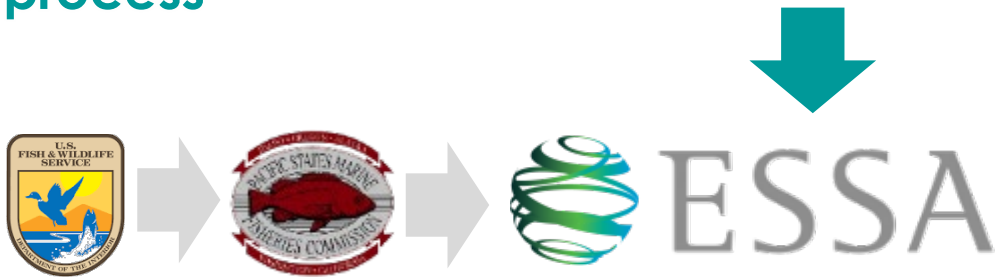
2010

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.

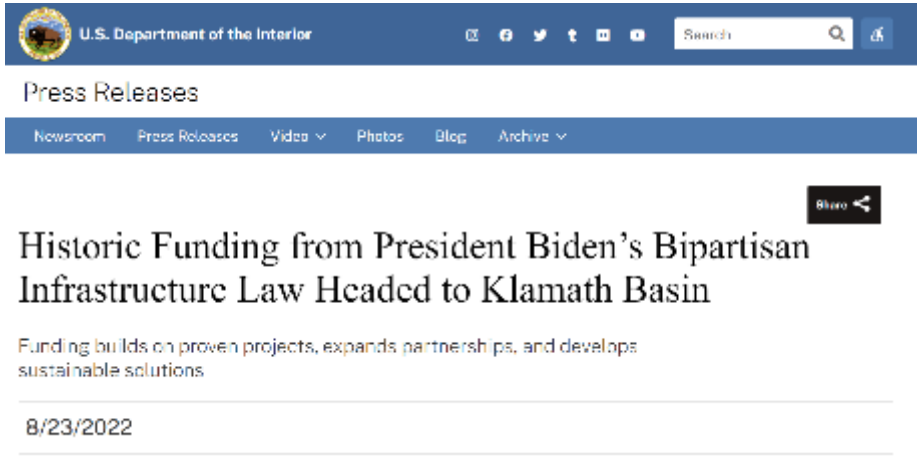
The authors also emphasized the **need for an impartial body to define the vision for science and restoration needs**, made up by neutral scientists who do not represent the values of a particular management agency or tribal government (NRC 2008).

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.



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?

PUBLIC PARTICIPATION GOAL	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives and/or solutions.	To obtain public feedback on analysis, alternatives and/or decision.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice & recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

INCREASING IMPACT ON THE DECISION

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

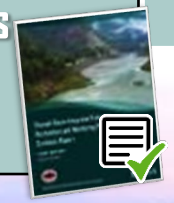
THE IFRMP JOURNEY (2016-2022)…

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

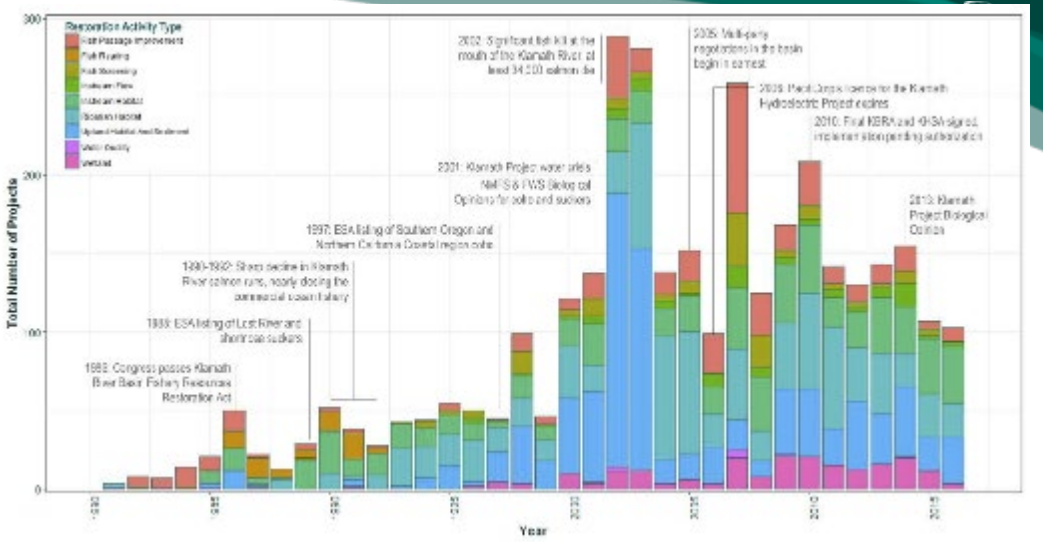
Final Plan Document

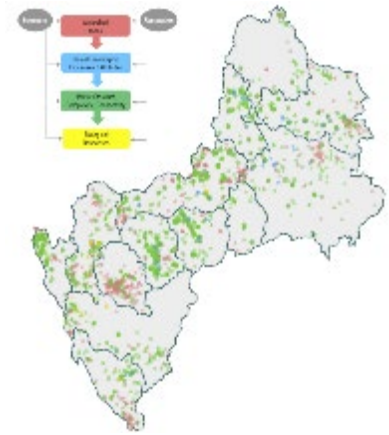
IMPLEMENTATION

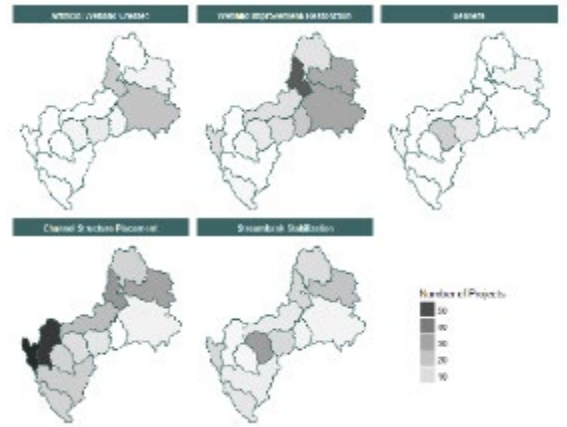
Mouth of the Klamath River by Linda Tanner, 2011, licensed under CC by 2.0

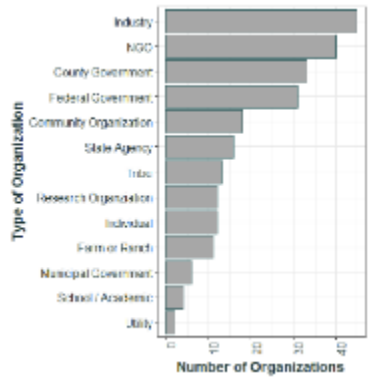
PHASE 1: KLAMATH SYNTHESIS REPORT

- **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



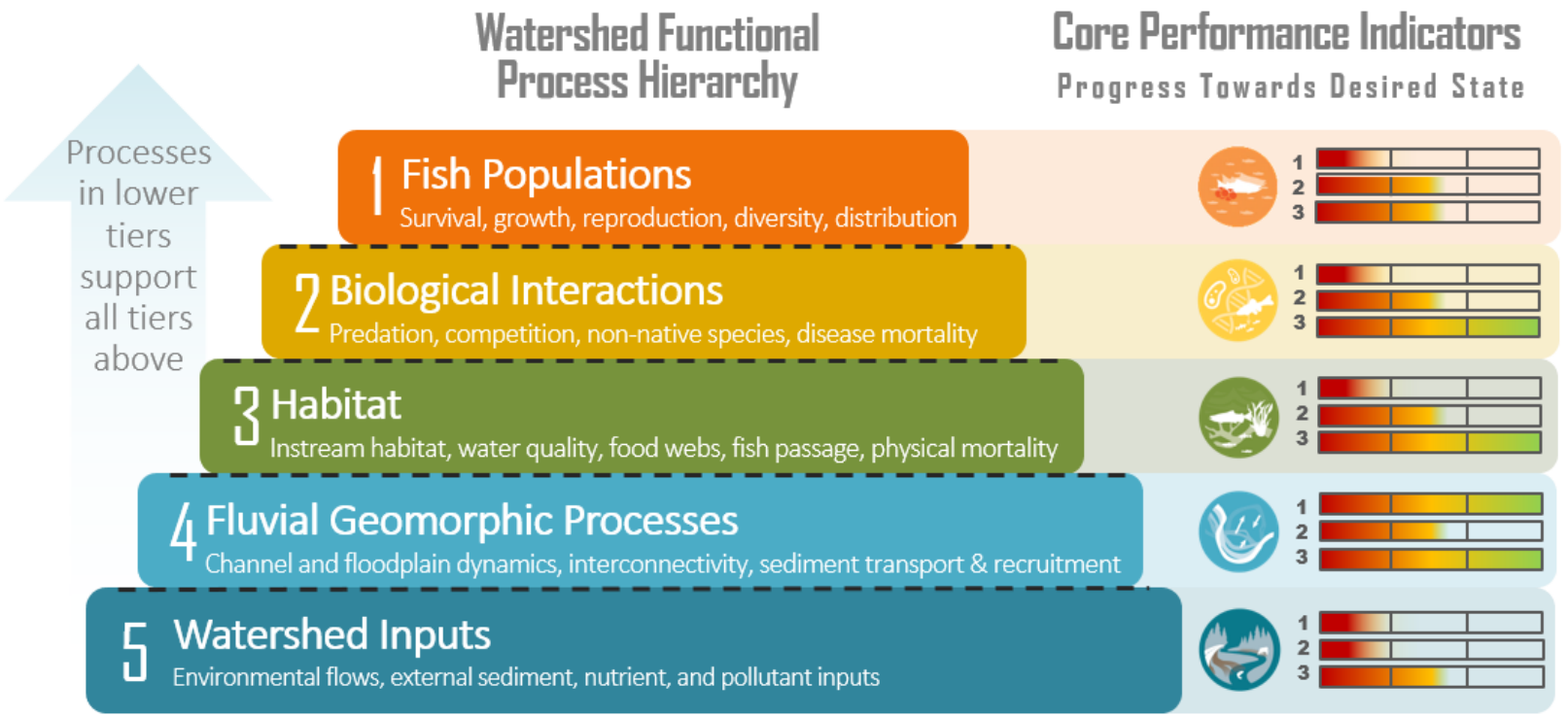






PHASE 2: INITIAL PLAN VISION & FRAMEWORK

- 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)

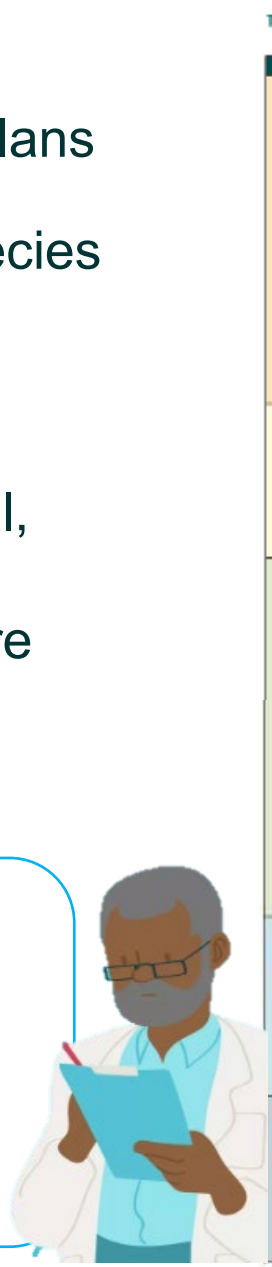
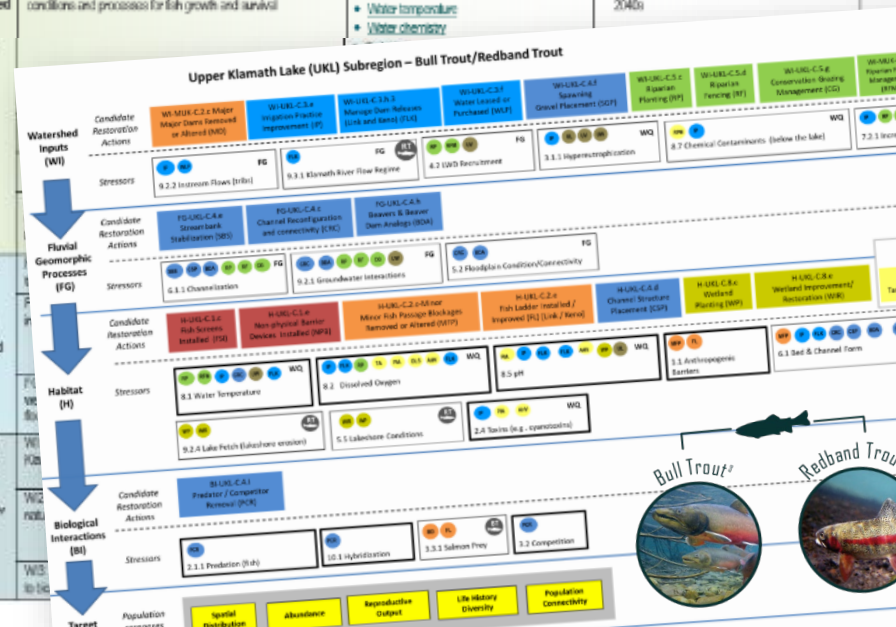


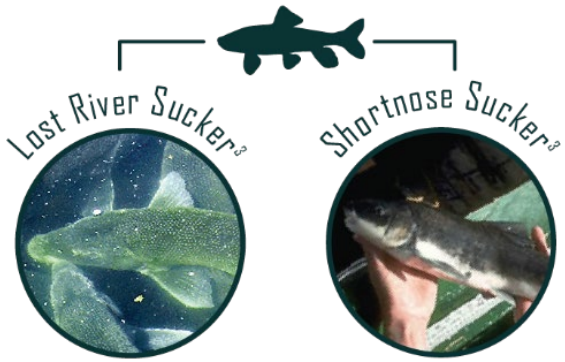
Table 2-2. IFRMP Core Performance Indicators (CPIs) selected by Working Group participants across goals and relevant objectives and associated CPI proxies used currently within the KI IFRMP Restoration Prioritization Tool.

Goal	Objectives	CPIs	CPI proxies
Fish Populations (FP) 1. Achieve naturally self-sustaining native fish populations.	FP1: Maintain or increase spatial distributions	• Focal species presence/absence • % of historical habitat occupied	• 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	• Presence of spawning • Presence of rearing • Productivity	None identified
	FP3: Increase juvenile survival and recruitment to spawning populations	• 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	• Abundance	None identified
	FP5: Maintain or increase life history and genetic diversities	• Life history diversity • Age structure/demographics • 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	• Prevalence of disease pathogens • Prevalence of disease-related mortality	None identified
	BI3: Reduce impacts of non-native plant and animal species on native fish	• Presence of invasive aquatic species	• Trout 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 by all freshwater life stages	H1: Restore fish passage and re-establish channel and other habitat connectivity, particularly in high-value habitats (e.g., thermal refugia)	• See FP 1	• EPA - Density Road-Stream Crossing • Trout Unlimited - Relict current mass, stream network connectivity to historical (inland)
	H2: Improve water temperatures and other local water quality conditions and processes for fish growth and survival	• Thermal refugia • Water temperature • Water chemistry	• NorWeST Mean Aug Stream Temperatures – 2040s
Fluvial Geomorphic Processes (FG) 5. Create and maintain spatially connected and diverse channel and floodplain ecosystems			
Watershed Inputs (WI) 6. Improve water quality, quantity, and ecological flow regimes			

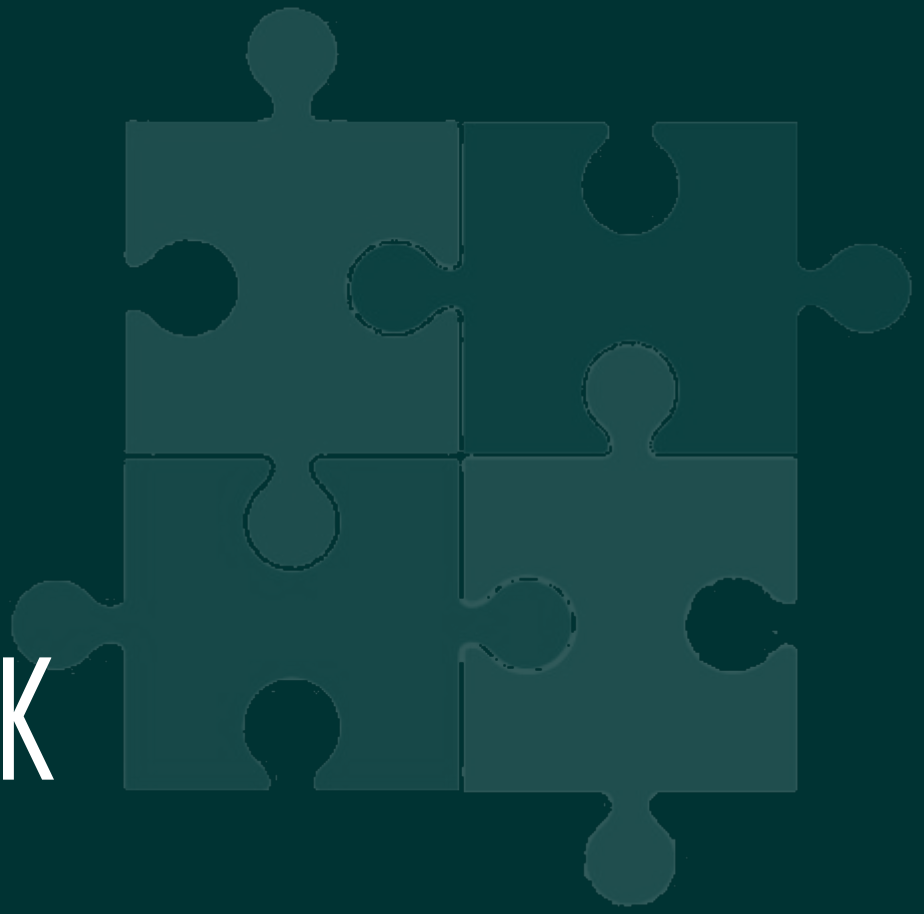


MEANWHILE… THE TRAGEDY OF THE SUCKER SUMMIT

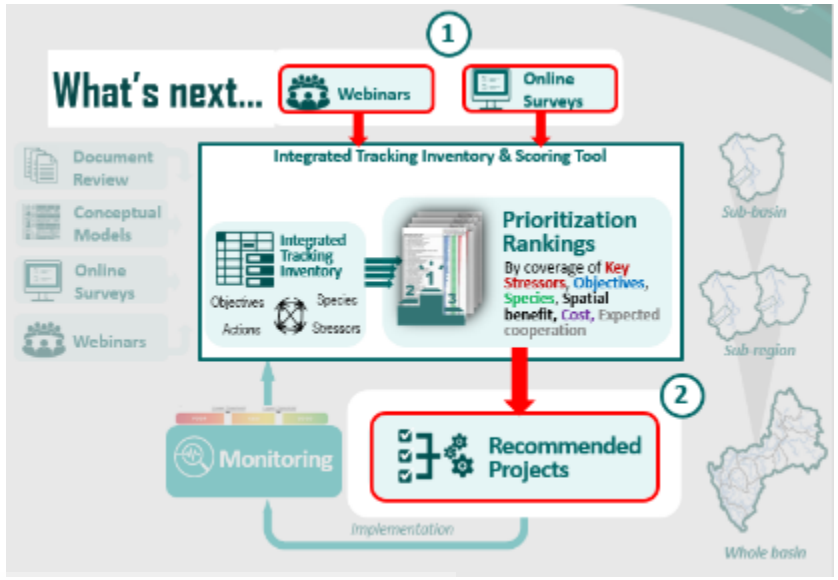
Around this time, Democratic Senator of Oregon (Jeff Merkley) hosts a summit in the basin to act on decline of two endangered and ESA-listed suckers…



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.

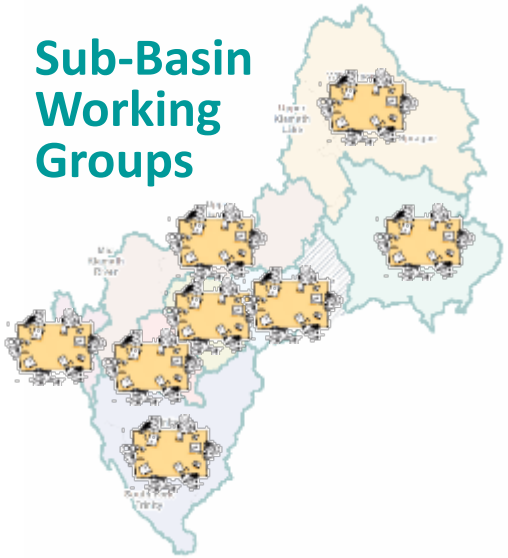
20 interactive webinars

3 online surveys

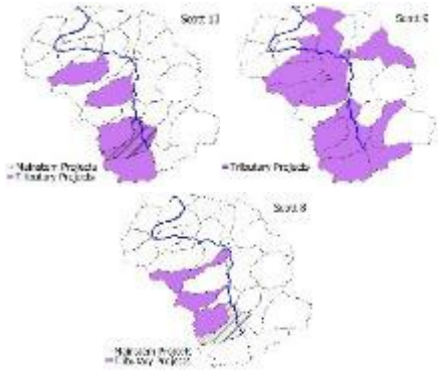
COVID-19

222 references
276 pp

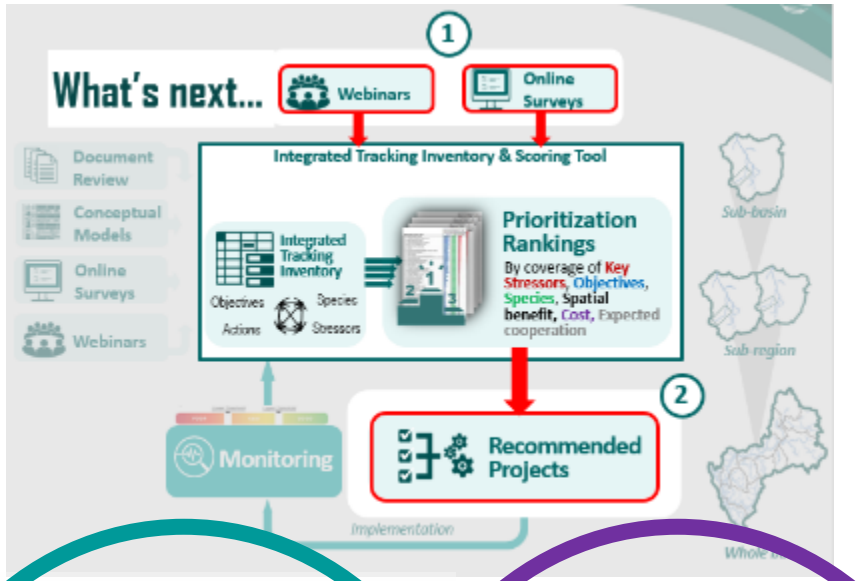
Sub-Basin Working Groups

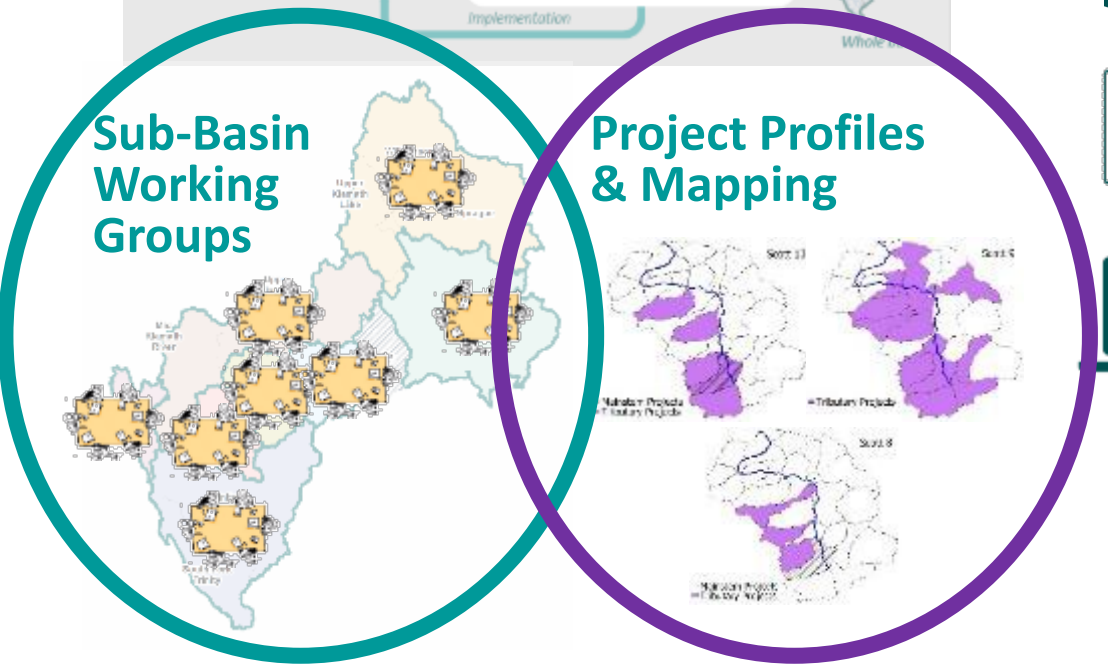


Project Profiles & Mapping



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

COVID-19

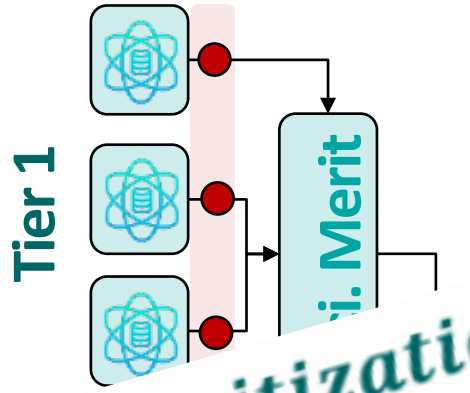
222 references
276 pp

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



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

Tier 1 – Breadth of pote

1. Species ra
2.

...es range maps

...ely-sensed ...e scale data

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

Participant elicitation

...of concern)

...ale benefits of the restoration

...tion for focal species

Tier 2

Tier 2 – Feasibility considerations

5. Implementability / Feasibility
6. Criteria Weightings

Participant elicitation

Participant elicitation

EXAMPLE - Q1. ARE FOCAL SPECIES THERE?

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

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

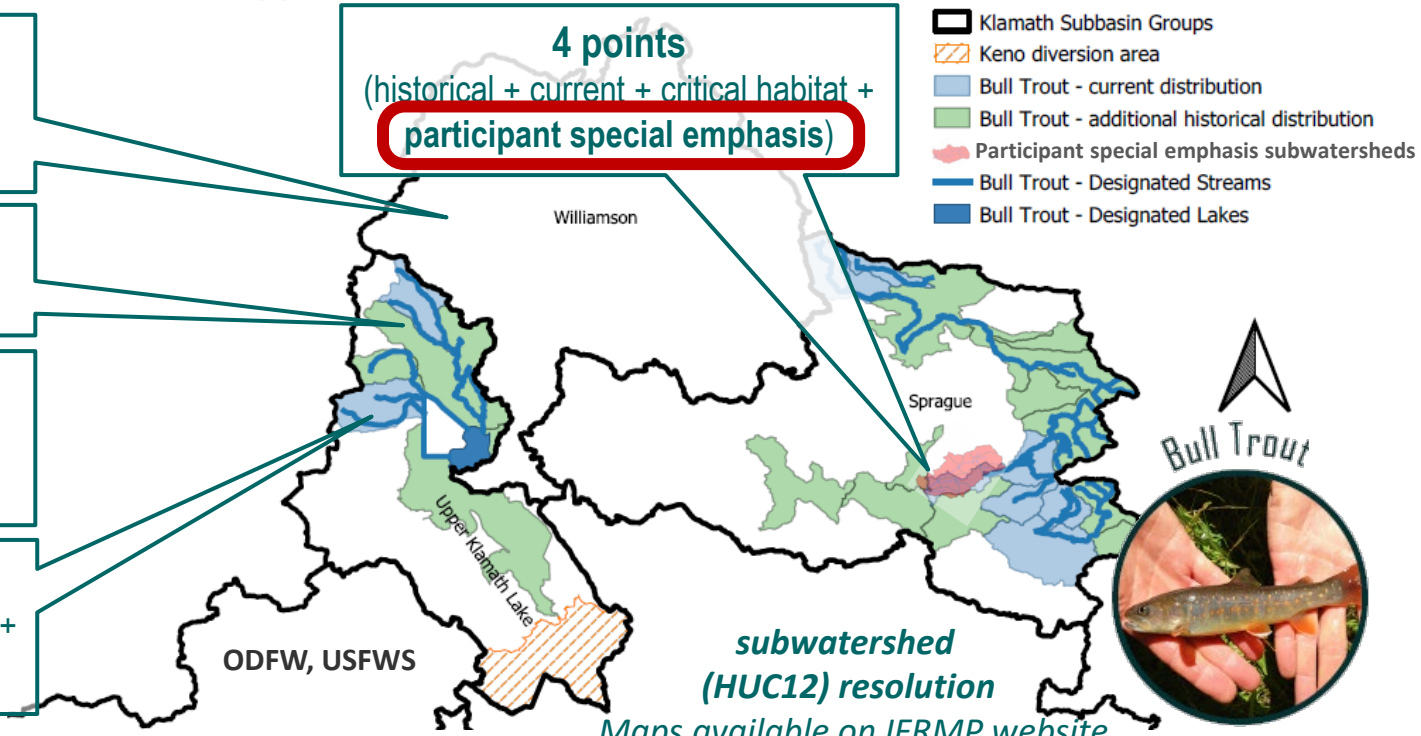
0 points
(no record of ever being present)

1 points
(historical only)

2 points
(historical + current only)

3 points
(historical + current + critical habitat)

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



subwatershed (HUC12) resolution

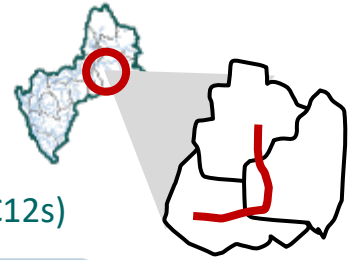
Maps available on IFRMP website

Q2. What Is The Restoration Need?

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

EXAMPLE

Project 1
A riparian fencing project spanning 3 sub-watersheds (HUC12s)



Impairment Priority Toggle

Grouping by Watershed Goals/Functional Tiers

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

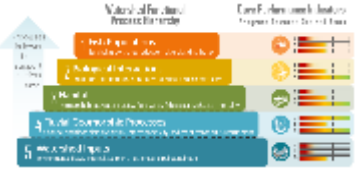
STEP 4 WEIGHTED AVERAGE

FINAL SCORE

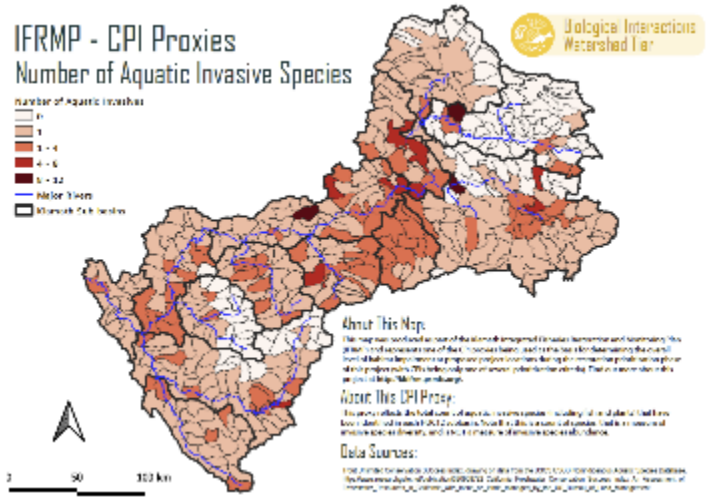
Project 1 CPI Status =

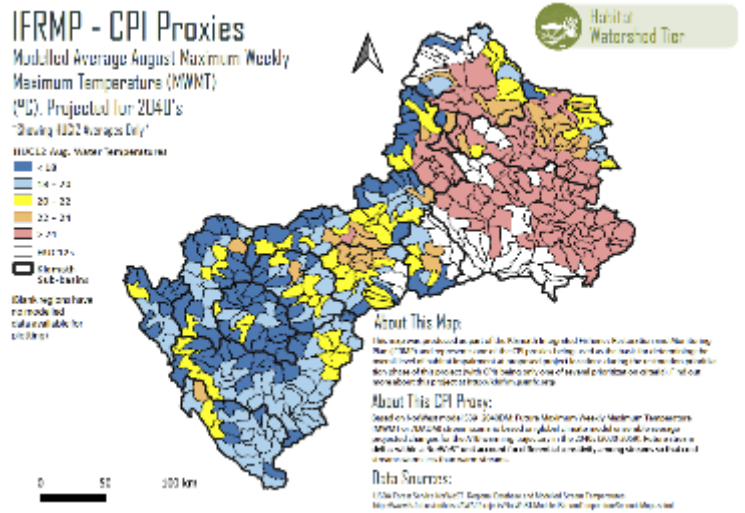
6/10

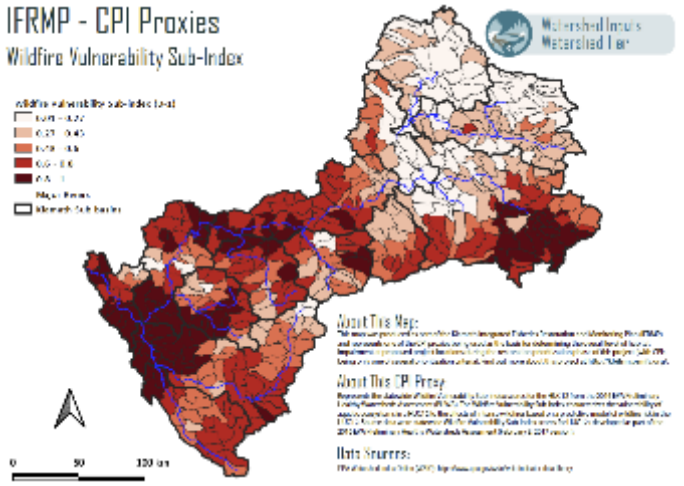
Q2. What Is The Restoration Need?

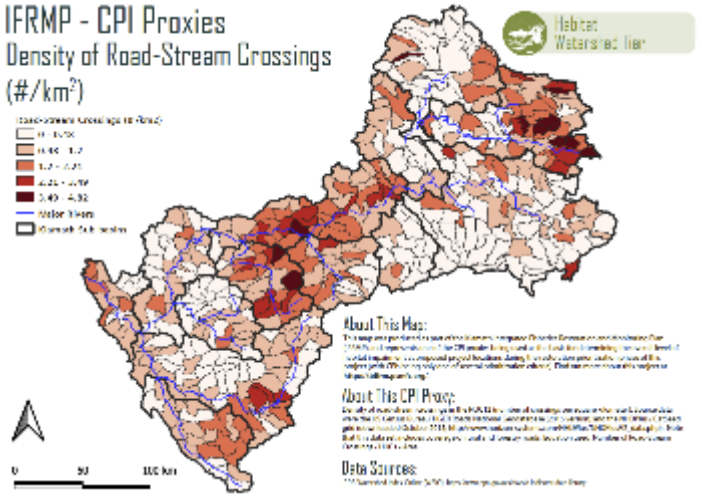


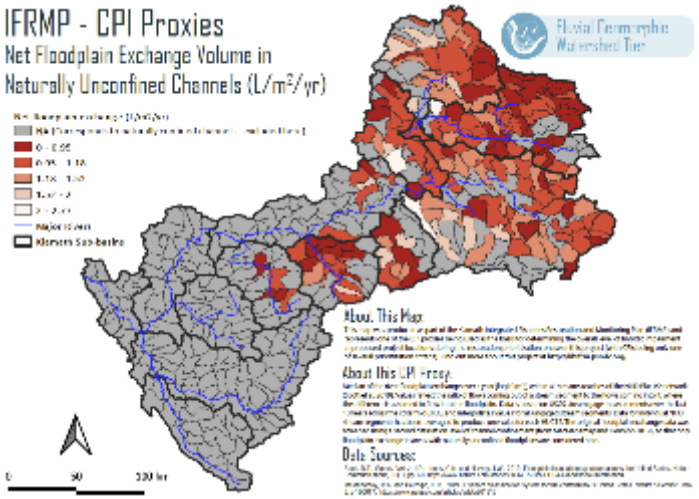
EXAMPLE CPI PROXY LAYERS (showing 6 of 18 selected by participants)

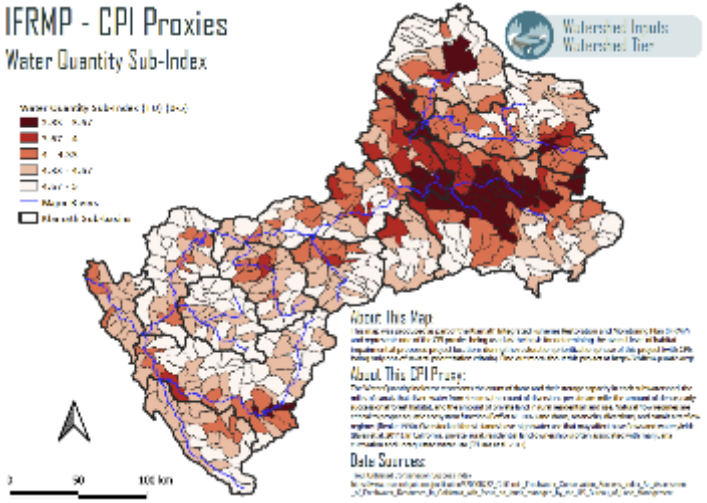




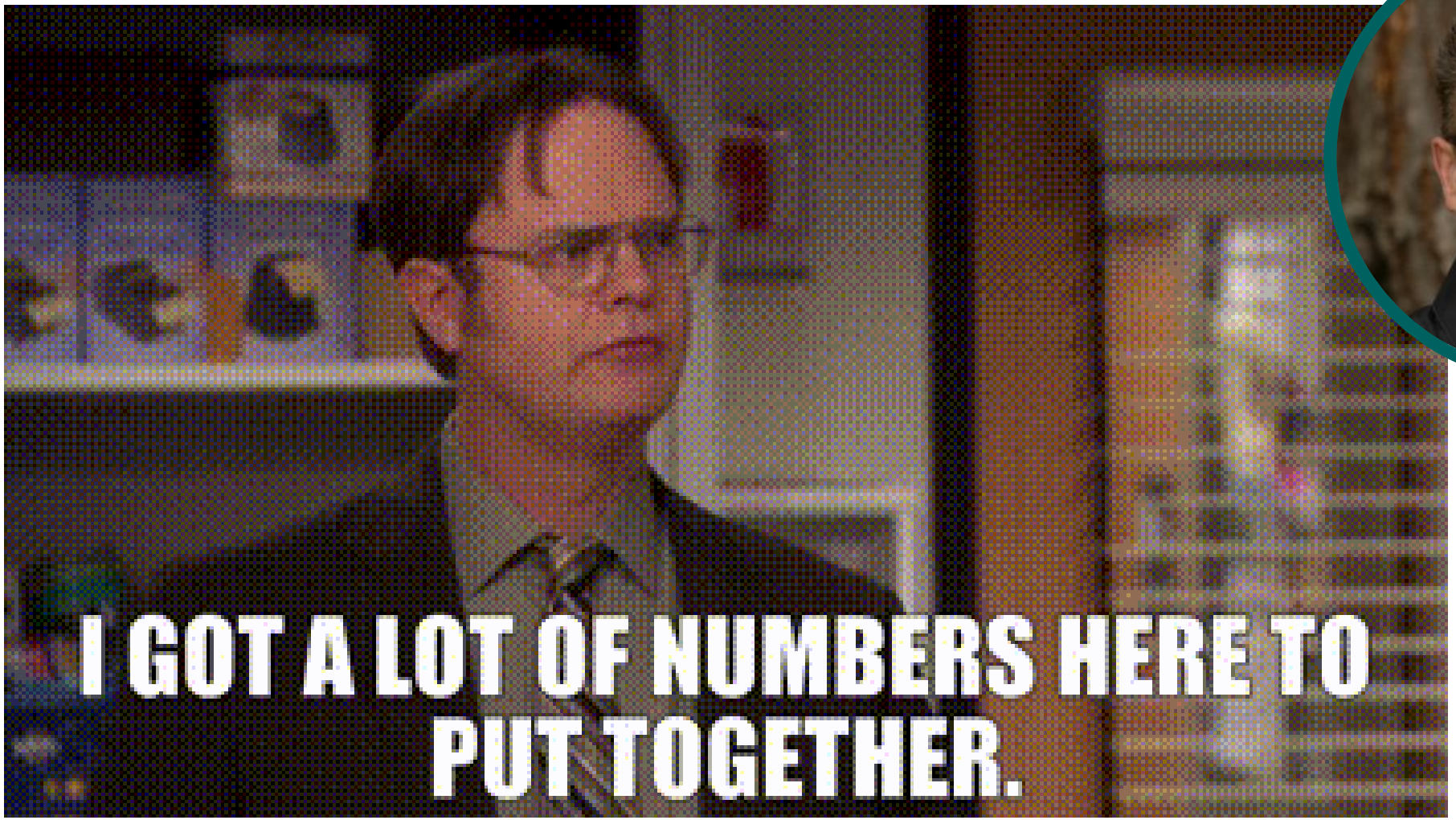








Simple questions, still many detailed inputs… what is the road to ongoing implementation?



PART 2

Clint Alexander

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

Part 2: Basin-Wide Restoration Prioritization Tool + Overall Lessons

NCER
National Conference on Ecosystem Restoration

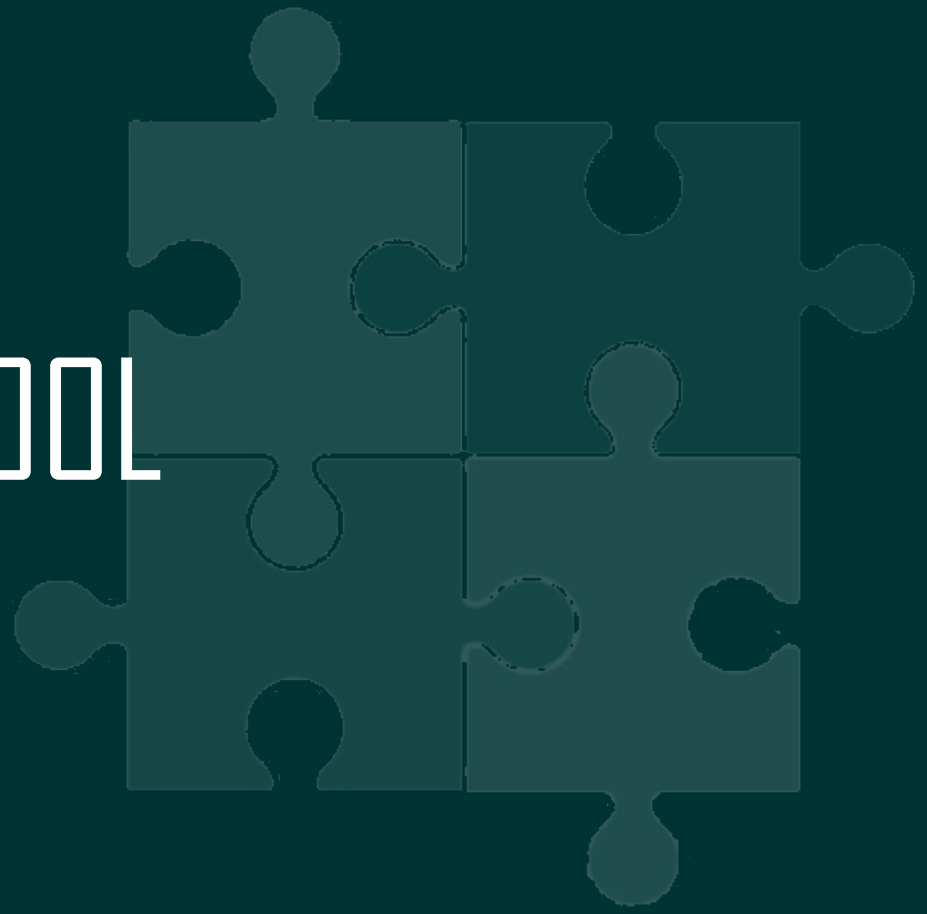
Clint Alexander (calexander@essa.com); Natascia Tamburello (ntamburello@essa.com)
ESSA Technologies Ltd., National Conference on Ecosystem Restoration 2024

U.S. FISH & WILDLIFE SERVICE

PACIFIC STATES MARINE FISHERIES COMMISSION

ESSA

PART 2A: PRIORITIZATION TOOL



KLAMATH IFRMP RESTORATION PRIORITIZATION TOOL

An interactive and accessible web tool for organizing diverse restoration planning data for collaboratively updating projects + priorities over time.

Custom-built Interactive Prioritization Web Tool

KLAMATH IFRMP RESTORATION PRIORITIZATION TOOL

Home Tutorial Scenarios Projects Map explorer Scoring history Logout

Subbasin weighting scenarios

http://klamath.essa.com/

Guest, read-only access:
username: ifrmpguest
pwd: table-box-12

Select a subbasin: Scott (Team 1)

Select a scenario: Scott – 202211 - Default scenario - w implementability

Scenario name: Scott – 202211 - Default scenario - w implementability

New | Copy | Delete | Save

Scoring criteria | Biophysical tier importance | Species importance | Restoration need weight | Feasibility importance

W1 = Species Range Overlap : 0.7 (Less important — More important)

W2 = Core Performance Indicator (CPI) Status : 0.7 (Less important — Mo)

W3 = Stressors Addressed for Focal Species : 0.9 (Less important — M)

W4 = Scale Benefit : 0.7 (Less important — M)

W5 = Implementability : 0.6 (Less important — More i.)

Total basin cost

$0 — $80.4m

Basin budget limit: $ 80,357,000

Min project cost: $ 0

Individual projects cost

$0 — $20.0m

Max project cost: $ 20,024,000

Total midpoint cost of all listed projects is $80,357,000. 1 out of 17 projects do not have cost specified.

Reset cost filters

Sort by: Cost (low to high) Score (high to low)

14. Restore upland wetlands and meadows to improve cold water storage and flood attenuation in the Scott River sub-basin. — Midpoint cost: $17,749,000 — 24.0

15. Callahan Dredge Tailings Remediation — Midpoint cost: $8,890,000 — 21.4

11. Install appropriate in-channel structures such as LWD, boulders, etc. to improve condition of fish habitats in priority tributaries. — Midpoint cost: $1,675,000 — 17.2

7. Improve/decommission priority roads identified in the Five Counties Road Erosion Inventory to reduce fine sediment inputs to Scott sub-basin streams. — Midpoint cost: $2,347,000 — 17.1

11. Install appropriate in-channel structures such as LWD, boulders, etc. to improve condition of fish habitats in priority tributaries. — Midpoint cost: $1,675,000 — 17.2

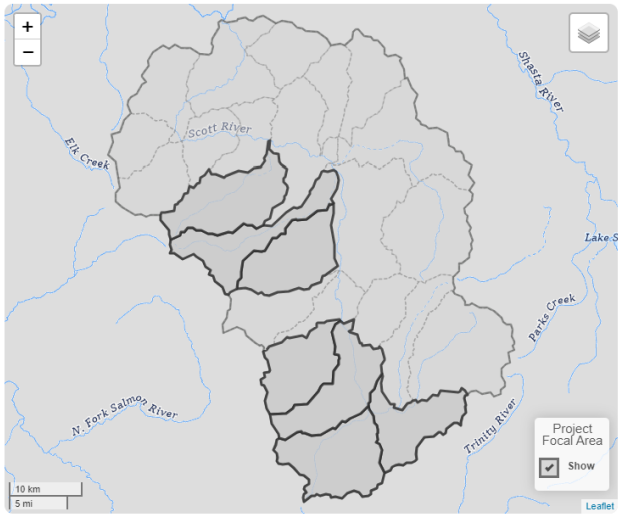
Placement of appropriate instream structures, most likely large woody debris (given that large boulders are not native to the lower Scott River) to provide cover for rearing salmonids at streams identified as priorities for this purpose (NMFS 2014). These activities may be further guided by the Scott River Water Shed Council's new plan: Restoring Priority Coho Habitat in the Scott River Watershed: Modeling and Planning Report (SRWC 2018) with the potential for increased floodplain connectivity with groundwater recharge and water quality benefits.

Action types | HUC12 | Stressors | Species | Restoration needs | Objectives | Project cost | Implementability | Final criteria score

Fish distributions

Restoration needs

External Layers



Map: HUC12 polygons within the selected Klamath subbasin

Prioritization Outcomes

- **146 candidate projects** identified in separate lists for each sub-basin.
- Cost range for the **133** fully costed projects (86%) is **$484M (2020 USD).**
  - **This pays for "**one round**" of restoration actions basin-wide, but >1 usually needed.*
    - Does not include additional cost of decommissioning four dams & implementing reservoir site restoration (+$495M)
    - Does not include cost of filling monitoring gaps
  - Depending on # rounds, total cost over 20-25 years *could* exceed **$3 billion**.

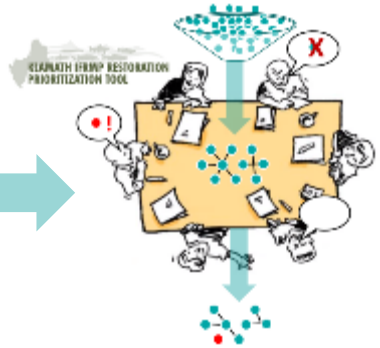
RECOMMENDED IMPLEMENTATION FLOW

REPEAT OVER TIME

IFRMP

Periodic Restoration Symposia

Next Restoration Action Agenda



UPDATES…

…and…

Detailed Project Proposals

Proposal Help Desk?

Select Proposals

Informed by Restoration Action Agenda + Prioritization Tool

Implementation

FUND

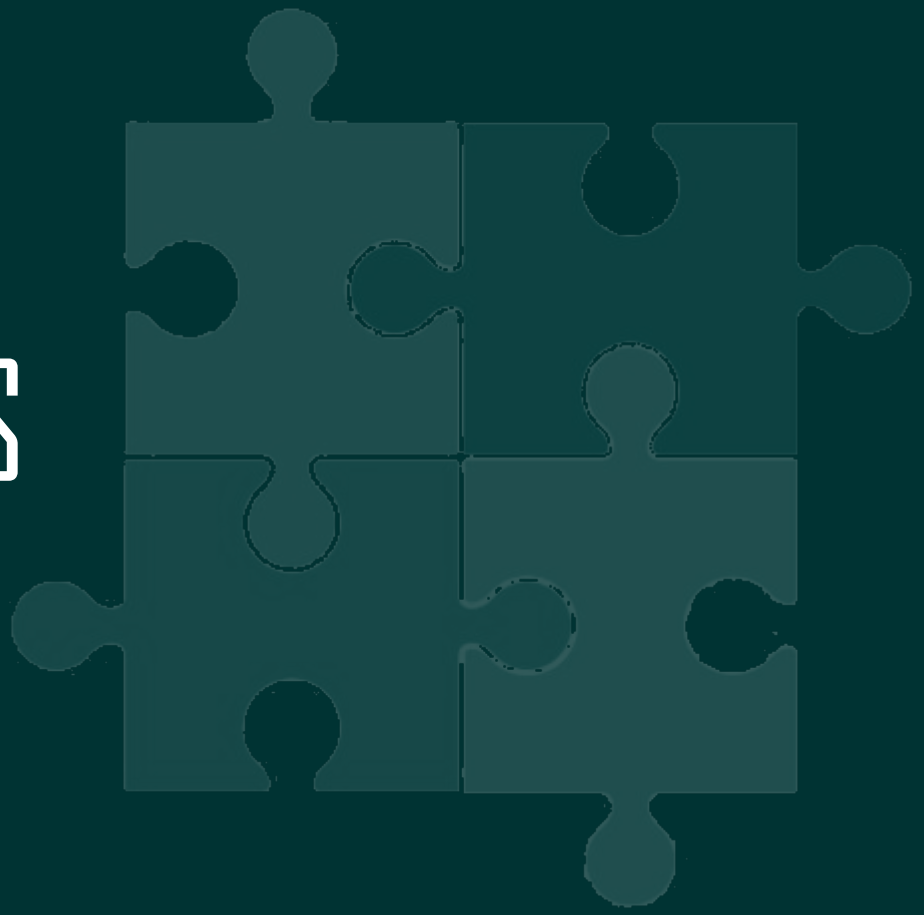
IMPLEMENT

TRACK

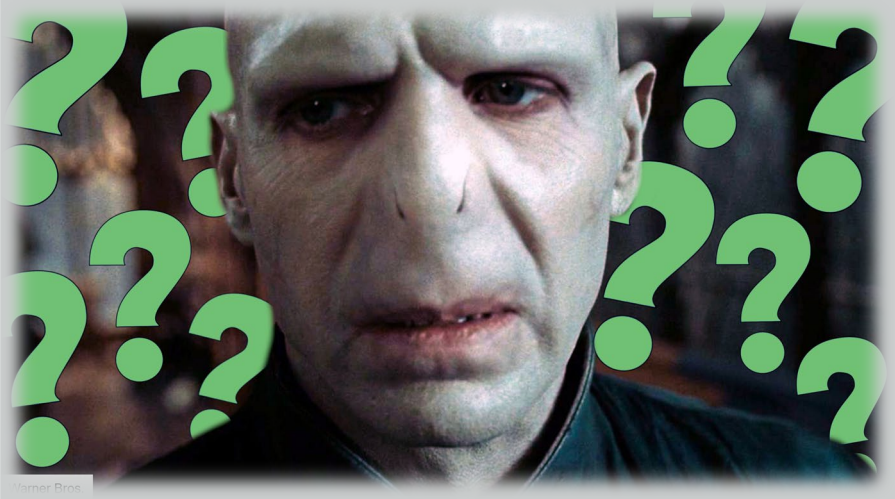
Update Prioritization Tool

KLAMATH IFRMP RESTORATION PRIORITIZATION TOOL + Status Atlas

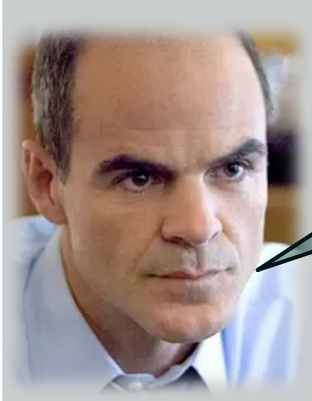
PART 2B: OVERALL LESSONS



BIG LESSONS LEARNED

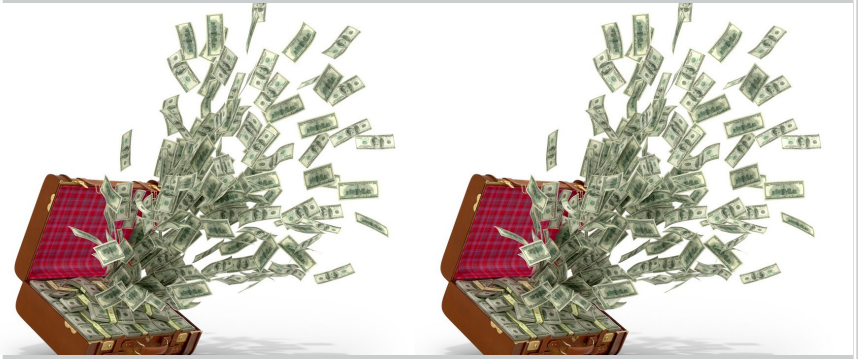
Challenge	Transferable Lesson
Governance 'Voldemort' – Governance being 'undiscussable' was a constant source of frustration for participants. 	**LESSON**: **People are distrustful of science with un-mentionable decision-making structures**. Best buy-in if tackle adaptive governance transparently head on early in process, ideally with **a concrete plan for long-term (20+ yrs) implementation follow-through**. Tell Sr. bureaucrats who just want to "keep the peace" that they should: **Distinguish** governance of **FUNDING** DECISION-MAKING *~from~* governance of HOW RESTORATION ACTIONS PRIORITIZED/SELECTED (**SCIENCE**).

BIG LESSONS LEARNED

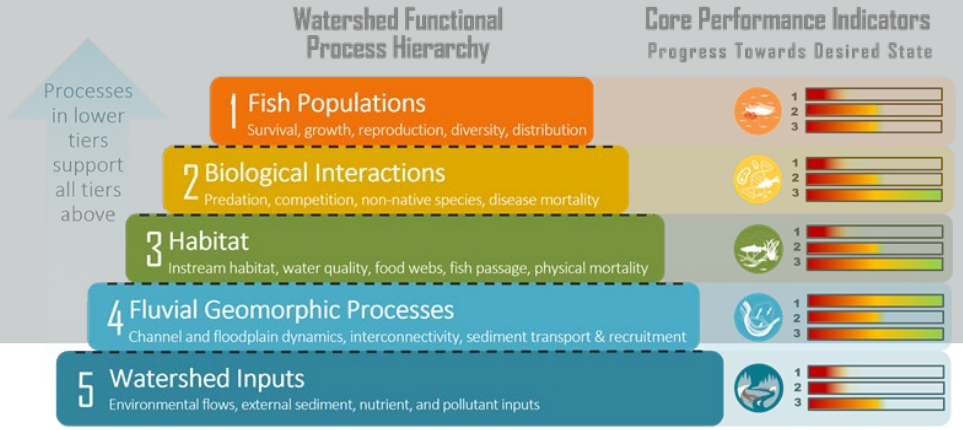
Challenge	Transferable Lesson
Failure to create a clear pathway for implementation is how planning products 'sit on the shelf' and perpetuate a Sisyphean déjà vu of recreating things. This is how most collaborative planning processes fall out of accountability.	**LESSON**: **An authorized implementation agreement trumps 'report recommendations' & 'next steps'.** Lobby Congress to authorize long-term funding (e.g., legal ROD, Platte, TRRP, CERP, GCDAMP, Yakima Basin Integrated Plan, etc.) ***whenever it is obvious (as in Klamath) there will be a large, 20+ investment needed to carry out needed restoration and monitoring***.  **If you're sincere about long term implementation… Have a team ready to lobby in DC.**

*WITHOUT A CLEAR GOVERNANCE / AUTHORIZED IMPLEMENTATION PLAN:

OTHER LESSONS

Challenge	Transferable Lesson
Burst of BIL funding unprecedented. More money to spend than admin to issue, evaluate and contract projects. 'Handshake' style deals to move all the money. 	**LESSON: Expressly link the 'handshakes' to any validated tools that give partners a trustworthy referee so that hurried choices have scientific merit.** **~AND~** KLAMATH IFRMP RESTORATION PRIORITIZATION TOOL  **Think long term. *$2B doesn't even cover what is needed in the Klamath over the next 10-20 years <u>let alone what is needed across the US</u>*.** Long term governance and implementation for 20+ years needed to see it all through. More exhilarating & impactful accomplishment than BIL.

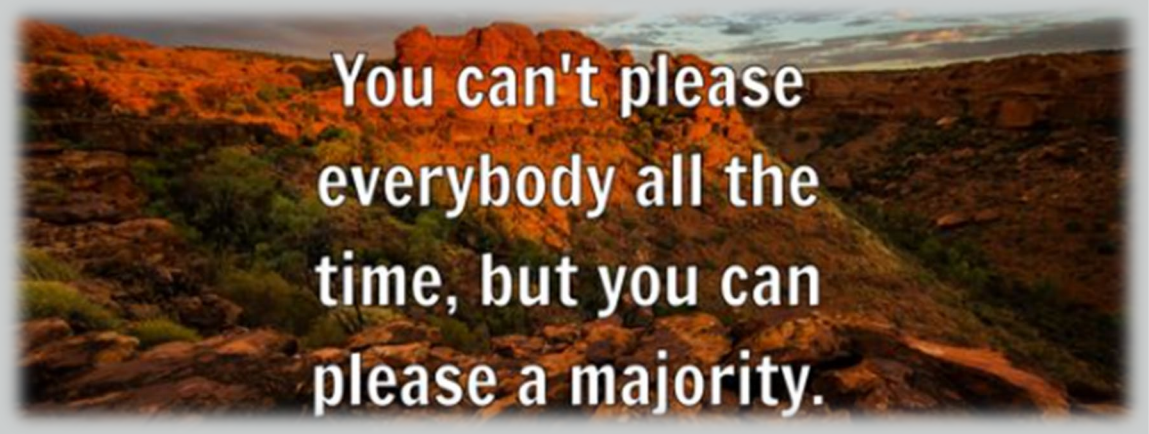
OTHER LESSONS

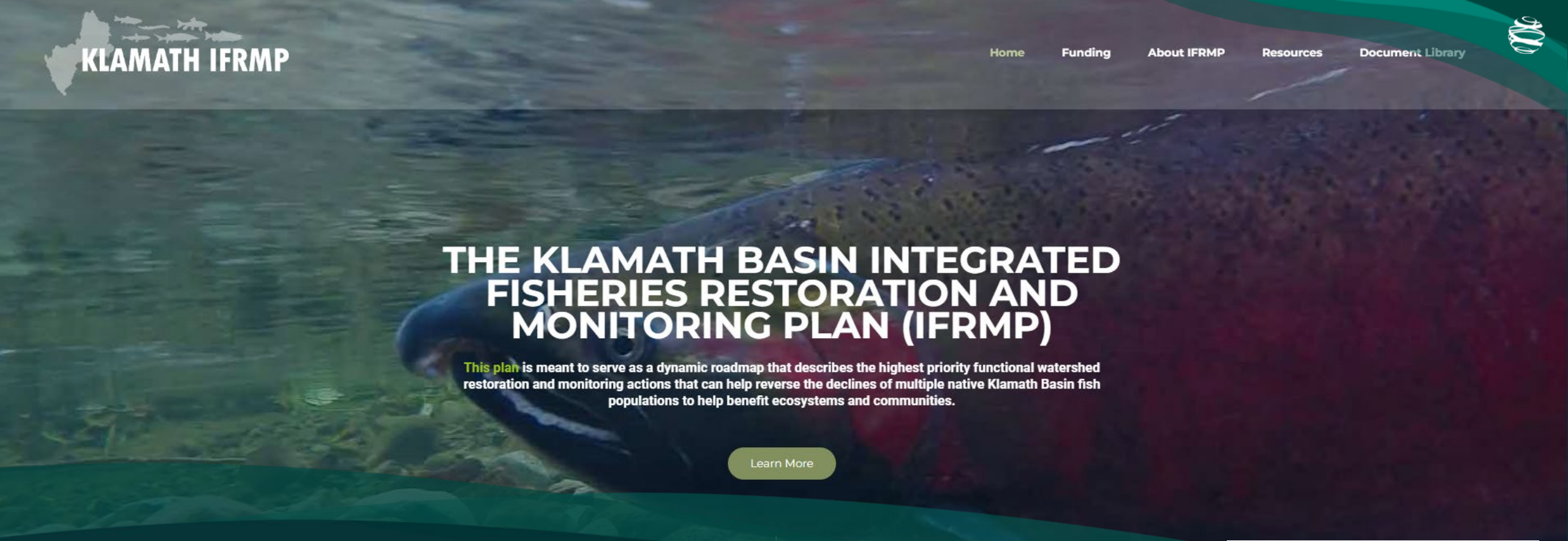
Challenge	Transferable Lesson
Completing AM learning loop and APPLYING project level lessons on project effectiveness to future funding decisions.	**LESSON:** Even a well vetted list of priority restoration projects will have surprises and unexpected results. **A comprehensive and coordinated long term monitoring program is essential to underpin adaptive learning.** ***Monitoring needs to focus on all core performance indicators over <u>all</u> relevant biophysical tiers.** (e.g., not just water quality). 

OTHER LESSONS

Challenge	Transferable Lesson
Open door engagement policy has trade-offs. Highly participatory processes good for buy in and plan defensibility but involve latecomers trying to scuttle what has come before and periods where key people invited won't always show.	**LESSON: Deploy a dedicated facilitation team and prepare for multiple years of consultations and review (= cannot sprint through an inclusive process). + *Be prepared for political and other lags and stoppages*** – In Klamath, 2020 election, fires, covid, meteors, locusts… As found in Klamath Basin, need a champion with serious stamina to see it through (as found in Matt Baun and USFWS/PSMFC). **Consultation (facilitation) can be around 50%-60% of planning budget.**

OTHER LESSONS

Challenge	Transferable Lesson
The "Integrated Plan" was never integrated enough. E.g., The Klamath IFRMP could not officially include fisheries management actions (harvest) or population monitoring (domain of USFWS, NOAA) -- tricky. *Notionally* included but only to defer to ongoing activities by those agencies	**LESSON: Integration still needs to have boundaries on it**, a distinct scope and scale. Integrated Plan ≠ Everything Plan. Be understanding but know **it is impossible to be everything to everyone.** 



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/