



# 43<sup>RD</sup> Annual Salmonid Restoration Conference *Bridging the Gaps in Restoration*

APRIL 28 - MAY 1, 2026 REDDING, CA

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# Bridging the Gaps in Restoration

In many ways, the watershed restoration field evolved to bridge gaps between the need to restore watersheds and the resources and technologies available to address the legacy impacts that impaired their ecological function. In the far northern corners of California, we have witnessed a transition from resource extractive industries like mining, logging, ranching and unregulated cannabis cultivation to an ever-expanding watershed restoration field. In many watersheds including the mid-Klamath, Trinity River, Salmon River and the Mattole, community-based watershed restoration drives both salmon and economic recovery. These communities thrive by weaving salmon recovery and a land stewardship ethos into the very fabric of social networks. This whole-cloth and generational approach to salmon recovery benefits both people and the environment by creating restoration jobs, improving infrastructure, and enhancing water security.

The restoration field has been bridging gaps for decades by bringing together non-profits, scientists, tribes, planners, utilities, consultancies and engineers to create multi-faceted projects that are often implemented by watershed groups. These community-based groups often have decades of experience, monitoring data, and observational insights about the watershed where they live and work. They are bridge builders to what is possible!

Gaps are not just filled by best science and comprehensive data sets. In the real world, we bridge the gaps between what we think is viable and how to actually make it happen with collaborative processes that engage diverse constituents over many years. Is it often excruciating? Yes. Is it sometimes rewarding? Usually. For those of us in the long-game of restoration and restoring wild salmon, it is the fostering of collaborative relationships that count. They are what fuel us to keep doing this work.



## *Special Thanks*

The Annual SRF Conference is a collaborative effort that amplifies the expertise and enthusiasm of our many restoration partners.

The SRF Conference could not happen without the dedicated support of SRF Co-sponsors; Session, workshop, and field tour coordinators; SRF Board of Directors and Staff; our many Conference Presenters; and all of the conference attendees who migrate from far and wide to participate in this conference.

For many conference participants, the Annual Salmonid Restoration Conference is where we bridge gaps in our often-siloed fields and get re-energized. We become inspired by seeing the on-the-ground work in the region, and sharpen our planning and collaborative skills. In this challenging time when many of us struggle with the gaps between our conservation goals and the dismantling of agencies and environmental mandates, it is even more important to convene and converse.

As both landscapes and our political institutions are eroding, perhaps we need to think not just about what is possible, but how we perceive what is impossible. California and our beloved salmonids will always need water and as we navigate all of these new stressors, restorationists will always need to practice compassion and open-mindedness using the best available science to restore our fragile watersheds.

In the spirit of bridging gaps, I hope that the SRF conference can hold space for all of us who are dedicated to the worthy cause of preserving wild salmonids in our precious state.

—Dana Stolzman, Executive Director and Agenda Coordinator

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## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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**Workshop Coordinators:** Konrad Fisher, Water Climate Trust; Nick Joslin, Mount Shasta Bioregional Ecology Center; and Angelina Cook, California Sportfishing Protection Alliance

The goal of this workshop is to promote improved instream flow outcomes through better water accounting, encouraging accountability, and strategic advocacy. This wide-ranging workshop is intended to be broadly applicable to many disciplines and roles, including scientists, funders, restoration project developers, advocates, and regulators.

We will explore why some approaches to increasing instream flows are more likely to be successful than others. Regulations to establish instream flow requirements can keep significant quantities of water instream, however, barriers include political realities and potential scientific uncertainties. At the same time, some instream flow projects seem promising at first glance but are actually counterproductive. Examples include: 1) replacing leaky ditches with pipelines without requiring that the diversion be downsized to account for the previous ditch losses (i.e., groundwater recharge), 2) upgrading diversion infrastructure to provide flexibility that enables increased diversion rates and/or lengthening the seasonal duration of diversion, 3) providing new infrastructure to continue irrigating land that lacks a valid water right, and 4) purchasing “paper water” rights, short term transactions, or funding a property transaction without adequate understanding of water rights and beneficial uses. Funders may lack local knowledge and/or subject matter expertise, so providing knowledgeable locals and subject matter experts with opportunities to provide input prior to project funding can improve outcomes and avoid counterproductive projects. We all have a responsibility to ensure that restoration funds are invested in projects that provide maximal environmental benefits.

Attendees will learn about often misunderstood fundamental concepts including how instream flow studies can lead to instream flow requirements, characteristics of different kinds of water rights (pre-1914, post-1914, riparian, appropriative), weaknesses in instream flow dedications (i.e., conditions in permissive 1707 dedications that limit their efficacy), and the irrigation efficiency paradox (i.e., why converting from inefficient flood irrigation to efficient sprinklers can reduce diversions at the scale of individual farms, but increase consumptive use and intensify water scarcity at basin scales). Presenters will provide guidance on what makes a good instream flow project and how to avoid counterproductive pitfalls. We will explore why some cost-effective strategies, such as buying irrigated land and permanently retiring water rights, are seldom used. Significant flow benefits may also be achieved through better enforcement of existing laws and regulations, so presenters will provide guidance on how to effectively file complaints when violations are observed.

Attendees will learn what important—yet frequently overlooked—questions should be asked when developing and evaluating instream flow projects. In breakout sessions, attendees will have hands-on opportunities to review and critique anonymized conceptual project proposals and discuss their strengths and weaknesses. Group discussions will provide ample opportunities for lively and respectful exchanges of ideas.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Water Law 101:

#### An Overview of California Water Law for Instream Flow Practitioners

Matthew Clifford, J.D. and Lauren Bernadette, J.D., Trout Unlimited (Co-presenters)

One prerequisite for engaging effectively in efforts to protect instream flows in California is an understanding of California water law, which consists of the system of statutes, constitutional provisions, case law, and regulations that determine who has the legal right to divert and use water, the terms under which they may do so, the duties that come along with those rights, and the means by which the system of rights is administered and enforced. That body of law has evolved in response to various social, economic, geographic, and hydrological factors over the last two centuries, and its complexity can be a barrier to entry for those seeking to participate in conversations on how to better protect instream flows for the benefit of ecosystems.

This presentation will provide a primer on the basic elements of California water law, with an emphasis on topics of particular relevance to efforts to ensure that sufficient water is left instream to preserve native fish and wildlife, as well as the habitat and riverine functions that support them. Topics covered will include the basics of the state's dual system of riparian and appropriative water rights (both pre- and post-1914), the basic features and limitations of each type of right, and the means by which they are established, administered, and enforced. The presentation will also discuss various legal authorities for limiting existing water rights to protect instream flows, including the public trust and reasonable use doctrines, Section 1707 of the Water Code, and Sections 5937 and 1602 of the Fish and Game Code. Finally, the presentation will describe selected real-world examples of past and ongoing efforts to enhance and protect instream flows through both voluntary projects and regulatory requirements.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### An Incomplete Survey of Methodologies for Setting Instream Flow

Chris Shutes, Executive Director, California Sportfishing Protection Alliance

This discussion will focus on setting instream flows from a practitioner's perspective.

This discussion will start with the broad assumptions people make about water that is in rivers and water that is diverted from them. One polar end is the old school concept of "conservation": water not captured or stored is "wasted." The other end is the principle of the public trust: water in its natural environment is a public benefit for all and must be preserved in its natural state to the extent "feasible." These broad assumptions enter into the approaches to flow-setting that are often unspoken or unconscious.

Tiering from general assumptions, the discussion will survey different methodologies regulators use to set instream flow requirements. These methods have a wide range of specific inputs and assumptions. They include methods based on:

- References to unimpaired hydrology
- Defined biological and physical functions
- Habitat mapping
- Direct effects on fish or other biota
- Fish migration
- Water temperature

The discussion will also consider some of the elements that enter into flow-setting, including hydrology, water-year types, water storage and reservoir operations, and demands for power generation and water supply. On the biological side, it will consider management species and the life histories of fish, frogs, and other biota affected by river flows.



Mount Shasta from  
Big Springs Creek survey  
*Photo: Angelina Cook*

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Instream Flow Requirements on the Scott and Shasta Rivers: A Case Study in River Advocacy

**Nathaniel Kane**, Executive Director, Environmental Law Foundation  
and **Madi Richards**, Policy Manager, California Coastkeeper Alliance

This presentation will discuss some of the successes and challenges Tribes and Non-Governmental Organizations (NGOs) have faced in attempting to establish effective, legally enforceable minimum instream flows in two key salmon streams: Northern California's Scott and Shasta Rivers. The presentation, led by two attorneys who are actively engaged in the issue, will focus on the long-term efforts to convince the State Water Resources Control Board to adopt minimum flows as part of a multifaceted, long-term effort to restore salmon populations in these critical tributaries, what may be next in these rivers, and what's at risk if current efforts fail.

Historically, the Scott and Shasta Rivers—tributaries to the Klamath—have provided some of the most important spawning and rearing habitat for anadromous fish species in the North Coast, with the majority of Klamath coho and a large proportion of Chinook spending at least part of their life cycle in these rivers. Prior to a precipitous decline in recent decades—largely attributable to low flows caused by over-extraction of ground and surface water—the Scott and Shasta formed the backbone of thriving tribal fisheries and a flourishing commercial fishing industry. But the decline in recent decades has been devastating. Spring-run Chinook salmon have already been extirpated from the rivers. Fall-run Chinook are in decline, and coho salmon imminently face extirpation if cold flows are not restored.

Efforts to address flows, led by Tribes and the fishing community, have spanned decades. In 2018, years of litigation culminated in a Court of Appeals ruling recognizing that California's public trust doctrine—meaning the duty to consider and mitigate impacts to navigable waters—extends to depletions of groundwater which affect navigable rivers such as the Scott.

In 2021, the Karuk Tribe and Environmental Law Foundation petitioned the State Water Resources Control Board to establish emergency regulations on the Scott River. The Board then adopted temporary, year-long emergency regulations ("E-regs") for both the Scott and Shasta Rivers. The Board has re-adopted the E-Regs in each subsequent year. Tribes and NGOs have filed successive petitions with the State Board asking for permanent flow protections in both the Scott and Shasta Rivers.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Water Management Regulation: An Irrigator Experience of Navigating Water Regulations and Suggestions on How to Improve them for Better Ecological Outcomes

**Betsy Stapleton**, Project Development and Permit Specialist, Scott River Watershed Council

Water management regulation is an ever-increasing web of overlapping and complex regulations that can be expensive, daunting, and perplexing for an irrigator while also leaving considerable uncertainty about improving ecological outcomes. Regulators and water users alike are struggling with actualizing the multiple mandates contained in emergency and interim flow regulations, Lake and Streambed Alteration agreements, adjudications, groundwater sustainability requirements, and water quality permits (Total Maximum Daily Load—TMDL). There is reasonable concern that the regulatory process will create devastating economic consequences for agricultural producers without providing significant ecological benefit. This presentation is a first-person description of one water user's experience of navigating the regulations. The presentation's intention is to share an understanding of the regulations, what they are attempting to achieve, and the flaws that this user has seen. Ideas on how to improve user experience and ecological outcomes will also be shared.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Using FERC Relicensing to Improve Streamflows

**Chris Shutes**, Executive Director, California Sportfishing Protection Alliance

Relicensing of hydropower projects by the Federal Energy Regulatory Commission (FERC) provides an opportunity to re-evaluate and modify streamflows every 30-50 years. Relicensing is a public process in which non-governmental organizations (NGOs) and individuals are able to play an active and influential role.

FERC's study process in relicensing requires the hydropower project operator (or "licensee") to build a record on which FERC and other jurisdictional agencies develop substantial evidence to support instream flow prescriptions or recommendations. The study process is the first point of access for NGO and individual participants to influence flow-setting.

FERC has preferred methodologies for flow-setting and also places geographic limits on which waters are jurisdictional to hydropower licenses. The discussion will review the opportunities, the methodologies, and the limits. It will review some ways to improve flow outcomes. It will also review how hydropower operators use the process to limit instream flow requirements when those requirements reduce power generation and/or water supply.

Finally, the discussion will consider how some of the issues about flow-setting that arise in FERC relicensing also arise in other venues. This includes efforts to migrate methodologies used in FERC relicensing to venues where they are inappropriate or where they conflict with more appropriate methodologies. This also includes situations where there are overlapping jurisdictions and where differences in targeted river reaches lead to conflicting priorities and outcomes.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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Amy Campbell, Senior Project Director, The Nature Conservancy

### Lessons Learned on Instream Flow Dedications (1707)

One approach to dedicating water to nature in California is through an administrative process at the State Water Board affectionately called California Water Code §1707 (1707). This process involves adding fish and wildlife as an additional beneficial use to an existing water right so that water can be left instream and, in some cases, protected from diversion by downstream water right users. While simple in concept, the process to dedicate water rights instream can be difficult. Over the last 15 years, The Nature Conservancy has submitted a dozen 1707s in California, all with the primary goal of increasing ecological flows in key streams and rivers for salmon. This presentation will provide a general overview of what the 1707 process is, present real-world examples of how 1707s have been used to augment streamflows, and share key takeaways and lessons learned from the 1707 process.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### The Devil Is in the Details—Avoiding Unintended Consequences While Developing Flow Restoration Projects

Nick Joslin, Policy and Advocacy Director, Mount Shasta Bioregional Ecology Center

Irrigation infrastructure upgrades are being more commonly targeted as “restoration” projects with the assumption that any irrigation efficiencies gained will lead to water being left instream. This presentation will describe common irrigation infrastructure projects with purported instream benefit and discuss where practitioners need to look to identify possible unintended consequences.

Some common irrigation infrastructure upgrades are: new points of diversion, ditch lining, pipelines, solar pumping, and the conversion of flood irrigation to sprinklers. While these projects can appear to have potential instream benefits, we will explore how practitioners can investigate these projects with a new understanding of some basic principles of irrigation infrastructure and irrigation techniques. We will also explore how to better understand paper water rights versus stated water use so that we can avoid “inflated baseline syndrome”.

In this presentation, we will outline the process for dedicating water to instream benefit using common methods like forbearance agreements and Water Code 1707. We will discuss the practical limitations of each framework and discuss how to investigate the stated benefits that can be found in new water rights petitions.

Water accounting is complex, and water rights investigations can be daunting, but participants will leave this workshop with a better understanding of how to approach restoration projects with claims of instream water dedications. We will also discuss how to avoid the overvaluation of paper water rights that can lead to paper water dedications instead of wet water dedications.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Don't Rob Peter to Pay Paul—To Improve River Flows, Irrigation Improvement Projects Should Reduce Consumptive Water Use and Avoid Reducing Groundwater Recharge

Eli Asarian, Riverbend Sciences

Irrigated agriculture is the largest human water use. Improving irrigation efficiency is often erroneously considered a magic win-win solution that offers huge water savings (i.e., >50%) and will increase instream flows. In reality, irrigation efficiency rarely increases basin-scale instream flows unless accompanied by regulations that directly protect instream flows. The main benefit of efficiency is to lessen the economic effects of these regulations on agricultural producers.

In assessing the effects of irrigation on basin-scale water budgets and river flows, it is essential to differentiate between consumptive (water that is permanently removed as evaporation or transpiration by crops) and non-consumptive uses (water that returns to groundwater, soils, or waterways). Increased farm-scale irrigation efficiency usually fails to increase water availability at larger spatial scales, a phenomenon known as the “paradox of irrigation efficiency.” This is because prior to efficiency improvements, a large percentage of water withdrawals (e.g., 50%) is not consumed through transpiration or evaporation, but instead returns to surface or ground waters and eventually becomes available for downstream use. Increasing efficiency, such as converting from surface flood irrigation to drip irrigation, or converting conveyance from a leaky ditch to a pipeline, often reduces return flows (e.g., groundwater recharge) but does not reduce consumptive use. Such projects may increase flow within a localized reach or short time frame, which may be worthwhile if it improves a biological hotspot (e.g., a cold spring-fed reach with critical salmonid habitat), but does not increase flow at larger spatial scales or longer time scales. To increase streamflow at larger spatial scales, consumptive use must be reduced. Consumptive use can be reduced by fallowing or switching to crops that require less irrigation, but that can affect profitability. Opportunities to reduce non-beneficial consumptive use without reducing crop yields are meaningful, but generally limited to less than 20% of applied water. The largest opportunities for reducing non-beneficial consumptive use are in sprinkler-irrigated fields, where a significant fraction of water is blown away by the wind and never reaches the ground. Wind drift can be reduced or eliminated by reducing water pressure and lowering sprinkler heads (e.g., Low Energy Precision Application, LEPA) or converting to drip irrigation. In areas with abundant winter water, enhancing wet-season storage in tanks, reservoirs, and groundwater can reduce or offset summer water extraction.

Based on the principles above, this presentation will provide guidance on the questions that restoration practitioners, funders, and regulators should ask when designing, evaluating, and implementing projects or programs aimed at increasing instream flow. Answering these questions will improve the chances of achieving real benefits and avoiding adverse consequences. Projects should not be implemented unless the timing and magnitude of expected changes in water budgets components are known, including surface diversions, groundwater pumping, storage, return flows, and consumptive use. New tools such as OpenET can help quantify consumptive use.

To illustrate these concepts, this presentation will review some water conservation plans (known as Local Cooperative Solutions) for Scott Valley farms to assess potential consumptive use reductions.

## Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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### Measuring Cost-Effectiveness of Environmental Water Transactions

David Pilz, J.D. (Presenter) and Co-authors: Bruce Aylward, Ph.D.; Sarah Kruse, Ph.D.; and Amy McCoy, Ph.D.

The diversion, storage, and consumptive use of water in the western United States (U.S.) has drastically altered streamflow, water quality, and a raft of ecological, social, and economic goods and services. Over the last fifty years, Western states have begun to address this problem through a range of approaches. Water quality regulations, endangered species protections, application of the public trust doctrine, and other regulatory approaches reflect an effort to prevent further degradation of streamflow and associated values. For example, in Oregon, minimum streamflow requirements created in the 1950s were converted into instream water rights in the 1980s and 1990s to limit further appropriations of water for out-of-stream use. Unfortunately, as junior (or low) priority rights, these rights do not serve to restore flow to already dewatered streams. In other cases, both large and small, regulatory enforcement has led to real improvements in water for the environment. In California, the protections afforded to Mono Lake water levels and the re-dedication of contract water to environmental uses under the Central Valley Project Improvement Act are but two examples. However, the costs, whether of litigation or compensation, and the time required to dedicate water to the environment through regulatory approaches are unattractive to many conservation groups that focus on collaboration rather than litigation for environmental ends.

An alternative approach to meet streamflow restoration needs is to proactively negotiate in the “water market” for the acquisition of existing out-of-stream rights or for changes in water use and management to benefit the environment. These transactions result in “environmental flows,” including the dedication or protection of water instream or the provision of water to consumptive environmental uses (such as for floodplain habitat). This suite of activities is referred to as “environmental water transactions.” In California—where streamflow and freshwater ecosystems are as adversely impacted by water resource development as anywhere else in the country—this market-based approach to streamflow restoration has been slow to emerge as widespread practice. However, interest in this approach by conservation groups in California is increasing, particularly with the 2014 passage of the Proposition 1 Water Bond, which allocates \$500 million dollars for environmental water transactions in the coming years.

This report aims to provide context and methodological assistance on the cost-effectiveness of environmental water transactions (EWT) to the various groups that will be involved in this effort. In doing so, we draw on experience with these transactions from the Columbia Basin in the Pacific Northwest, and in states across the western U.S. . Specifically, this report aims to assist public funding agencies and project proponents to maximize the cost-effectiveness of investments in projects intended to enhance the quantity of environmental flows. The report provides discussion, guidance, and recommendations on cost-effectiveness metrics for environmental water transactions. Detailed instructions for the use of a basic cost-effectiveness metric based on water volumes are laid out, along with an initial testing of the metric on a set of existing transaction data from the Whychus Creek watershed in the Deschutes Basin, Oregon.

# Real Water for Fish: Improving Instream Flows through Water Accounting, Insights, and Advocacy

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## Fish Flow Funding Principles: Public Funding Should Improve and Avoid Harm to Instream Flows

Konrad Fisher, Director, Water Climate Trust

### Fish Flow Funding Principles

Public and private funding is allocated for a range of projects that can increase or reduce instream flows. This includes funding earmarked for water conservation, water infrastructure, streamflow enhancement, and environmental water transactions. In this workshop, we will discuss funding principles designed to improve, or avoid harm to, instream flows. These principles can be implemented via grant questions, requirements, and scoring criteria. Principles include:

#### 1. Measure the Impact on Environmental Flows (Water Accounting)

To avoid harm or maximize benefits for environmental flows, funding agencies should collect information needed to measure the impact of proposed projects on environmental flows. One useful methodology is described in a 2016 report, "Measuring Cost-Effectiveness of Environmental Water Transactions."

#### 2. Stop Harming Environmental Flows

Public funding agencies should stop funding projects that reduce environmental flows for endangered fish, river-dependent Native American Tribes, and other protected instream beneficial water uses. Projects that can reduce environmental flows include: (1) new or improved water diversion infrastructure where instream flow requirements do not exist or are not enforced, (2) water conservation or efficiency projects where conserved water is not legally and effectively dedicated for instream use, (3) projects that eliminate water conveyance losses without a corresponding net decrease in water consumption, and (4) environmental water transactions that dedicate surface water rights for instream use, but do not limit extraction of interconnected groundwater.

#### 3. Dedicate Conserved Water to Environmental Flows

Water that is conserved with public funding should be legally dedicated for instream use, particularly when a funding source is earmarked to improve fisheries or environmental flows. Instream water dedications should be permanent, legally enforceable, and dedicated instream for as many stream-miles as possible to avoid withdrawal by downstream water right holders.

#### 4. Prioritize Cost-Effective Environmental Water Transactions

Agencies that fund environmental water transactions should adopt: (a) metrics to rank proposed transactions based on relative cost-effectiveness and (b) funding requirements to reject proposed transactions that reduce environmental flows or provide negligible or unverifiable benefits.

#### 5. Provide Benefits Greater Than Required by Law

Public funds earmarked for fisheries and ecosystems should provide benefits greater than required by law. To this end, funding agencies should require that water dedicated for instream use augments, rather than satisfies, instream flow requirements. Where instream flow requirements have not yet been established, this requirement should be applied after instream flow requirements are established.

## Dam Removal Project Manager Training, Day 1

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**Workshop Coordinator: Meghan Quinn, Esq.,** Director of California Dam Removal and Hydropower, American Rivers

This 2-day workshop focuses on preparing individuals to work through the challenges of developing and managing a successful dam removal project. The goal is to build the knowledge, skills, and confidence of potential project managers to allow them to lead both straightforward and more complex projects that often involve engaging with active project opponents; working through unpredictable regulatory processes; significant fundraising; and coordinating a team of diverse project partners, property owners, engineers, and contractors. Topics include river science, the basics of dam removal design and construction, project identification and scoping, and managing stakeholder engagement. Attendees will learn about opportunities for dam removal projects identified through our work with the California Fish Passage Forum and hear from regional dam removal practitioners. The training will culminate in a tour of a local dam removal site and discussions with partners actively engaged in on-the-ground dam removal projects.

American Rivers is a national non-profit organization that believes every community in our country should have clean water and a healthy river. Since 1998, we have led a national movement focused on dam removal as a safe, reliable tool for restoring river function and connecting previously fragmented river systems. Our Dam Removal team has implemented and/or provided technical assistance to more than 326 successful dam removal and river restoration projects in watersheds around the nation. Even as American Rivers and our river restoration partners celebrate progress on removing 2,240 dams nationwide, there is a need for more action. To meet the growing demand to address outdated, ecologically damaging dams, we need additional project managers and stakeholders to fill a variety of roles necessary to ensure successful implementation of dam removal projects.

### Day 1:

*Opportunities and Goals for Dam Removal in California*, Meghan Quinn, American Rivers

*Introduction to Managing a Dam Removal Project*, Serena McClain, American Rivers

*Basics of Engineering Design and Construction: Role of a Project Manager*, Brian Graeber, American Rivers

*Site Visit: Battle Creek Dam Removals*, Battle Creek Watershed Conservancy

## Former Klamath Dam Reach Tour

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**Field Tour Coordinators:** Bob Pagliuco, Marine Habitat Resource Specialist, NOAA Fisheries Restoration Center and Mike Belchik, Senior Water Policy Analyst, Yurok Tribe

Klamath dam removal was the result of a 25-year effort that resulted in the largest dam removal project in history. Opening up approximately 400 miles of historic habitat, dam removal is already profoundly altering the ecology of the Klamath River and will continue to do so for decades to come.

A key component of the dam removal project is the restoration of the former reservoir footprint areas for Iron Gate and Copco Reservoirs. Floodplains to key tributaries were buried in silt deposits, and intensive restoration was necessary to restore their function. RES (Resource Environmental Solutions), the Yurok Tribe, the Shasta Indian Nation, and other parties worked diligently together and have completed several large projects intended to enhance access, provide critical habitat, and restore overall ecological function. Also showcased will be the revegetation efforts for both upland and riparian areas within the reservoir footprints.

In addition to observing restoration sites in and near the former reservoir sites, the tour will include discussion of other topics such as the dam removal process, the progress of salmon repopulation in areas far above the dam sites, spring Chinook restoration, and future restoration goals and plans.



Klamath River former reservoir footprint

*Photo: Shane Anderson*

## Lower Clear Creek Habitat Restoration Tour

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**Field Tour Coordinators:** Derek Rupert, Bureau of Reclamation, and Natasha Wingerter, U.S. Fish and Wildlife Service

Clear Creek has emerged as a preeminent watershed for supporting anadromous salmonids within California's Central Valley. This result comes from extensive restoration efforts over the past 25 years, which aimed to restore anadromous fish habitat after a long history (~150 years) of deleterious land use practices. This tour will visit key locations along lower Clear Creek to show the previously completed restoration sites, the ongoing habitat management actions, and the areas where significant improvements are needed. We will discuss spawning and rearing habitat, salmon and steelhead populations, dam operations, and planning for future restoration actions.

### Itinerary

**Clear Creek Gorge Overlook**—The group will meet up at the overlook and do introductions. Coordinators will provide current and historical information on Clear Creek and habitat restoration efforts and discuss flow and water temperature management. Additionally, we will discuss how water flows through the Central Valley Project's (CVP) Trinity River Division components, and its relation to Lower Clear Creek's salmon and steelhead.

**China Gardens/Phase 3C Project Site**—Visit a recent large-scale restoration project and discuss some of the site's key features, such as new channel alignment, Beaver Dam Analogs (BDAs), and large wood.

**Gold Dredge Trailhead**—Hike across a large area of the Lower Clear Creek Floodway Rehabilitation Project, discussing ongoing habitat management projects and novel implementation practices. Portions of this site have tremendous floodplain habitat potential. This site will likely be wet and muddy. It showcases some high-value rearing habitat and floodplains capable of long-term inundation.

**Horsetown Restoration Project Site**—This location is currently in the design phase of a large-scale restoration project. We will discuss the importance of the site to spring run Chinook salmon and steelhead and the preliminary designs and future habitat conditions for the project site.



Spring run Chinook salmon holding in the Clear Creek canyon 2021. *Photo: Derek Rupert*

## Lessons Learned: A Post-Fire Tour of Fish Passage Projects Across the Lassen West Slope

**Field Tour Coordinators:** Eric Ginney, Environmental Science Associates; Tricia Bratcher, U.S. Fish and Wildlife Service; and Mark Gard, Ph.D., California Department of Fish and Wildlife. Guest presentation by Zeke Lunder, The Lookout

The 2024 Park Fire burned nearly 430,000 acres across Butte and Tehama counties. It was the fourth largest fire in California history, the second largest single wildfire (as compared to a wildfire complex, with multiple ignition points), and the largest fire ever caused by arson in the state. The post-fire response of key anadromous watersheds west of Mt. Lassen in terms of sediment supply and transport has been remarkable and has affected irrigation diversions, fish passage, and screening facilities.

This tour will visit important past and ongoing current fish passage projects on Cow Creek, Paynes Creek, Mill Creek, and Deer Creek—home to remaining populations of imperiled spring-run Chinook salmon and steelhead. Importantly, it will highlight sediment dynamics in watersheds impacted (and not impacted) by the Park Fire, illustrating fire effects on channel morphology, irrigation diversions, and fish passage and screening facilities. Each stop will provide lessons learned that may be applied to other future projects.

Speakers will include landowners, agencies, and others involved in the projects. To orient participants to the species, remaining habitat, challenges, and the history of actions to improve fish passage, the tour will start with a brief presentation. The presentation will also cover geology, geomorphology, fish populations and distribution, the extent and burn severity of the Park Fire, the size of diversions and approach for fish passage and screening, and other relevant factors.



Deer Creek upstream of a new fish screen at the DCID diversion where a dam was removed and a roughened rock ramp constructed.  
*Photo: Eric Ginney*

## Boat Tour of Sacramento River Restored Side Channels for Juvenile Habitat

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**Field Tour Coordinator:** Greyson Doolittle, North State Planning Collective, California State University, Chico

Since 2017, around 15 side channels have been restored to create juvenile salmonid rearing habitat on the Sacramento River between Red Bluff and Redding. We would like to invite interested SRF members on a tour by motorboat from Bonnyview boat ramp to Anderson River Park to view three different restored side channel complexes. The first stop features the recently restored Shea Island Complex, where construction allowed the perennial inundation of 3 channels previously only accessible to migrating fish during high flows. The second stop features 3 restored side channels varying in age, and also gives an additional look at two natural side channels for comparison. The third stop features Anderson River Park Complex, where fish strandings were combatted with 3 side channels that were restored in 2019 and 2020, bringing life to this large channel complex for both fish and recreationists alike. Features that will be highlighted on this tour are centered around juvenile habitat and include large woody and cobble placements, engineered shallow-water benches, snags, and riparian plantings, as well as placed gravel pads for spawning and additional challenges that engineers had to overcome at each site. The tour will likely take 5-6 hours on the water, including a stop to eat sack lunches, allowing for about an hour at each boat launch to get everyone loaded up. The number of participants will ultimately depend on boat availability, but the max group size will likely be between 20 and 40 people. Alternatively, if a boat tour is not logistically feasible, the sites could be effectively toured via carpool convoy, but the tours would not be nearly as extensive and would not include either of the natural side channels.



Sacramento River boat tour will explore off-channel projects along the river.

*Photo: John Hannon*

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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**Workshop Coordinators:** Lenya Quinn-Davidson, University of California Agriculture and Natural Resources Fire Network; Josh Smith, Watershed Research and Training Center; and Will Harling, Mid Klamath Watershed Council

In recent decades, it has become increasingly clear that the West suffers simultaneously from too much fire and not enough. Fire exclusion has created vulnerable landscapes, far departed from the fire regimes through which they evolved. Losses are multifaceted: unprecedented high-severity fire is causing widespread habitat loss, while other systems wither in the absence of needed fire. Meanwhile, fire suppression activities pose a different set of threats, adding insult to injury for aquatic habitats and species. However, the two disciplines remain mostly siloed, with few opportunities to find shared value or to innovate together in management and policy efforts.

Over the last three years, we have hosted Fish & Fire workshops at each SRF conference. These workshops have met with increasing interest and momentum, focusing on the many intersections—ecological, cultural, and spatial—across fish and fire. This workshop will continue to build on that understanding, further exploring cross-disciplinary connections, identifying management implications and research needs, day-lighting potential synergies in policy and action, and furthering the potential for beneficial fire to be incorporated into restoration efforts.



All Hands All Lands Burn at Guys Gulch in Shasta Valley brings fire back to a white oak woodland after a century of fire exclusions.

*Photo: Will Harling, MKWC*

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Fish and Fire—Key Past Workshop Insights

**Joshua Smith**, Watershed Research and Training Center and **Lenya Quinn-Davidson**, University of California, Agriculture and Natural Resources Fire Network

Wildfires are increasing in scale and intensity, which in turn increasingly is affecting aquatic systems; therefore, there is a greater importance of understanding pathways linking fires and fish. The interactions between fire and fish are numerous, complex, and sometimes difficult to understand. The same wildfire can produce catastrophic sediment pollution, cause fish kills, but then increase streamflows, add large amounts of habitat wood, and decrease water temperatures. From basic fire ecology to new science to indigenous knowledge, there are many lessons to be learned. We will bring key lessons from past year's SRF Fish and Fire Workshops to light so that this workshop gives participants a full suite of exposure to the world of fire and its positive and negative impacts on fish.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Metals in Wildfire Suppressants

**Daniel L. McCurry**, University of Southern California (Presenter)  
and Co-authors: **Samantha Gold** and **Marella Schammel, Ph.D.**, University of Southern California and Shimadzu Scientific Instruments

Frequent and severe wildfires have led to increased application of fire suppressants in the western United States. Increased heavy metal content in soils and surface waters at the wildland-urban interface has been observed after wildfires, but has primarily been attributed to ash deposition or anthropogenic impact from nearby urban areas. In this study, metal concentrations in several fire suppression products (some approved by the U.S. Forest Service and some marketed for consumer use) were quantified to evaluate whether these products could contribute to increased metal concentrations observed in the environment post-fire. Long-term fire retardants contained concentrations of toxic metals (vanadium (V), chromium (Cr), manganese (Mn), copper (Cu), arsenic (As), cadmium (Cd), antimony (Sb), barium (Ba), thalium (Tl), and lead (Pb) many times greater than drinking water regulatory limits and greater than some aquatic toxicity thresholds when released into the environment. Based on these concentrations and retardant application records, we estimate fire retardant application in the U.S. contributed approximately 380,000 kilograms of toxic metals to the environment between 2009 and 2021. We also estimate that, in the case of the 2009 Station Fire near Los Angeles, the mass of cadmium contributed by fire suppression was sufficient to account for documented cadmium export during post-fire storms.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### The Potential of Ecological Remediation for Post-Fire Soil Cleanup

Danielle Stevenson, Ph.D., Centre for Applied Ecological Remediation

Wildfires are accelerating in frequency, intensity, and extent across the western United States, generating complex contamination legacies that threaten watersheds, fish habitat, community health, and long-term ecological resilience. Post-fire soils often contain a mixture of heavy

metals, polycyclic aromatic hydrocarbons (PAHs), dioxins, (PFAS), and other combustion-derived toxics that are transported downslope into aquatic ecosystems, yet most existing remediation and cleanup strategies rely on conventional engineering approaches that are costly, simply move pollution around, and are often misaligned with the dynamic nature of burns. This workshop introduces ecological remediation, a set of methods that integrate fungi, plants, microbes, soil ecology, and community stewardship to stabilize, transform, and reduce post-fire contaminants while supporting ecosystem recovery and preventing pollution of watersheds after fires. Ecological remediation can offer adaptable, lower-cost, and more ecologically grounded complement to traditional methods.

Drawing on recent work across Los Angeles County, Altadena, and the Santa Monica Mountains, and collaborative pilots with county agencies, universities, and community organizations, this workshop will outline the scientific foundations of ecological remediation, including an overview of interventions and the mechanisms behind fungal enzymatic degradation, mycorrhizal-plant uptake pathways, and microbially mediated transformations relevant to key post-fire contaminants. Real-world case studies into how targeted inoculation and revegetation strategies can be deployed to reduce pollutant loads will be shared.

In addition to presenting scientific foundations, the workshop emphasizes practical implementation: site assessment and hotspot identification, designing ecologically appropriate remediation plans, integration of erosion control and bioremediation materials, safety considerations, and low-tech strategies that communities can begin immediately, versus interventions requiring laboratory support. Attention will also be given to the limits of biological remediation—what it can and cannot do in post-fire contexts—and how it can be combined with engineering and policy tools.

The workshop will highlight early results from regional coalitions such as the Consortium for Post-Fire Bioremediation and the Southern California Post-Fire Bioremediation Coalition, demonstrating how coordination and aligned protocols can accelerate regional learning and reduce redundancy.

## **Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration**

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### **Integrating Process-Based Restoration into Post-Fire Emergency Response Efforts**

**Gabrielle Bohlman, U.S. Forest Service**

As we see increases in high-severity fire due to a legacy of fire exclusion and a trend towards more extreme drought conditions, we have a critical need and an opportunity to address potentially severe and long-lasting fire effects in our watersheds. A handful of recent examples demonstrate the effectiveness of using process-based restoration (PBR) techniques to capture sediment and improve fish habitat in post-fire environments, but it is clear we need to accelerate these efforts and ensure they are implemented, monitored, and results shared in a timely fashion. Unfortunately, permitting and funding constraints often delay these efforts. The Forest Service's Burned Area Emergency Response (BAER) program is intended to address imminent post-wildfire threats to human life and safety, property, and critical natural or cultural resources on federal lands, and to take immediate actions to implement emergency stabilization measures before the first major storms. While imminent threats to resources such as critical fish habitat or water quality are often identified during the assessment process due to anticipated post-fire sedimentation, PBR activities to address these threats as part of the BAER program are often either not considered, not recommended, or not funded due to the perceived low probability that such treatments would successfully reduce the risk to an acceptable level. There is a need to demonstrate that PBR is a cost-effective approach that can be implemented safely and rapidly to substantially reduce post-fire sedimentation and threats to critical resources immediately following fire and into the future.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Connecting Instream and Upslope Restoration in the Western Klamath Mountains

**Will Harling**, Co-Lead, Western Klamath Restoration Partnership (WGRP) and Restoration Director, Mid Klamath Watershed Council (MKWC)

As interagency, multi-disciplinary restoration efforts expand throughout California, more attention is being given to how instream and riparian restoration projects overlap with and incorporate upslope fire and forest restoration projects and strategies. Historically, streams and riparian areas slowed or stopped fire spread across the landscape. Over a century of fire exclusion policies has severely altered fire regimes, and regulations that exclude riparian areas from fuels treatments have converted these fire barriers to fire wicks. Specific examples from the western Klamath Mountains highlight how various projects, from low-tech process-based restoration to off-channel habitat restoration to full-scale channel and flood-plain restoration, can integrate fuels objectives and a deeper understanding of fire processes to increase resilience from both planned and unplanned fire events. Recent examples from the 2025 wildfire season in the Klamath Mountains will tie together several previous Fish and Fire 2006 presentations with on-the-ground examples of how wildfire management can integrate not only stream and riparian protection, but also highlight opportunities for incorporating stream restoration into emergency fire response.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Fuels To Flows: Bringing Nature-Based Stewardship to the Headwaters

**Brock Dolman**, Occidental Arts & Ecology Center/WATER Institute

The Occidental Arts & Ecology Center (OAEC) will present on the utilization of various low-tech process-based restoration (LTPBR) best-management practices (BMP's) to better steward water, fire, and ecological processes for upland systems. The presentation will introduce OAEC's Fuels to Flows Campaign, which advances climate-smart nature-based restoration solutions at the nexus of fire and water. This approach advocates for the holistic reintegration of organic fire and "fuel" load materials within the "flows" of soil carbon, water, and life cycles at both the site and landscape scale. This intersectional approach addresses the critical need to both rehydrate landscapes and riverscapes while simultaneously improving forest health and fire resiliency. Brock will share ample project case studies to demonstrate how the Fuels to Flows principles can offer a framework for creative, low-tech, cost-effective, hands-on solutions to a wide variety of restoration projects around California and beyond. The speaker will specifically emphasize opportunities for how their beneficial biomass portfolio framework can seamlessly integrate with the use of beneficial fire. Once burn bosses and biomass bosses find common purpose in broader shared goals, the sequential and strategic deployment of these regenerative disturbance regimes can be amplified to yield even more multiple benefits.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Temporal Habitat Changes and Related Fish Response following Catastrophic/Landscape Level Fires: Accounting for Impacts when Prioritizing Restoration Need and Location and Fish Population Estimation(s)

**Patricia Bratcher**, U.S. Fish and Wildlife Service (Presenter) and Co-authors: **RJ Bottaro**, **Andrew Trent**, **Samuel Provins**, and **Karissa Bridges**, U.S. Fish and Wildlife Service; and **Patrick Jarrett**, California Department of Fish and Wildlife

As it relates to anadromous fish population dynamics, restoration priorities, and overall recovery, recent large-scale fires may significantly alter key assumptions (and/or data) used to inform restoration planning programs. This presentation offers a preliminary investigation intended to consolidate information on how stochastic events, such as fire on the landscape, may influence modelling efforts, the decision-making process, and priorities for restoration, with support narrative from two case studies in northern California.

## Fish & Fire 2026: Bringing Restoration into Fire and Fire into Restoration

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### Riverscape Restoration—Habitat Resilience in the Face of Wildfire along Whychus Creek, Central Oregon

**Mathias Perle**, Restoration Program Manager, Upper Deschutes Watershed Council (Presenter) and Co-author: **Lauren Mork**, Monitoring Program Manager, Upper Deschutes Watershed Council

Whychus Creek is the focus of multi-year collaborative restoration efforts intended to support fisheries restoration, improve stream habitat, and restore natural stream processes. In 2016, project partners broke ground on the first mile of a six-mile restoration project along Whychus Creek at Deschutes Land Trust Preserves. Three contiguous miles of riverscape restoration have been completed to date.

Habitat work along Whychus Creek has focused on restoring key physical, chemical, and biological processes employing established principles in process-based stream restoration as well as key principles of ecological restoration in order to establish and support a resilient and productive stream ecosystem for the long-term benefit of fish, wildlife, and water quality. This includes a focus on natural channel floodplain connectivity and processes such as floodplain-wide riparian cover, erosion, deposition, and avulsion to create, maintain, and support resilient terrestrial and aquatic habitat that can support all life stages of fish and wildlife species over time. Over ten years of biological and physical monitoring data have provided strong evidence supporting this approach. Since reintroduction started in 2007, and for the first time in over 70 years since downstream dam construction, evidence of steelhead spawning along Whychus Creek was observed in 2025; all redds were located within restored reaches.

Anticipated climate change impacts are expected to continue altering water quantity, water quality, and wildfire behavior in the Whychus Creek watershed, with direct consequences for native and anadromous fish. Rising temperatures and declining snowpack are reducing summer and fall stream flow, shifting peak runoff earlier, and increasing both low-flow extremes and the likelihood of flooding during warmer, rain-dominated storms. Lower flows elevate summer stream temperatures, further stressing cold-water species. At the same time, increasingly frequent and severe wildfires in the watershed may contribute to sedimentation and loss of vegetative cover, particularly in disconnected floodplain areas with deeper water tables that no longer sustain resilient riparian woodlands. Frequency and severity of wildfire within the Whychus Creek Watershed have increased, with the recent August-September 2025 Flat Fire burning over 23,000 acres, including 11 miles along the Creek, over ¼ of the overall watershed length.

Whychus Creek habitat restoration is directly addressing these impacts by restoring a resilient and diverse wet valley floor ecosystem along with ecological processes rather than specific habitats. The complex aquatic and terrestrial habitats created, and the processes restored that will help maintain them, have created an ecosystem more resilient to the changes brought on by climate change. Raising the valley-wide water table in combination with planting riparian and wetland plant and tree species has created a more diverse and abundant riparian ecosystem throughout more of the valley floor, which, during the 2025 Flat Fire, proved more resistant and resilient to wildfire than unrestored reaches upstream. Early post-fire site visits and aerial monitoring indicate low fire impacts in the restored areas and more considerable impacts in unrestored areas.

## Development of Tribal Beneficial Uses and Strategies for Healthier Water

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**Workshop Coordinator:** Sherri Norris, California Indian Environmental Alliance, and Tribal Partners

This workshop focuses on the history of establishing beneficial uses to support beneficial uses of water, water quality, and fish tissue testing for toxins of concern, database entry and reporting, interpretation of results, the process to develop Total Maximum Daily Loads to reduce toxins, emerging regulatory efforts, and development of health advisories. We will discuss the new Tribal Beneficial Use designations, challenges to designations with these uses, recommendations being developed by tribes, communities, and state agencies, and the steps to prepare for the negotiations among agency stakeholders to set water quality objectives. The intersection between flows and water quality will be discussed, and finally, we will share and discuss an overview of how to develop healthful instream flow criterion.

## Dam Removal Project Manager Training, Day 2

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**Workshop Coordinator: Meghan Quinn, Esq.** Director of California Dam Removal and Hydropower, American Rivers

This 2-day workshop focuses on preparing individuals to work through the challenges of developing and managing a successful dam removal project. The goal is to build the knowledge, skills, and confidence of potential project managers to allow them to lead both straightforward and more complex projects that often involve engaging with active project opponents, working through unpredictable regulatory processes, significant fundraising, and coordinating a team of diverse project partners, property owners, engineers, and contractors.

### Day 2:

*Basics of Engineering Design and Construction: Six Components of Dam Removal Science and Design*, Brian Graeber, American Rivers

*Dam Removal and Restoration at Varying Scales: Jenny Creek Dam Removal*, Evan Bulla, Trout Unlimited; and *Klamath River Dam Removals and Restoration*, David J. Bandrowski, Yurok Tribe

*Understanding the Social Landscape: Effective Community Engagement*, Serena McClain, American Rivers

*Tribal Engagement at Battle Creek and Beyond*, Angelina Cook, California Sportfishing Protection Alliance; and Emily Maloney, Cal Trout

*Demystifying Decommissioning: Hydropower Dam Removal*, Charlie Schneider, Cal Trout, and Meghan Quinn, American Rivers

*Dam Removal Permitting and Regulatory Session*, facilitated by Meghan Quinn, American Rivers, in conversation with Stephanie Falzone, Sustainable Conservation, and others

*Lessons Learned in Navigating Regulatory Compliance in Dam Removal*, Michael Belchik, Yurok Tribe

*Wrap Up*, Brian Graber and Serena McClain, American Rivers



Matilija Dam  
in Ventura County  
*Photo: Mike Wier*

## Lower Battle Creek Floodplain Reconnection Tour

**Field Tour Coordinators:** Michael Rogner, River Partners and Jacob Katz, Ph.D., Cal Trout

Join River Partners and Cal Trout on a tour of riparian restoration projects on lower Battle Creek. Our first stop will be an ongoing project with the Bureau of Land Management, which is restoring 340 acres of mixed riparian woodland. The vegetation is being restored in advance of the next project phase, which will increase the frequency and duration of floodplain inundation to benefit juveniles of all four runs of Chinook salmon in the Sacramento watershed. This unique spot on the landscape is vital to the recovery of the federally endangered winter-run Chinook salmon. The 2nd stop is a 20+ year old riparian restoration project on CDFW's Battle Creek Wildlife Area, in which the existing water infrastructure has been replumbed so that off-channel wetlands restored in 2005 can be used to cycle critical aquatic food resources for juvenile salmon in Battle Creek in several pulses throughout the wet season. At both stops, the project team and partners will talk about the past, present, and future challenges and opportunities of transformational, landscape-scale restoration to benefit our native fish species.



Rancho Breiggau  
*Photo: Michael Rogner*

## Scott River Tour: Scaling Solutions for Salmon and Community

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**Field Tour Coordinators:** **Charna Gilmore**, Scott River Watershed Council, Executive Director; **Betsy Stapleton**, Scott River Watershed Council, Project Development & Permitting Specialist; **Erich Yokel**, Scott River Watershed Council, Monitoring Supervisor and Project Manager; **Amy Campbell**, Senior Project Manager, The Nature Conservancy; **Molly Breitmun**, Stewardship Manager, The Nature Conservancy; **P. Travis James**, Yurok Tribe, Senior Civil Engineer; **Dustin Revel**, California Trout, Project Manager

This full-day field tour will showcase ongoing restoration efforts within the Scott River Watershed, a major tributary of the Klamath River and a critical stronghold for coho recovery in the Klamath River Basin. The tour will highlight restoration techniques that match the scale and complexity of the challenges.

Since 2014, the Scott River Watershed Council (SRWC) has worked to address the challenges facing working landscapes, tackling both legacy impacts and present-day conditions, through collaborative solutions and community engagement. With The Nature Conservancy's (TNC) Scott Watershed conservation purchases in 2023, SRWC and TNC have been working together to achieve large scale restoration in the watershed. Also in 2023, the Yurok Tribe, California Trout, and Farmers Ditch Company (FDC) entered into an agreement to address some long-standing issues within the reach owned by FDC.

The first portion of the tour will feature current restoration efforts underway in the Scott River tailings, showcasing a suite of strategies aimed at rehabilitating this heavily altered landscape including, implementing beaver dam analogs (BDAs), constructing floodplains and side channels to reconnect the river with its historic habitat, and acquiring key properties to secure opportunities for long-term recovery. These efforts are designed not only to improve habitat complexity and water quality but also to lay the groundwork for sustained ecological resilience in this critical reach of the watershed.

Participants will also visit a project completed in 2025 by the Yurok Tribe, California Trout, FDC, and other partners that balanced the needs of surface and groundwater connection, habitat creation, and FDC water delivery. The project included the reconstruction of the Scott River and Sugar Creek at their confluence, construction of rearing and high-flow refuge habitat, floodplain improvements, and the construction of new diversion infrastructure.

The second portion of the tour will focus on French Creek, one of the West Coast's most important contributors to coho salmon populations. The SRWC and TNC will guide participants through a series of restoration sites, highlighting a comprehensive, watershed-scale approach that integrates instream habitat improvements with forest health initiatives. These efforts address critical needs such as enhancing spawning and rearing habitat, improving water quality, and reducing wildfire risk, demonstrating how coordinated actions across the landscape can bolster the long-term resilience of both the stream systems and its fisheries.

Lastly, the tour will showcase innovative technology that supports the agricultural community in managing cattle while minimizing impacts to sensitive areas such as riparian corridors and meadow systems. Participants will learn how these tools, such as virtual fencing, are helping balance productive grazing with the protection and restoration of critical habitats.

## The Trinity River - A Living Laboratory for Salmonid Habitat Restoration

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**Field Tour Coordinators:** James Lee, Implementation Branch Chief; Eric Peterson, Science Coordinator; and Mike Dixon, Executive Director, Trinity River Restoration Program

The Trinity River and its abundant runs of Chinook, coho, and steelhead sustained unique cultures of Native Americans for millennia and continue to provide a large portion of the anadromous fish populations in the Klamath basin. Yet since the 1960's, this river is also a critical component of California's water infrastructure, with approximately half of its annual flow diverted out-of-basin for energy production, irrigation, and municipal purposes. In the landscape context of an area that was heavily exploited by mining and timber extraction, this diversion led to unanticipated changes to the physical form of the river itself, which was detrimental to native fish populations. The Trinity River Restoration Program (TRRP) — a multi-agency program represented by eight county, tribal, and federal agencies with an interest in improving the fishery, was formed to address the gap caused by the use of the river and its resulting consequences.

Among the tools that TRRP uses is channel rehabilitation- physically changing the shape of the channel and floodplain to support the attributes necessary to sustain anadromous fish populations at ecologically, culturally, and economically meaningful levels. Channel rehabilitation projects are intended to interact with managed flows and the sediment supply to not only provide short-term habitat benefits, but also to continue to evolve into the future in ways that maintain these benefits.

Several recent projects that incorporate not only lessons learned over decades of restoration within the Trinity River, but also lessons learned from other rivers and practitioners, provide examples of how and why TRRP restores ecological function through restoring the form of the Trinity River.

The tour will depart Redding in the morning and travel directly to Junction City, CA, where several sites of varying ages are readily available for field-based presentations and up-close inspections of some of the work that TRRP has performed. Some projects that will be observed include the Oregon Gulch, Chapman Ranch, and Upper Conner Creek projects. You will see some of the most significant projects TRRP has implemented, as well as budding riparian vegetation, riparian birds establishing nesting territories, and (water clarity permitting) juvenile salmonids foraging and sheltering in the shallows.



Aerial photo  
of the Trinity River  
*Photo: Aaron Martin*

## Following the Stars: Restoring Nur to the Winnemem Waywaket

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Chief Caleen Sisk, Winnemem Wintu Tribe

In our language, Winnemem Wintu means “middle water people.” Since time immemorial, we have served as the ecological and spiritual caretakers of our ancestral watershed and its bountiful salmon runs. The Winnemem Waywaket (McCloud River in Northern California) is the center of our universe. The construction of the Shasta Dam interrupted our people’s way of life and the migratory return of our Nur (Chinook salmon.) For decades we have continued our ceremonies and prayers that the salmon will return. We now know that salmon from our home river were offered safe haven in New Zealand a century ago. They deserve the opportunity to return to the place of their ancestral origin. When Shasta Dam was constructed in the 1940s and blocked the Nur from coming home, invaluable genetic diversity and adaptation gained over thousands of years were lost.

Our intent is to return our wild Nur from New Zealand to the McCloud River to bring back genetic diversity and special survival traits retained in New Zealand. In 2023, the Winnemem Wintu Tribe signed historic agreements as equal partners with CDFW and NOAA to restore Nur to the Winnemem Waywaket. The Tribe prioritizes rematriating wild Nur from New Zealand, and has also partnered with agencies to provide more nature-like rearing and trapping strategies for reintroducing Winter Run salmon eggs above Shasta Dam. We are also working with partners to advance a volitional, “hands off”, fish passage route around Shasta and Keswick Dams so the Nur can swim freely from the mountains to the oceans and back and maintain their wild traits. As the salmon face extinction, our survival as a people is in peril—if the salmon do not exist, neither will we. Wild salmon are needed for healthy rivers, ecosystems, and people.



Chief Caleen Sisk

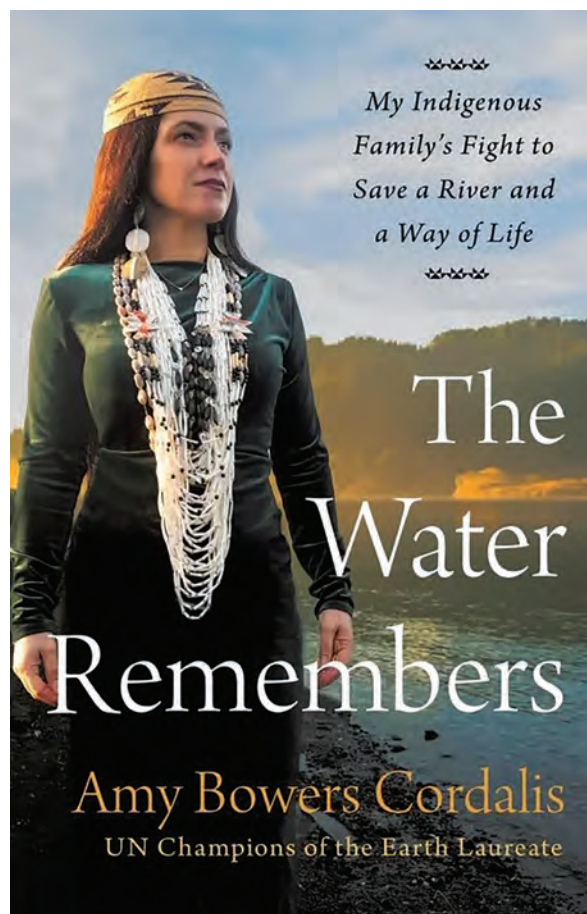
## The Water Remembers

**Amy Bowers Cordalis**, Yurok tribe, Co-Founder of Ridge to Riffles and author of *The Water Remembers: My Indigenous Family's Fight to Save a River and a Way of Life*

For members of the Yurok tribe, salmon are the lifeblood of the people—a vital source of food, income, and cultural identity. When a catastrophic fish kill devastates the river, Amy Bowers Cordalis is propelled into action, reigniting her family's 170-year battle against the U.S. government.

In a moving and engrossing blend of memoir and history, Cordalis propels readers through generations of her family's struggle, where she learns that the fight for survival is not only about fishing—it's about protecting a way of life and the right of a species and river to exist. Her great-uncle's landmark Supreme Court case reaffirming her Nation's rights to land, water, fish, and sovereignty, her great-grandmother's defiant resistance during the Salmon Wars, and her family's ongoing battles against government overreach shape the deep commitment to justice that drives Cordalis forward.

When the source of the fish kill is revealed, Cordalis steps up as General Counsel for the Yurok Tribe to hold powerful corporate interests accountable, and to spearhead the largest river restoration project in history. *The Water Remembers* is a testament to the enduring power of Indigenous knowledge, family legacy, and the determination to ensure that future generations remember what it means to live in balance with the earth.



Amy Bowers Cordalis, author of *The Water Remembers*

## Listening to the Salmon: Life History Diversity as Our Blueprint for Recovery

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**Rachel Johnson, Ph.D.**, Central Valley Recovery Leader,  
Southwest Fisheries Science Center, NOAA Fisheries

Salmon are storytellers. For thousands of years, they have carried knowledge of rivers, floods, droughts, and change within their bodies. This knowledge is etched in their otoliths and eye lenses like diaries written in time. These remarkable fish evolved alongside a shifting mosaic of habitats and hydrologies, developing strategies to spread risk across space and seasons. Their diversity of behaviors allowed them to persist through megadroughts, floods, and profound environmental change. Today, many of these life-history strategies are at risk. Habitat modification, fragmentation, and the loss of Indigenous stewardship has narrowed the pathways salmon once used to adapt and endure extreme climate conditions.

I will share stories from my research on modern and ancient salmon, exploring how their biological archives reveal a blueprint for recovery in an uncertain future. By “reading” these diaries, we learn how salmon once navigated dynamic landscapes and how restoring that diversity of habitats and pathways can create conservation “hope spots” where salmon can continue to thrive. Equally, my work highlights how Western science is strengthened and reimaged when Indigenous voices lead. Indigenous knowledge systems carry generations of observation, care, and relationship with salmon and their waters. When these perspectives guide research and stewardship, new innovations emerge rooted in reciprocity, responsibility, and hope. As climate extremes intensify, restoring these adaptive pathways and habitat options for wild salmon to be salmon will become increasingly important. By listening to the salmon, the wisdom of the past, and embracing collaborative stewardship, salmon will guide us towards recovery.

## Letting Fire Flow: Restoring Ecology, Culture, and Connection

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**Lenya Quinn-Davidson**, Director, UC ANR Fire Network  
and Director, Women-in-Fire Training Exchange (WTREX) Program

Across California, fire is as natural and necessary as rain, snow, and sunshine. California's landscapes and communities have evolved with fire over millennia, and fire has, in one way or another, shaped most of the places that we all know and love. However, much of the state is out of balance with fire, either suffering from fires that are too severe or withering in the absence of needed fire. This imbalance is felt both ecologically and culturally, given the integral role of people in stewarding with fire, and the symbiosis that fire can bring to people and place.

This presentation will share a story of fire that is all too familiar in the world of rivers and fish: the oppression of traditional knowledge and cultural practice, the removal of natural processes, the misguided management, and all the unraveling that follows that approach. However, like the stories of rivers and fish, this fire story is in a pivotal moment—one where Indigenous and local communities are organizing around shared values, effecting social and political change, and reclaiming their power.

In many ways, the fish story is the fire story, with the same patterns, partners, and key players—parallel tracks that wend and weave together, sometimes more philosophically, and at other times, in very palpable, physical ways. This presentation will explore those connections, daylight the shared progress, and recast fire as core to the way we imagine, experience, restore, and steward our places. As we fight for our rivers to flow freely, let us not forget that fire, too, needs to flow.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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**Session Coordinators:** Carrie Monohan, California State University, Chico and Mooretown Rancheria of Maidu Indians

Process-based restoration involves restoring a site's ability to withstand and recover from disturbance, also known as ecosystem resiliency. Measuring ecosystem resiliency with metrics using geospatial data, landscape pattern analysis, and simulation modeling to evaluate ecosystem resiliency at management scales is needed to operationalize the concepts of process-based restoration. Ideally, managers are able to measure the ecological resiliency of current conditions and project resiliency under future scenarios after restoration. As process-based restoration projects are implemented, and as they include upland management, how we measure near and long-term metrics of success will enable us to learn what techniques work best as well as what site conditions are best suited for process-based restoration. This session invites examples that include using remote sensing tools, chrono sequences, citizen science models, and Traditional Ecological Knowledge (TEK) to evaluate process-based restoration success.



Off-channel habitat located along French Creek.

*Photo: Erin Feinblatt*

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### Large-scale PBR in Golden Trout Wilderness Meadows: Change Detection, Critical Metrics, and Restoration Effects

Sabra Purdy, M.S., Restoration Ecologist, Trout Unlimited

Trout Unlimited (TU) has undertaken ambitious, large-scale meadow restoration projects throughout the Sierra Nevada range to address historical and contemporary impacts to degraded meadow systems. The largest of these projects is underway on the Kern Plateau on over 20 meadows in and adjacent to the Golden Trout Wilderness. The majority of these meadows occur in designated federal wilderness areas, which severely curtails the types of activities and tools allowed on these lands. Process Based Restoration (PBR) can be utilized in these areas because it does not require mechanized tools and is consistent with the constraints and principles of the 1963 Wilderness Act, thus it is an excellent tool to address the significant and widespread impacts to meadow function and cover across the Sierra Nevada. Since this project is the first major PBR project on wilderness meadows in California, TU proposed an in-depth monitoring program to track the effects of this treatment and project impacts over time. Due to the iterative nature of PBR projects, signal and impact detection can be challenging or take time to realize results. The monitoring program developed by TU identifies 2 overarching goals with 11 and 9 specific objectives, respectively, each with hypotheses for performance measure targets, monitoring metrics, and associated indicators. Additionally, we developed decision criteria and trigger conditions for adaptive management with adaptive management strategies if the treatments are not performing as hypothesized. These intensive criteria formed the basis of field monitoring efforts for the project, which primarily use ARC Field Maps and Survey 123 for data collection. We collect data on vegetation cover, fish and amphibian visual encounter surveys, range condition, headcuts, channel geomorphology and instream habitat, photo points, hydrogeomorphic mapping, and a suite of hydrologic surveys including streamflow data, water quality, and groundwater wells to quantitatively measure the effects of restoration treatments and overall condition of meadow systems. This methodology provides a robust assessment of stream and meadow condition and provides an effective and diverse basis for quantifying the results of Process Based Restoration treatments over time.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### Measuring Success: Process Based Restoration in the Haskell Peak Meadows

E. Rose Ledford, South Yuba River Citizens League

The Haskell Peak Meadows Restoration Project focused on restoring five unique wetland sites to rehabilitate 229 acres of degraded meadow and fen habitat. Desired project outcomes include restored hydrologic processes, reestablishment of native wetland and riparian plant communities, decreased extent of encroaching conifers, increased potential beaver habitat, improved carbon sequestration, and improved climate resilience. This project used a process-based approach to restoration by combining the use of low-impact beaver dam analogs to address channel incision, with heavy equipment to remove relic infrastructure such as old roads and culverts.

To reactivate the floodplains within five distinct wet meadow systems, over 400 beaver dam analogs have been built in incised stream channels over a three-year period. By promoting floodplain connectivity, groundwater recharge, and sediment aggradation, these actions are expected to support increased resilience, especially in a changing climate with a predicted increase in drought frequency and severity, rain-on-snow events, and more precipitation as rain.

Pre- and post-project monitoring have been conducted to evaluate the impact of process-based restoration on groundwater, surface water, carbon, and vegetation communities. Hydrologic monitoring occurred at 23 groundwater wells and 13 stream gages across the five project meadows. Vegetation monitoring, following the Wetland and Riparian Area Monitoring Plan (WRAMP) protocol developed by the Sierra Meadows Partnership (SMP), was conducted within 85 monitoring plots across all project meadows. Soil carbon and root carbon samples were collected at four of the five sites.

As this project took place across five unique sites, with varying degrees of degradation, results from project monitoring can be used to inform both the suitability of restoration techniques in different geomorphic conditions and the effectiveness of restoration toward desired project outcomes. By analyzing three years of hydrology data, we can determine flow regimes under which low-impact tools function best. This talk will pair vegetation data with hydrology data to look at site specific trends following restoration. And consider how field measurements can be combined with remote sensing to investigate long-term resilience and management techniques while also informing site suitability for future projects.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### How Can We Approach Stream Restoration that Supports Diversity for Physical Processes, Ecosystems, Species, and Life Stages?

**Rebecca Flitcroft**, Co-Chair, International Union for the Conservation of Nature, World Commission on Protected Areas, Freshwater Specialist Group, USDA Forest Service, Pacific Northwest Research Station

Freshwater aquatic biodiversity is declining on global scales, as well as in our own backyard. For much of the past few decades, the U.S. (through implementation of the Endangered Species Act) has essentially been exploring the hypothesis that protecting “keystone species” can protect ecosystems. Along those lines, single-species approaches to conservation, protection, and rehabilitation have focused on listings under the Endangered Species Act. Thus, habitat restoration efforts have often been targeted at individual species and their habitat needs. But has this really protected freshwater ecosystems? In freshwater systems of the Pacific Northwest, conservation of Pacific salmon has driven much of the innovation and implementation of habitat recovery planning and protections. As climate change threatens to alter the phenology of native fishes by changing predictable patterns of temperature and discharge, other approaches to habitat restoration and conservation are also necessary. It is prudent to expand the scope of restoration goals to include hydrogeophysical processes that generate diverse habitats. Such efforts support complex assemblages of biota and can complement existing single-species efforts. Restoration that facilitates the enhancement and re-expression of life history diversity also contributes to resilience in the face of changing climate drivers. In this presentation we will review different aspects of biodiversity and how habitat conservation can be implemented and designed to capture different forms of variation that contribute to the resilience of our freshwater ecosystems now and into the future. We will also review evidence collected across process-based restoration sites in Oregon and Northern California to evaluate effectiveness in achieving ecosystem recovery goals.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### Like an Ecosystem, Good Restoration Planning is a Web

**Jay Stallman**, Stillwater Sciences; **Betsy Stapleton**, Scott River Watershed Council; and **Adam Cummings**, The Watershed Research and Training Center

The Cabin Meadow Creek and Rock Fence Creek Restoration Project, led by the Scott River Watershed Council, represents an innovative, science-driven approach to restoring headwater areas within the Klamath Mountains. Holistic restoration in these areas has historically been constrained to more narrowly focused projects driven by funding mandates, regulatory structures, and limited data. This effort breaks that pattern by integrating multiple resource management strategies into a single, cohesive plan that combines forest health and fuels treatments to improve wildfire resilience; road management to reduce hydrologic alteration; and low-tech, process-based techniques for restoring meadows, wetlands, and stream channels. Planning, design, field implementation, and monitoring are informed by a suite of empirical mapping and innovative spatial analysis tools applied across multiple scales to evaluate long-term geomorphic context, hydrologic and geomorphic processes influencing channel condition, historical and current meadow extent and condition, and forest and fuel-related dynamics. These insights are guiding prioritized, phased, and adaptive actions that are responsive to evolving watershed conditions. This deeply collaborative effort engages private, public, tribal, and non-profit partners to build on region-wide collaboration facilitated by the Klamath Meadows Partnership. By integrating diverse disciplines and management strategies, this project establishes new tools and a model for future headwater restoration across the Klamath region and beyond.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### Can Bull Trout Navigate Non-wicker Weave Beaver Dam Analogs? A Case Study of Fish Passage at Beaver Dam Analogs Constructed Using Modern Techniques in the Upper Klamath Basin, Oregon

**Charlie Erdman**, Trout Unlimited (Presenter)

and Co-authors: **Tommy Cianciolo**, Trout Unlimited and **Dave Hering**, National Park Service

Beaver dam analogs (BDAs) are an important tool for process-based restoration, used to promote flood-plain connectivity, address channel incision, and influence hydrologic and geomorphic processes. As the pace of BDA installation has increased over the past decade, methods for the construction of these structures have evolved. Today, post-line wicker weave BDA installations are less common. Instead, many restoration practitioners follow the postless BDA method, as outlined in the “Low-Tech Process-Based Restoration of Riverscapes: Design Manual”, which recommends layered mixtures of woody material and sod or other inorganic and organic material, often with a woody mattress on the downstream side to dissipate energy. Most studies evaluating fish passage at BDAs, however, occurred at projects with earlier style post-line wicker weave BDAs (e.g., Bridge Creek and Scott River tributaries), and additional investigations are necessary to assess salmonid passage at BDAs constructed using more modern techniques. Here, we use a long-term fish monitoring study on Sun Creek in the upper Klamath Basin, Oregon with spring and fall single-pass electroshocking surveys conducted since 2017, end point PIT tag arrays installed in 2017, and an upstream migrant fish trap operated annually since 2021 to assess bull trout (*Salvelinus confluentus*) upstream and downstream passage across a 1.3-mile reach with 34 post-assisted BDAs constructed in 2022-2024 using the layered technique with downstream mattresses.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### When process-based Restoration Also Refers to People Dynamics: Strategic Collaboration and Nature-based Engineering as the Foundation for Restoring the Redwood Creek Estuary in Humboldt County

Joél Flannery, M.S., Project Manager, U.S. Army Corps of Engineers

The Redwood Creek Estuary Restoration Feasibility Study is an ongoing, multi-partner effort showing how strategic collaboration paired with nature-based planning and engineering can restore estuary function and salmon rearing habitat. The unique collaboration between the U.S. Army Corps of Engineers (USACE), Humboldt County, the Yurok Tribe, CalTrout, landowners, and agency partners seeks to modify federal levees that have disrupted hydrodynamics and sediment transport, shrinking the historic 85-acre Redwood Creek Estuary to roughly 20 acres of unvegetated, confined habitats between the levees. The loss of such vital estuary habitat has virtually eliminated critical summer rearing habitat for ESA-listed salmonids, and the tidewater goby has been locally extirpated. Additionally, the levees created nuisance flooding that has left county roads and local pastures underwater due to the blocked drainage pathways.

This locally-rooted collaborative began in 2017, when landowners and CalTrout convened a neutral forum that centered the values and interests of the landowners and agencies, set up a transparent process of shared learning, and together developed a durable agreement about how to fix the issues. Through the lens of salmon recovery, the study demonstrates how nature-based planning and engineering, built on geomorphic and hydrologic principles, and grounded in a locally rooted collaborative process, can work towards restoring dynamic equilibrium to a disrupted system. The project team has developed measurable objectives and alternatives to expand estuarine complexity, reconnect tributaries, and restore habitat conditions for juvenile salmon.

By leveraging the Continuing Authorities Program (CAP) Section 1135, the study pairs inclusive, science-driven analysis with measurable objectives and monitoring metrics focused on salmon outcomes. As a case study for salmon recovery, the Redwood Creek Estuary Restoration Study illustrates how modifying legacy infrastructure through collaborative, nature-based solutions can produce lasting ecological benefits and advance both cultural and community interests.

## Evaluating Process Based Restoration as a Method to Restore Ecosystem Resilience

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### Introducing California's Beaver Coexistence Program as Yet Another Process-based Salmonid Recovery Tool

**Brock Dolman**, Director, Occidental Arts & Ecology Center (OAEC) WATER Institute

Beaver is widely recognized as a primary agent of nature-based & process-based restoration regimes, and coexistence with them is well documented as a key strategy in the diversified recovery portfolio of salmonids in California. OAEC will share lessons learned from a new state-wide, policy-driven initiative to improve human-beaver coexistence. California has discovered that beavers offer many benefits if only humans can adapt to coexisting alongside them. In recent history, beavers have been recovering from near extirpation, only to find themselves at the focus of frequent lethal control efforts due to negative interactions with humans. Tree destruction, culvert blocking, water conveyance infrastructure plugging, and flooding are frequent concerns, but each of these has a coexistence strategy that has proven effective. To increase adoption of these strategies, the California Department of Fish and Wildlife (CDFW) has provided support through policy, personnel, and grant funding, including start-up support to the Occidental Arts & Ecology Center's WATER Institute to create the state's first Beaver Coexistence Training and Support Program (BCP). New CDFW depredation policy guidance now mandates coexistence practices before lethal control, which has opened new opportunities for coexistence. To build on those opportunities, the BCP is improving beaver-human conflict assessment, training, and targeting technical assistance, dispersing landowner stipends, and funding coexistence projects. We will discuss the new multifaceted California Beaver Help Desk website and share successes from a collaboration between OAEC & the Beaver Institute's BeaverCorps program to train and certify California's first cohort of professional coexistence contractors. We will also share ideas to better nurture early adopters in wildlife coexistence, including both technical assistance providers as well as landowners seeking project support. Finally, we discuss other CDFW Beaver Restoration Program directions promoting this process-based restoration superstar. We hope that our presentation will inspire the salmon restoration community to more actively engage with the emerging field of beaver-human coexistence, so that more places can enjoy the benefits of restoring this important ecosystem architect, especially as it relates to amplifying the recovery of salmonids across California.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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**Session Coordinators:** Shari Anderson, Lazuli Ecological Services and Craig Tucker, Suits and Signs Consulting

Following the largest dam removal project in U.S. history, Klamath Basin partners are preparing for the reintroduction of spring-run Chinook salmon, potentially the basin's most historically abundant run. Achieving a resilient, self-sustaining population will require collaboration among Tribal nations, agencies, landowners, Non-Governmental Organizations, and the scientific community. This session will bring together diverse perspectives to share knowledge, examine challenges, and explore pathways for successful reintroduction in the Upper Klamath Basin.

This session will convene state and federal agency staff, scientists, and tribal representatives to examine the implementation of active spring-run Chinook reintroduction in the Upper Klamath Basin. The discussion will begin with a review of reintroduction plans developed prior to dam removal, followed by presentations from leading researchers on habitat use and genetics. Topics will include the importance of preserving the unique genetics associated with early run timing, the role of habitat exclusivity in future restoration strategies, and considerations for identifying appropriate brood stock.

Tribal representatives will discuss how emerging science aligns with Traditional Ecological Knowledge (TEK), deepening our understanding of the diverse life history strategies expected as spring-run Chinook repopulate the basin. The session will also highlight new monitoring data from recent experimental smolt releases, exploring how observed fish movements and habitat use can inform restoration priorities to support successful repopulation of the Upper Klamath Basin.

After hearing from the diverse set of speakers, we will facilitate dialogue in a panel discussion that allows open conversation with the audience. We expect the conversation to be energetic and informative, given the developing nature of the reintroduction strategy.



Spring Chinook South Fork Gorge on the Salmon River

*Photo: Michael Bravo*

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### Runs in the Genes: Technologies for Rapid Genetic Identification of Chinook Salmon Runs

Sean Canfield, Ph.D., California Department of Water Resources

The California Central Valley hosts four seasonal runs of Chinook salmon (*Oncorhynchus tshawytscha*): fall, late fall, spring, and winter. Spring- and winter-run Chinook have faced steep declines due to the combined effects of habitat loss and anthropogenic climate change, prompting multi-agency efforts to monitor these imperiled populations. However, juveniles from different runs are morphologically indistinguishable, and overlaps in juvenile outmigration timing pose a significant challenge for monitoring efforts at this crucial life stage. Fortunately, runs are genetically distinct and can be reliably distinguished using DNA. In this presentation, we discuss technologies and approaches for the genetic identification of Chinook salmon runs both in the laboratory and in the field, highlighting the potential for rapid point-of-capture run identification. We then discuss how these tools can be applied to conservation and monitoring efforts aimed at Chinook salmon in the Klamath Basin.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### Ecosystem Response to the Removal of the Elwha River Dams, Washington State, U.S.A.

George Pess, Ph.D., George Pess Consulting

Worldwide stream and watershed restoration efforts cost billions annually. These projects are typically local-scale activities that do not have a measurable effect on ecosystem function or services. One ecosystem restoration technique that can have a large-scale effect is dam removal. This single action allows for the re-connection of ecosystem processes such as upstream and downstream organism movement, the rapid transformation from lentic to lotic conditions in former reservoirs, rapid shifts in community structure and food webs, and accelerated habitat creation through sediment deposition. We present results from the Elwha River, where the 2nd largest dam removal ever undertaken resulted in measurable ecosystem changes. The release and subsequent downstream transport of tens of millions of metric tons of sediment from former reservoirs has resulted in the transformation and rebuilding of estuarine and riverine habitats. Short-term changes due to large changes in sediment supply resulted in reductions in salmon productivity, but it has recently rebounded. Following dam removal, marine-derived nutrients increased, entered food webs, and altered the migration patterns and fecundity of an aquatic songbird. The resumption of free passage for aquatic organisms has re-established anadromous fishes to areas that have been void of such species for 100 years. For *Oncorhynchus mykiss*, dam removal, along with hatchery and harvest actions, has increased abundance, resident and anadromous life history diversity, and now displays both winter and summer anadromous migration timing. Our results demonstrate the critical importance of maintaining longitudinal connectivity for maintaining watershed processes and ecosystem services, and linking management such as habitat restoration, hatchery operations, and harvest actions into an integrated set of actions.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### The Role of Natural and Man-Made Barriers on the Distribution of Summer and Winter-Run Steelhead in the Greater Klamath-Siskiyou Region

Samantha Kannry, TRIB Research (Presenter) and Co-author: Samuel Rizza, TRIB Research

Summer-run steelhead are physiologically less fit than winter-run steelhead. Their advantage lies in being able to access spatial and/or temporal habitats unavailable to winter-run steelhead. As a consequence of their life-history strategy, summer-run steelhead have experienced more severe declines than winter-run steelhead. These declines are the result of their reliance on cold, upriver habitat for over-summering, which has been reduced and degraded by dams, diversions, and subsequent flow alteration, and increasing stream temperatures. We began our research into summer steelhead in the Eel River, and have since expanded into all the basins in the greater Klamath-Siskiyou region that currently or historically are home to summer steelhead. We examined the distribution of the two run-types in the Mattole, Eel, Redwood Creek, Mad, Klamath, Trinity, and Rogue Rivers. We collected caudal fin clip tissue samples from juvenile *Oncorhynchus mykiss* (*O. mykiss*) above and below numerous man-made and natural barriers throughout these basins. We used Reduced-Representation sequencing methods to look at a subset of the genome. We were particularly interested in the genomic regions associated with run-timing and anadromy/residency, as well as overall diversity. Our previous research has provided valuable information for designing conservation, restoration, and management strategies for steelhead in the Eel River, and our new research continues to do so in the rest of the greater Klamath-Siskiyou bio-region.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### What Spring Chinook Need Most: An Evolutionary Reason to Exist

**Tasha Thompson, Ph.D.**, Wild Salmon Center (Presenter)  
and Co-author: **Matthew Sloat**, Wild Salmon Center

The spring-run life history in Chinook salmon (*Oncorhynchus tshawytscha*), characterized by early river entry timing and extended freshwater residence before spawning, incurs substantial costs not faced by later-migrating fall-run Chinook salmon. For example, spring-run Chinook give up months of growth in the ocean, fast for months while holding in freshwater, and undergo their energetically-intensive sexual maturation while fasting. These costs put them at a disadvantage when required to directly compete with fall-run Chinook salmon that arrive on the spawning grounds fresh from the ocean. For the spring-run life history to be evolutionarily viable (i.e., to be maintained in a watershed), the fitness benefits must outweigh these costs. The leading hypothesis (Quinn et al., 2016) is that access to highly exclusive temporal and/or spatial habitat that is generally unavailable to fall-run Chinook salmon is the main evolutionary advantage of early migration. Here, we examine case studies to explore how the loss of habitat exclusivity—driven by human factors—has contributed to the decline of spring-run Chinook. Furthermore, we explore active restoration efforts designed to re-establish habitat exclusivity. An understanding of the evolutionary selective forces that maintain the spring-run life history is critical for developing effective, mechanism-based conservation and recovery strategies.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### Lessons Learned from the San Joaquin River Restoration Program

Phillip Street, Ph.D., Science Coordinator, U.S. Fish and Wildlife Service

The primary goal of the San Joaquin River Restoration Program (SJRRP) is to reintroduce Central Valley Spring-run Chinook Salmon to the San Joaquin and restore the river to support a self-sustaining and naturally reproducing population. This presentation will focus on the details and continuing efforts of SJRRP to mitigate fish passage barriers, the reintroduction of an ESA-listed population, habitat restoration, and monitoring of fish in “good condition” in the San Joaquin River Restoration Area. I’ll highlight successes of the program, including barrier removals, construction of fish passage projects, successfully releasing juvenile spring-run salmon, and the first spring-run adults returning in 2019. Adult spring-run have successfully spawned and returned to the San Joaquin River for seven consecutive years and genetic results suggest the presence of adult returns during flood flows in an additional year. I’ll also share lessons learned from SJRRP’s salmon reintroductions, highlight the opportunity of this project to bring a threatened species back to its native habitat, and how that reintroduction will potentially help recover the species within the California Central Valley.

As California’s second largest river, the San Joaquin historically supported large numbers of spring-run and fall-run Chinook salmon, with their populations estimated to be in the hundreds of thousands. As California’s human population grew, the demand for infrastructure to irrigate the San Joaquin Valley’s agriculture and hydroelectric power also grew. The first major fish passage barrier on the San Joaquin River was completed in 1919 with the construction of Mendota Dam. Shortly thereafter, the Southern California Edison company proposed a large dam near the town of Friant, CA. However, the California Supreme Court blocked the proposed dam in 1927, laying the groundwork for legal battles over the San Joaquin’s water that continue today. Coming out of the Great Depression, the Bureau of Reclamation assumed control over the Central Valley Project. As part of the project, the Friant Dam was constructed in the same location proposed by the Southern California Edison Company. With its completion in 1942, salmon populations declined precipitously, and evidence suggests that within 10 years, Chinook salmon were extirpated from the San Joaquin River above its confluence with the Merced River. Starting in 1988, and building off the language from the California Supreme Court’s original 1927 ruling, an 18-year legal dispute involving the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority concluded in a 2006 settlement, creating the SJRRP.

## Springing into Action: Spring Chinook Reintroduction in the Klamath Basin Post-Dam Removal

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### Wild ishyâat (*Oncorhynchus tshawytscha*) in a Spring-Run Chinook Salmon Stronghold

**Toz Soto**, Karuk Tribe, and **Sophie Price**, Salmon River Restoration Council (Co-presenters); and Co-authors: **Karuna Greenberg**, Salmon River Restoration Council and **Amy Fingerle**, University of California, Berkeley

The Salmon River is home to one of only two remaining populations of wild ishyâat, or spring-run Chinook salmon (*Oncorhynchus tshawytscha*), in the Klamath River Basin. Spring Chinook were once the most abundant salmonid in the Klamath River but are now reduced to near extinction levels. Thirty-five years of population monitoring in the Salmon River indicates that the population size has remained below the long-term average for the last ten years, which has prompted an urgent effort to better understand the needs of spring Chinook in the Klamath Basin. Collaborative research efforts by the Karuk Tribe, Salmon River Restoration Council, UC Berkeley, UC Davis, Wild Salmon Center, and U.S. Forest Service have shed light on what makes spring Chinook distinct from fall Chinook from both a genetic and ecological perspective. Long-term monitoring of spring Chinook and recent genotyping of tissue samples collected during spawning ground surveys, rotary screw trap outmigrant monitoring, and seine net sampling have revealed patterns in distribution and population structure which could have both local and far-reaching implications for Klamath River spring Chinook recovery and reintroduction post-dam removal.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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**Session Coordinator:** Michael Rogner, Director of Science, River Partners

The industrialization of the Central Valley has resulted in the loss of over 90% of floodplain rearing habitat. The recovery of native fish populations in this region is complicated by the operation of State and Federal water projects and the infrastructure for these, which includes 20 major dams, over 1,600 miles of levees, and hundreds of miles of bank revetment. These projects, while essential for public safety and water reliability, place constraints not only on habitat for these fishes but also on floodplain restoration work within their boundaries, greatly increasing project timelines and costs. The state of anadromous fish in the Central Valley is an escalating, large-scale problem that requires large-scale solutions to be implemented in a shorter timeframe. This session will include examples of floodplain reconnection projects completed or in process on mainstem rivers in the Central Valley. The session will not only discuss different types of projects, but also the successes and setbacks experienced in reducing barriers to implementation.



Flooding on a restored floodplain near the confluence of the Feather and Bear Rivers, Yuba County, CA

*Photo: River Partners*

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### Helping Fish Back to the River: Innovative Fish Passage Gate on Remnant Floodplain

**Daniel J. Howes, Ph.D., P.E.**, Professor and Chairman, Irrigation Training and Research Center, California Polytechnic State University, Humboldt

The Irrigation Training and Research Center (ITRC) and River Partners (RP) have developed a gate designed to help juvenile salmonids trapped in a remnant floodplain. The location of the remnant floodplain is on the outside of Willow Bend along the Sacramento River, north of Colusa, CA. The remnant floodplain regularly floods when the Sacramento River overtops the low bank on the western edge of the site. The floodplain is between the river and the main U.S. Army Corps of Engineers' (USACE) levee to the east and was historically surrounded by orchards, which have recently been restored to native vegetation. Juvenile fish that enter the floodplain thrive in the food-rich environment of the shallow pond but are trapped and cannot return to the river once it drops to an elevation of approximately 72' (mean sea level (MSL) below the top of the bank).

The main objective of this project was to develop a gate structure that would automatically drop the water level in the floodplain by releasing a small flow from the pond continuously and consistently. Specifically, the goal was to retain water for up to 16 days after a flood event, slowly releasing 2 cubic feet per second continuously until empty. While in theory this is not difficult with today's technology, there were many constraints that created challenges. Some of these constraints included the lack of power, complete inundation of the site and gate, the need to meet National Oceanic & Atmospheric Administration's fish passage and bypass requirements, and minimal maintenance.

This gate has now been in place for multiple seasons under various flood scenarios. It is operating better than expected, allowing hundreds of juvenile salmonids that would have been trapped to escape back to the river in a safe and beneficial manner. This presentation will discuss the design, operation, issues, monitoring, and assessment of the ITRC/RP Floodplain Gate.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### When the Levee Breaks: Strategic Levee Breaching and Abandonment as Strategy for Floodplain Reconnection and Ecosystem Restoration at Great Valley Grasslands State Park, Merced County, California

Kristan Culbert, MSEM, Associate Director of California River Conservation, American Rivers

Great Valley Grasslands State Park (GVGSP), a 2,000-acre state park in Merced County, contains the largest expanse of unplowed grassland within California's Central Valley, and is also home to extensive riparian habitat, seasonal wetlands, and a rare plant community that includes the perennial bunchgrass alkali sacaton (*Sporobolus airoides*) (Solomesch and Barbour, 2005). However, a 1950's-era levee built to facilitate livestock grazing has cut off seasonal San Joaquin River flows from the park's historical floodplain, eliminating periodic floodplain inundation and enabling exotic vegetation to invade the park's native grasslands.

In 2010, the California Department of Parks and Recreation's (CDPR) Central Valley District identified an opportunity to restore hydrological connectivity to 220 acres of the park's historical floodplain on the San Joaquin River by breaching the levee. These strategic levee breaches allow the river's floodwaters to inundate the park's wetlands, thereby suppressing invasive plant species, replenishing flows needed by native riparian plant species, and restoring rare habitat for sensitive terrestrial and aquatic wildlife species, including giant garter snake (*Thamnophis gigas*), San Joaquin kit fox (*Vulpes macrotis mutica*), California tiger salamander (*Ambystoma californiense*), Swainson's hawk (*Buteo swainsoni*), western spadefoot toad (*Spea hammondi*), and numerous waterfowl that migrate along the Pacific Flyway.

Additionally, the project presents a clear opportunity to restore and protect critical rearing habitat for juvenile spring-run Chinook on the upper San Joaquin River: floodplain connectivity is a critical element of a healthy river ecosystem (Bayley, 1995), and juvenile Chinook salmon (*Oncorhynchus tshawytscha*) have faster growth rates on floodplains compared to those on a river's mainstem (Sommer et al. 2001b; Jeffres et al. 2008). Juvenile Chinook can enter and rear on floodplains during their downstream migrations in the winter and early to mid-spring. Juvenile Chinook also have access to a diverse and dense prey base on floodplains, as zooplankton density can be 10-100 times greater in a floodplain compared to the river (Grosholz and Gallo, 2006). Finally, the project will create temperature refugia for fish through enhancing the growth of riparian vegetation that provides shade and improving hyporheic exchange within complex channel and floodplain features (Tompkins, 2006; Arrigoni et al., 2008).

In partnership with the California Department of Parks and Recreation, various agencies, nonprofit and private partners, American Rivers is leading the effort to breach the park's obsolete levee. Upon project completion in March 2027, this multi-objective project will enhance and improve climate resilience for the park's native grasslands, seasonal wetlands, and riparian ecosystems; restore critical salmonid rearing habitat; and reduce maintenance costs associated with maintaining a non-functional levee. Ultimately, the project team hopes that successful project implementation will serve as a model and catalyst to significantly advance ecosystem restoration and flood management planning efforts in the San Joaquin River Basin and throughout the state of California.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### Hydrologic and Hydraulic Modeling Yolo Bypass Cache Slough Master Plan—A Large-Scale Multi-Benefit Planning Effort to Establish a Framework for Flood Risk Reduction and Floodplain Restoration

**Patrick Ho, P.E.**, MBK Engineers (Presenter) and Co-authors: **Mary Jimenez, P.E.**, California Department of Water Resources and **Kristyne Van Skike**, Master of Public Policy and Administration, Project Management Professional, Central Valley Flood Protection Board

Hydrologic and hydraulic modeling were conducted to support the Yolo Bypass Cache Slough Master Plan (YBMP) and will be the focus of this presentation. The Central Valley Flood Protection Plan (CVFPP) and its Conservation Strategy is California's strategic blueprint to improve flood risk management in the Central Valley and enhance the ecological health and sustainability of the State Plan of Flood Control (SPFC) while addressing both environmental and societal needs. Project planning and implementation within the Yolo Bypass involves participation and partnerships across local, state, tribal, and federal levels, which often times introduce layers of competing interests and regulatory requirements. The Draft YBMP is a guide to project planning and implementation that is consistent with the Central Valley Flood Protection Plan (CVFPP) and related programs within the Yolo Bypass. The YBMP utilizes hydrologic and hydraulic modeling to support the establishment of a more predictable framework towards flood risk management and programmatic and phased approaches to project implementation. While some conceptual projects may have potential for adverse impacts to flood conveyance capacity of the Yolo Bypass alone, the hydraulic modeling demonstrates that the cumulation of 20+ multi-benefit projects currently conceptualized within the YBCS region, when phased appropriately and planned programmatically, could produce net conveyance improvements over time.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### Fish Go Where Water Flows: Examining Pre-European Flood Processes to Recalibrate Our Restoration Efforts for the Next Century

**Eric M. Ginney**, Environmental Science Associates (Presenter) and Co-authors: **Alejo Kraus-Polk, Ph.D.** and **Justin Gragg**, Environmental Science Associates

Before the mid-1800s, California's Central Valley had about 4 million acres of seasonal wetlands that provided vital floodplain habitat and food for juvenile Chinook salmon. Approximately 95% of these wetlands have been drained or are now inaccessible behind 2,100 miles of levees. In the Sacramento Valley, most of these wetlands were historically found in flood basins located behind broad, low, natural levees along major rivers, which were seasonally overtopped in numerous locations.

Historic floodplain areas retaining some hydrologic connection to a river are now confined mainly to the valley's extensive system of engineered flood bypasses and/or areas converted to agriculture. However, research shows that juvenile salmon can grow vigorously in these "bypass floodplains", which can offer survival benefits during outmigration and their critical transition to the ocean. Even inundated floodplains converted to agriculture can provide an important source of food for juvenile salmon. Based on this growing body of research, particular planning efforts are now focusing mainly on increasing the duration of inundation in the existing flood bypass system. Primarily, this would be achieved by 'notching' existing flood weirs to allow flows and fish at lower river discharge levels to reach the bypasses, thereby prolonging inundation, boosting food production, and extending the time this habitat is accessible. Other efforts are examining ways to increase fish food production behind levees (i.e., dry-side food production) and drain food-rich water back into rivers.

We see little if any harm in implementing these actions. Both approaches are receiving significant investment and are being integrated into concepts that work within the existing flood system and support a transition to wildlife-friendly agricultural practices. However, critical physical (e.g., hydrologic and hydraulic) and biological conditions and cues that route juvenile fish from rivers to floodplains have received little attention. While weir-notching and food export projects have demonstrated benefits, the species-level response remains unclear, and recovery will require consideration and implementation of approaches beyond just these actions alone. Indeed, the scale of the salmon recovery problem is large, so our response needs to be correspondingly large to yield desired outcomes.

To rehabilitate the critical physical and ecological processes that create and sustain the habitat needed to restore our salmon populations, we must further explore the fundamental physical processes and coupled biological responses—specifically, the spatial and temporal aspects of juvenile fish, flows, physical habitat, and food. Do fish and food need to better align in time and space, and in the same proportions and types of habitats as under historical conditions? Can this be achieved within the Valley's altered physical template (i.e., narrow flood weirs compared to the broad overflow of natural levees)?

Using historical ecology and semi-quantified conceptual models, we begin addressing these critical questions to assess the benefits the current suite of actions may accrue relative to the scale necessary to recover populations. We also begin to expand the suite of potential restoration actions to include early thoughts on design criteria for any critical flood processes and/or floodplain morphologic attributes that these efforts discover, hopefully increasing our chances of achieving recovery.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### Evolving Stream Habitats and Managed Flow Regimes to Support Floodplain Rearing of Juvenile Chinook Salmon

Derek Rupert, M.S., Bureau of Reclamation

Lower Clear Creek (Shasta County, CA) has undergone large-scale habitat restoration over the past three decades to support anadromous fishes, particularly Chinook salmon. These efforts, which included major channel and floodplain reconfiguration and additional water releases from Whiskeytown Dam, aimed to build and restore habitat lost after a century of deleterious land-use practices. However, floodplain rearing habitats did not materialize as planned, as the creek has lacked key physical and hydrologic characteristics to maintain sufficient inundation duration and area. To enhance juvenile salmon rearing habitats, a long-term gravel augmentation program and a re-balanced managed flow regime were implemented to increase floodplain inundation and to align this inundation with the peak juvenile rearing season. These combined actions have substantially increased the duration and spatial extent of floodplain-rearing habitat based on hydraulic modeling and field monitoring. Juvenile Chinook salmon have been observed utilizing these newly reconnected habitats. These results demonstrate that adaptive restoration, combining geomorphic modification with managed flows, can successfully recreate functional floodplain rearing habitat and support salmon population recovery and suggest a promising framework for future restoration in regulated river systems.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### The Simple Math of Salmon Recovery: Scaling Solutions to Those of the Problem

Jakob Katz, Ph.D., Lead Scientist, California Trout

This talk will introduce the String of Pearls project, which is using cutting-edge mapping technology to inventory and prioritize the potential floodplain and side channel habitats along the 300-mile corridor of the winter run Chinook migration in the Sacramento River Valley from Redding to Rio Vista. From Shasta to the saltwater and through the long, channelized, and leveed river reaches in between, this project will enhance salmon access to a mosaic of high-quality, off-channel rearing habitats for all runs of Sacramento River salmon. We will introduce the Ecological Floodplain Inundation Potential mapping tool, designed and operated by CBEC Eco Engineers (now Verdantas), as well as describe several side-channel and floodplain restoration sites being implemented by River Partners. Only with landscape-scale action can a population-level response be expected.

## Against the Current: The Critical Need for Large-Scale Floodplain Reconnection in the Central Valley

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### Lessons from 100 Years of Sacramento Valley “Floodplain” Science

**Bjarni Serup**, Senior Environmental Scientist, California Department of Fish and Wildlife

Sacramento Valley flood basins have been the focus of fisheries studies over the past 100 years. Floodplains have been and continue to be a buzzword in salmon recovery efforts, but an enormous amount of complexity hides beneath the surface. In evaluating the significant number of studies and monitoring conducted on multiple different native fish species, contaminants, fish rescues, salmon rearing, food webs, migration patterns, and how all of those interact with existing land uses, the question arises: what does all that information really tell us about ecological floodplains? Salmon will be the center of attention, but one cannot pretend to understand floodplains through salmon ecology alone. This presentation includes the positives, the negatives, and the unknowns of fish vs flood basins in the Sacramento Valley with a particular emphasis on a multitude of connectivity issues. Hopefully, lessons learned from looking at the past 100 years can guide floodplain restoration over the next 100 years.

## Science and Research to Inform Management

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**Session Coordinator:** Eli Asarian, Riverbend Sciences

This session will explore science across a range of topics relevant to river restoration and conservation, including: sampling design, genetics, water management, hydrologic effects of habitat restoration, and climate change effects on salmonids and food webs. Habitats discussed will span from mountain meadows to coastal streams and regulated mainstem rivers and from the Pacific Northwest to California's North Coast and Sierra Nevada.

## Science and Research to Inform Management

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### Assessing Freshwater Biodiversity With eDNA

**Brooke Penaluna**, U.S. Department of Agriculture, Forest Service,  
Pacific Northwest Research Station

Freshwater biodiversity is declining globally, with one-quarter of freshwater fauna threatened with extinction. Assessing the presence of freshwater organisms in streams is challenging owing to their small area, the networked nature of streams, and the large number of rare, endemic, and cryptic species found in these habitats. With the development of eDNA, it is becoming a reality where we can identify fishes, amphibians, invertebrates, and pathogens. Using examples from streams, rivers, and lakes across the Pacific Northwest, we show that we can detect common, rare, endangered, and nonnative fishes, uncovering the hidden biodiversity in streams. For example, we revealed a cryptic species complex with ramifications for fish conservation, potential pockets of endemism, and possible identification of new species. In another example, we showed distribution extensions of key fishes and genetically distinguish fishes that are difficult to separate taxonomically. Ultimately, we highlight the extensive diversity in freshwaters, transforming our understanding of species presence and distributions.

## Science and Research to Inform Management

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### Hybridization of Coastal Cutthroat Trout and Steelhead at the Southern Tip of Their Range

Sam Rizza, TRIB Research

Assessing the amount and type of hybridization between coastal cutthroat trout (*Oncorhynchus clarkii*) and steelhead/rainbow trout (*O. mykiss*) is important for the conservation and management of these species. We sampled coastal cutthroat trout and steelhead/rainbow trout from the Eel River, CA to the Umpqua River, OR, to evaluate hybridization. We successfully sequenced >1,300 individuals from >75 sampling locations using restriction site-associated DNA sequencing (RADseq). This study highlights sampling locations with a relatively high incidence of first-generation hybrids, and locations where putative coastal cutthroat trout above barriers show varying degrees of *O. mykiss* introgression. Furthermore, comparison of genetic identification with field identification reveals that hybrids are difficult to distinguish from the parental types in the field, and pure coastal cutthroat trout and steelhead/rainbow trout are sometimes misidentified regardless of the fish's lifestage or the observer's experience.

## Science and Research to Inform Management

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### Pacific Salmon Data Discovery Tool

**Katie Barnas**, NOAA Fisheries (Presenter)

and Co-authors: **Monica Diaz**, **Nancy Leonard**, **Greg Williams**, and **Mari Williams**, Pacific States Marine Fisheries Commission and **Damon Holzer**, **Mary Hunsicker**, **Chris Jordan**, **Michelle Rub**, **Dawn Urycki**, and **Eric Ward**, NOAA Fisheries

The Northwest Fisheries Science Center and Pacific States Marine Fisheries Commission are leading a collaborative effort to develop a Pacific Salmon Data Discovery Tool. The goals of this web-based database are to: (1) provide annually updated summaries and visualizations of Pacific salmon data (e.g., population abundance estimates, productivity trends, age data) and the associations between salmon populations and environmental drivers (e.g., marine heat waves, abundance and survival rates of predator and prey species, freshwater habitat quality and quantity), and (2) serve as a data repository to publicly house salmon relevant data currently held by organizations (e.g., Pacific Fisheries Management Council), co-managers, and research scientists. The data discovery tool provides a single location to hold data across ecosystems (freshwater, estuary, marine) and data types (documents, data files, derived data products, spatial data, GitHub links) relevant to Pacific salmon. Many of these datasets exist in agency reports or databases maintained by external agencies or groups (e.g., states, tribes, Pacific Salmon Commission, Pacific Fisheries Management Council) but are not centralized or generally accessible to the public. Our focus will be to serve as an information clearinghouse for a broad user community—from casual data exploration through standardized data visuals to comprehensive data downloading supporting regional harvest and conservation management analysis.

## Science and Research to Inform Management

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### The Importance of Flow Variation for Regulated Rivers

Seth Naman, NOAA Fisheries

Like snowflakes, the hydrograph for each water year of any rain, rain-snowmelt mix, or snowmelt-dominated stream is unique for any given water year. That is, water has never, and will never, flow down a river in the exact same pattern as any other water year, resulting in an infinite number of unique annual flow patterns. Dams have disrupted these natural flow patterns on regulated rivers throughout the world for centuries. Many authors have studied and identified how altering the timing, magnitude, and duration of flow events in rivers has resulted in the degradation of aquatic habitats and the species that depend upon them. In the more recent past, there have been advancements in developing recommendations for flow releases from dams that provide more benefits to aquatic species and their habitats than typical flow release methods. However, these flow restoration recommendations themselves result in simplification of complex flow patterns that support the development of important species characteristics such as life history diversity. I show how the temporal scale of flow analysis (e.g., 15-minute, hourly, daily), summary of data into percentiles, and binning of features such as water year type contribute to simplified flow recommendations. I provide example flow recommendations and compare their performance relative to unimpaired river flows in meeting several metrics for flow variation both within and across years. Many life-history adaptations of aquatic organisms involve the synchronization of a life stage to long-term flow regime dynamics, highlighting the need to preserve this long-term hydrologic complexity to preserve the integrity and resiliency of aquatic species.

## Science and Research to Inform Management

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### Hydrologic Benefits of Meadow Restoration: Insights from the Van Norden Meadow Restoration Project

**Alecia Weisman, M.S.**, South Yuba River Citizens League and **Sam Diaz, P.E.**, Verdantas (Co-presenters) and Co-authors: **Sarah M. Yarnell, Ph.D.**, UC Davis, Center for Watershed Sciences and **Kyle McNeil**, South Yuba River Citizens League

High elevation wet meadows in the Sierra Nevada are highly productive ecosystems that are dependent on floodplain connectivity to support hydrologic and ecosystem function. The majority of wet meadows in the Sierra Nevada are in some state of degradation and are unable to provide the ecosystem benefits that healthy meadows provide. In degraded meadows, hydrology is often interrupted, leading to incised channels that are disconnected from the meadow floodplain. Van Norden Meadow, located at the headwaters of the South Yuba River, has been impacted for centuries by human activities such as logging, grazing, water storage, infrastructure development, and recreation. The Van Norden Meadow Restoration Project is a 485-acre meadow restoration project aimed at restoring high-functioning headwater wetland habitat. This large-scale meadow restoration project was implemented in 2022 and used a variety of restoration techniques, including full channel fill, intermittent fill, and beaver dam analogs to reconnect the remnant floodplain. Building on a long-term baseline data set, three years of post-restoration data have been collected, allowing the multi-disciplinary project team to identify trends in groundwater recharge and flow attenuation. This presentation will focus on initial results, highlighting the effects of restoration on meadow hydrology. Results will also shed light on how the increase in pace and scale of meadow restoration projects throughout the Sierra Nevada can contribute to downstream water management goals.

## Science and Research to Inform Management

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### Simulating Telemetry Studies that Estimate Component Mortality Rates of Imperiled Juvenile Salmonids

**Elizabeth M. Greenheck**, George Mason University (Presenter)  
and Co-authors: **T. Reid Nelson**, George Mason University; **Matt Peterson**, Tyler Pilger,  
and **Matea Djokic**, FishBio; and Jack Eschenroeder

Juvenile salmonids have low survival during their outmigration into marine environments, and there is disagreement regarding the factors that contribute to low juvenile survival, the relative strength among those factors, and how to develop effective management actions to improve survival. In this study, we provide a planning tool for researchers interested in quantifying component mortality of juvenile salmonids using a multistate mark-recapture model (MSMR) framework for telemetry projects to increase study precision and better understand data needs prior to project implementation. We evaluated the accuracy and precision of multistate mark-recapture models (MSMRs) by generating simulated data and model code under four study designs of increasing complexity. Study design A considers a passive-only acoustic array (low detection probability) and three observation states (alive, fish predation, unknown mortality). Study design B expands study design A to include active tracking (high detection probability). Study design C expands study design B, where predation and unknown mortality are modeled using biological (fork length) and environmental (temperature) covariates. Study design D expands study design B to model four observation states (alive, fish predation, avian predation, unknown mortality). Our results suggest that increasing sample size is more effective than increasing detection probability for reducing error, especially when estimating more than three states. This research provides realistic study design scenarios and model code that can be used by resource managers when designing projects aimed at identifying component mortality for salmonids to increase the likelihood of project success while considering the costs of facilitating such research.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

**Session Coordinators:** Bob Pagliuco, Marine Habitat Resource Specialist, NOAA Fisheries Restoration Center and Mike Belchik, Senior Water Policy Analyst, Yurok Tribe

The Klamath River once supported the third-largest salmon runs in the U.S. West Coast. Between 1918 and 1962, PacifiCorp built four hydroelectric dams—J.C. Boyle, Copco Nos. 1 & 2, and Iron Gate—that blocked migratory fish passage and degraded river ecosystems. After decades of advocacy by tribal nations and environmental groups, the Klamath Hydroelectric Settlement Agreement was reached, paving the way for dam removal. Physical removal began in mid-2023 and was completed in September, 2024. The removal of the Klamath River dams marks a historic step toward restoring one of the West Coast’s most important salmon runs, but success won’t be measured in months—or even just a few years. Restoration and monitoring need to occur to understand the outcomes of this landscape scale project. This session will highlight the current and future restoration efforts in the footprints of the former reservoirs on the Klamath River and highlight what the first year of physical and biological monitoring has revealed thus far after the largest dam removal in history.



The Yurok tribe led the massive native revegetation project following the dam removal

*Photo: Shane Anderson*

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Klamath Dams and Downriver Nutrient Dynamics: Past, Present, and Future

John R. Oberholzer Dent, M.S., Biologist, Karuk Tribe Department of Natural Resources

Nutrients regulate algal growth, drive microbial processes, and determine food web structure. Despite major alterations to nutrient dynamics, the temporal and spatial patterns of nutrient retention are poorly understood in large rivers, in part due to limited sample records. While reservoir nutrient retention is well-studied, how dams impact nutrient dynamics in reaches downriver has rarely been assessed. However, on the Klamath River, the Karuk and Yurok Tribes have collected over two decades of biweekly nutrient (nitrogen [N] and phosphorous [P]) samples at 11 stations throughout the lower Klamath Basin (from the former Iron Gate Dam to Turwar, 190 miles of the mainstem and its tributaries), including before, during, and after the largest dam removal in history. We used this extensive dataset to model daily nutrient concentrations and loads from 2005 to 2023 and then calculated monthly reach-scale (15-42 mi) nutrient retention and release. P was high compared to N in all reaches of the lower Klamath River with N:P << 16:1, and nutrient concentrations generally decreased while loads increased in a downriver direction due to tributary accretions. Prior to dam removal, the reach below the dams stored nutrients for part of the year, then released nutrients during periods of high algal growth, exacerbating eutrophication downriver. During reservoir drawdown and dam removal in 2024, nutrient concentrations were the highest ever recorded (up to 10 mg/L for both N and P), but appeared to not increase autotrophic biomass due to limited benthic light associated with high turbidity. In a post-dam Klamath River, we expect that N:P ratios will be more balanced in downriver reaches due to reduced internal storage in the former reservoir reaches. Understanding how these dams impacted nutrients longitudinally is only possible due to long-term, place-based tribal datasets, which offer insight into how dams and dam removal may impact rivers broadly. A restored nutrient regime continues to evolve and will take years to stabilize, underscoring the importance of support for continued tribal nutrient sampling for future study of the long-term response of the world's largest dam removal.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Effects of Dam Removal on Klamath River Aquatic Food Webs

**Claire Inouye**, Cal Poly Humboldt, Department of Environmental Science & Management (Presenter) and Co-authors: **Rosa Cox** and **Alison O'Dowd**, Cal Poly Humboldt, Department of Environmental Science & Management and **Toz Soto**, Karuk Tribe

The removal of the four lower dams on the Klamath River provides an opportunity to evaluate the ecological responses of large-scale dam removal. The reservoir drawdown and dam demolition in 2024 caused large fluctuations in turbidity and dissolved oxygen downstream of Iron Gate Dam. This study examines changes in benthic macroinvertebrate abundance and community structure collected at four main-stem Klamath sites and four corresponding tributary sites located within a 60-mile reach downstream of Iron Gate Dam. Benthic macroinvertebrate, invertebrate drift, and juvenile salmonid diet samples were collected before, during, and after dam removal in both the spring and the fall from 2022-2025 to capture possible changes occurring in the system. Preliminary results comparing before (2022 & 2023) and during (2024) dam removal were mixed. Spring invertebrate drift count density increased in the main-stem Klamath during dam removal but estimated biomass density did not change. In juvenile salmonid diet samples many invertebrate metrics actually increased during dam removal. Spring benthic samples revealed a decrease in diversity and taxa richness during dam removal but no change in abundance or % EPT. Fall benthic samples indicated a dramatic decrease in invertebrate abundance in the fall after dam removal compared to before dam removal, which was not observed in the spring samples. Community shifts during dam removal were notable. The relative abundance of Chironomidae (non-biting midges), Simuliidae (blackflies), and Blephariceridae (net-winged midges) increased notably during dam removal. Samples collected in spring and fall of 2025 will provide insight into the response and recovery of invertebrate communities post-dam removal. These findings will improve understanding of aquatic food-web responses to a large-scale dam removal.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Rebuilding Tributaries in the Former Reservoir Footprint to Support a Newly Free-Flowing Klamath River

**Dan Chase, M.S.**, Biologist, Resource Environmental Solutions (Presenter)  
and Co-author: **Dave Coffman, P.E.**, Resource Environmental Solutions (RES)

Removal of four hydropower dams on the Klamath River in northern California and southern Oregon is the largest dam removal and river restoration project in the country. Tribal communities had long advocated for an undammed and restored river, citing the negative impacts on tribal fisheries, health, and culture. After decades of advocacy and work, in Fall 2024, dam removal was achieved. The historic project restored free-flowing conditions and volitional fish passage to hundreds of miles of the Klamath River, once the third largest producer of salmon on the West Coast, and is leading to landscape-level change seldom seen in a single project. The Klamath River Renewal Corporation selected RES to lead restoration for this ambitious effort, as well as accept liability associated with ensuring restoration meets ecological and biological performance standards and long-term goals/objectives. This presentation provides a look at the stream restoration work conducted in five tributaries within the formerly inundated reservoir footprints and the restoration construction completed in 2025. As the project moves into the monitoring and maintenance phase, an overview of the monitoring, reporting, and actions ahead will be provided.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Beyond the Reservoir Footprint: Restoring Tributaries to the Klamath River After the World's Largest Dam Removal Project

**Max Ramos, M.S.**, (Presenter) Restoration Engineer, Yurok Tribe Fisheries Department Technical Services Program, and **William Nuckoles, M.S.**, Restoration Engineer, Yurok Tribe Fisheries Department Technical Services Program

Over a century of human manipulations to the Klamath River and its tributaries upstream of Iron Gate Dam have impacted geomorphic and ecological processes critical to reestablishing anadromous fish populations after large-scale dam removal. Lands of the Shasta, Modoc, Yahooskin, and Klamath tribes, since time immemorial, these streams are of utmost cultural importance and have been identified as high-priority streams for the recovery and reestablishment of anadromous fishes.

This project focuses on building back the ecological and cultural resilience of streams and the people that call them home. The Inter-Tribal Planning and Advisory Committee (IPAC) was established in 2024 to oversee the restoration of the Klamath River, Jenny, Fall, Long Prairie, Shovel, and Spencer creeks, providing tribal restoration priorities and oversight from the first stages of design.

The removal of four major Klamath River dams (Iron Gate, Copco I & II, and JC Boyle) in 2024 was the largest dam removal project in the world. The creeks targeted by this project represent the major newly accessible priority Southern Oregon /Northern California Coast coho, ESA (Endangered Species Act)—listed threatened tributaries upstream of the former Iron Gate Dam. These creeks have been impacted by more than a century of cattle grazing, logging, in-channel mechanical manipulations, unscreened water diversions, manmade barriers, unthoughtful infrastructure, reservoir impoundments, and unnatural flow regimes.

This restoration project was designed to synchronize with the dam removal effort preparing streams for returning anadromous fishes. We describe the scope, existing conditions, design philosophy, and ecological benefits of the restoration projects. The Yurok Tribe, with project partners Shasta Indian Nation, Modoc Nation, Karuk Tribe, Klamath Tribes, Trout Unlimited, Ridges to Riffles, and NOAA Fisheries, plans for restoration implementation in 2027 and 2028.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### How Best to Remove a Fish Passage Barrier: Blast or no Blast? A Case Study of the Jenny Creek Barrier Removal Implementation Determination

**Evan Bulla**, Project Manager, Trout Unlimited

The Jenny Creek Concrete Barrier was built in the 1960s and it blocked fish passage seasonally or completely, depending on the species. The barrier was a top priority for removal for the United States Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), and the California Department of Fish and Wildlife (CDFW). The question is, how is this going to get done? The concrete barrier is on private property, accessible only by a 1.5-mile-long trail. Getting to the barrier is a challenge, so how are we going to remove it? We partnered with Resource Environmental Solutions (RES) to design and obtain permits for the project. We started by gathering baseline data of Jenny Creek, above and below the barrier. We needed to understand how water is moving past the barrier and how the water might move if the barrier is removed. We reviewed different alternatives: full removal, partial removal, or no removal, and presented them to project partners that include United States Fish & Wildlife Service (USFWS), National Oceanic & Atmospheric Administration (NOAA), California Department of Fish & Wildlife (CDFW), State Water Resources Control Board (SWRCB), the Yurok Tribe, and the Shasta Indian Nation. The group provided guidance on permitting and implementation options. The coordination meetings were followed up with site visits and then additional coordination meetings. We bounced around different options and how they would affect permitting, habitat impacts, budget, cultural resources, implementation, and schedule. Based on the information provided by the working group, RES was able to create a cost estimate for the preferred removal, with explosives and a hand crew removing the debris, or with a hand crew deconstructing the barrier and removing the debris. The preferred removal option was to remove the entire barrier with explosives and have a hand crew move the debris to a disposal area.

On September 18, at 12:30 pm, the Jenny Creek concrete barrier was detonated and removed. The Jenny Creek Barrier Removal Project was accomplished because of the collaboration of the working group. Everyone contributed the expertise needed for this project to be successful. This project has a positive impact on salmon return to Jenny Creek for the first time in 60 years. When salmon return to Jenny Creek and approach the barrier, instead of stopping, they now have over a mile more habitat to use.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Modernizing Fisheries Data in the Klamath Basin: A Collaborative Leap Forward

**Monica Diaz**, Pacific States Marine Fisheries Commission (Presenter) and Co-authors: **Erin Benham** and **Nancy Leonard**, Pacific States Marine Fisheries Commission

The Klamath Basin Fisheries Collaborative (KBFC) PIT (passive inductive transponder) tag monitoring and database project is a Klamath Basin fish tracking infrastructure and associated fisheries monitoring collaboration with more than 30 entities. The PIT tag project supports an ambitious effort by many partners to monitor and evaluate Klamath River restoration opportunities in the face of an ecological system in crisis and several imperiled fish species requiring Endangered Species Act (ESA) protections. Several years of PIT tag research—led by multiple entities across the basin—catalyzed the formation of KBFC and informed many of the goals and strategies now driving collaboration, data sharing, and database development work. Key collaborators include tribes, federal and state agencies, non-governmental organizations, and the Pacific States Marine Fisheries Commission. These data collected focus on native Klamath fish data that will be shared through the KBFC PIT tag database and will be used to inform fisheries management and ecosystem restoration in the basin.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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**Session Coordinators:** Monty Schmitt, Sr Project Director, TNC California Water Program, The Nature Conservancy and David Dralle, Ph.D., U.S. Forest Service Pacific Southwest Research Station

No single project or parcel can restore streamflow on its own—lasting change happens at the watershed scale, where small and large efforts alike add up to healthier rivers and more reliable water supplies. Consequently, progress depends on the accumulation of work across scales—from focused site-specific projects to broader watershed planning.

This session will highlight a diversity of approaches that collectively support watershed health and salmon recovery. Topics will include groundwater and recharge work, streamflow restoration projects, and the role of local and regional water management policies in shaping outcomes for salmon and communities. Presentations will showcase case studies where practitioners are linking science, modeling, and monitoring with policy and on-the-ground action.

By bringing together researchers, managers, and community partners, this session will provide insights into how both small-scale efforts and watershed-scale strategies can restore and protect flows, improve water security, and advance salmon recovery.



## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Stormwater:

#### Slowing, Spreading, Stuffing, Sinking, Storing, & Sharing it to Save Salmon

Brock Dolman, WATER Institute Director, Occidental Arts & Ecology Center/WATER Institute

The movement of water over and through the living ecosystem connects us to one another and to all species living in our watershed basins of relations. The quality and quantity of this precious liquid can determine which and how many of each species can sustainably live in each watershed. The better we understand the relationship between our actions and the watershed we live in, the more likely we are to ensure water security for all species that share our watersheds. Stormwater is water flowing on land surfaces during or within 24 hours of a precipitation event that is not infiltrated into the soil. Historically, it has been viewed as a problem primarily of urban areas to be solved by outmoded 'form-based' engineering practices that promote a "pave it, pipe it, & pollute it" paradigm. Beyond urban areas, this dehydration dynamic is also ubiquitous in suburban, rural residential, agricultural, rangeland, and forestry settings. Tragically, this desiccation and degradation "Drain-Age" design fails to properly manage stormwater throughout our watersheds. This leads to disastrous consequences: large, powerful volumes of water moving too fast, resulting in severe erosion, channel incision, and flooding in low-lying areas whilst robbing the uplands of potential groundwater recharge, often resulting in once perennial salmon spawning and rearing streams becoming intermittent. This excessive runoff requires expensive engineered systems that simply move the problem downstream until too much toxic runoff enters streams and rivers, causing myriad problems for salmonids and ultimately polluting our oceans. Instead of it as a problem, shifting our relationship with stormwater towards a more "Retain-Age" informed framework can allow us to strategically recognize this enormously valuable nature and process-based solution. Slowing, spreading, sinking, storing, and sharing stormwater generated by hydrologically deranging impervious surfaces as high as possible in the uplands of any watershed can increase infiltration towards the goal of it leaking later, longer in support of salmon streams that are clearer, colder, and more copious for coho and communities throughout the dry season. This presentation will focus on sharing the many examples of OAEC's "Conservation Hydrology" based stormwater solutions and collaborations over three decades of applied engagements towards increasing the pace and scale of recovery for all salmonids in California.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Scott River Recovery Action Plan Project (SRRAPP)

**Charna Gilmore**, Executive Director, Scott River Watershed Council (Presenter)  
and Co-authors: **Betsy Stapleton**, Project Development and Permitting Specialist  
and **Erich Yokel**, Monitoring Supervisor, Scott River Watershed Council

The Scott River Recovery Action Plan Project (SRRAPP) builds on the Scott Valley community's long-standing commitment to understanding the interconnections between groundwater and surface water. Working with a diverse advisory committee, agricultural landowners, and a multidisciplinary technical team, the Scott River Watershed Council (SRWC) is developing a comprehensive, landscape-scale restoration strategy covering more than 30 miles of the mainstem Scott River and major tributary confluences.

Historically, the social, economic, and regulatory challenges of undertaking large-scale channel and floodplain restoration have been overwhelming. Today, accelerating pressures, climate-driven drought, heightened regulatory demands, declining fisheries, and economic vulnerability make it clear that incremental, small-scale actions are no longer enough. Landscape-scale restoration is essential to prevent further ecological decline and protect the natural and human systems that depend on the river.

The Scott River supports the strongest remaining population of SONCC coho salmon (*O. kisutch*) in the Klamath Basin, yet the populations of all salmon species have experienced steep declines over the past century. Spring-run Chinook have been extirpated, fall-run Chinook have sharply declined, and coho salmon are now listed as threatened under both state and federal Endangered Species Acts. Although many factors contribute to these declines, habitat degradation, channelization, floodplain disconnection, incision, and loss of channel complexity remain a primary driver.

To address these issues, SRRAPP employs a comprehensive watershed-scale hydrogeomorphic assessment. This includes documenting historical channel change through aerial imagery; developing hydraulic and sediment-transport models; mapping geomorphic features associated with habitat and channel complexity; and constructing a sediment budget. This information will be integrated with the Scott Valley Integrated Hydrologic Model (SVIHM), developed by the Scott Valley Groundwater Sustainability Agency to support implementation of the basin's Groundwater Sustainability Plan.

Together, these tools will support the identification and prioritization of restoration actions by evaluating watershed-scale sediment dynamics, hydraulic connectivity, and interactions between habitat, fisheries, and agricultural use. This component of SRRAPP will provide the detailed information needed to develop a holistic river action plan that includes prioritized recovery actions and outlines both anticipated benefits and implementation challenges. By aligning and leveraging existing planning and design efforts across the watershed, the project will help move SRRAPP-identified actions toward implementation.

This presentation will highlight the importance of SRRAPP as a unifying, science-based framework for restoring the ecological integrity of the Scott River while sustaining the valley's agricultural and community needs. By integrating hydrology, geomorphology, tribal, economics, and landowner perspectives, SRRAPP provides a clear path toward coordinated, watershed-scale actions that build resilience, support local livelihoods, and promote the long-term success of Scott River fisheries.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Development and Implementation of a New Flow Regime on the Trinity River, CA

**Chris Laskodi**, Yurok Tribe (Presenter) and Co-authors: **Kyle DeJuilio**, Yurok Tribe; **Chad Abel**, U.S. Fish and Wildlife Service; **Ken Lindke**, California Department of Fish and Wildlife; and **Seth Naman**, National Marine Fisheries Service

The construction of Lewiston Dam in the early 1960s blocked 109 miles of critical salmonid habitat and diverted the majority of Trinity River flow to the Sacramento River. A precipitous decline of returning salmonid species to the Trinity River soon followed. To address these declines, several pieces of legislation, policy decisions, and a decade-long study led to the signing of a Record of Decision (ROD) in 2000 and the formation of the Trinity River Restoration Program (TRRP). This partnership of federal and state resource agencies, tribes, and Trinity County was established to restore the Trinity River and the species that depend upon it. The ROD provided considerable improvement in flow management, including annual hydrographs dependent on inflows to Trinity Lake. Nevertheless, adult salmon populations continued to decline. Through a rigorous adaptive management process, TRRP used a science-driven approach to expand flow management temporally, leading to the first known winter dam releases in the Central Valley Project specifically designed for environmental benefit. Although the process was science-driven and followed previously agreed upon procedures, several social, economic, and political factors created challenges and slowed implementation. Here, we describe the long and bumpy road from development to the implementation of environmental flow management on the Trinity River.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Deep Deficits in Weathered Bedrock: Mechanisms of Runoff Suppression and Implications for California Water Management

**Dana Lapides**, USDA-ARS Southwest Watershed Research Center (Presenter) and Co-authors: **W. Jesse Hahm**, Simon Fraser University; **Daniella Rempe**, University of Texas, Austin; and **David Dralle, Ph.D.**, USDA Forest Service, Southwest Pacific Research Station

In 2021, following a multiyear drought, California water supply forecasts dramatically overpredicted available runoff from snowmelt, leading to early reservoir releases that could have buffered later shortages. Such forecasting errors exacerbate the tension between competing end-users—agricultural irrigators, municipal systems, and ecological flows—and jeopardize the survival of aquatic species, like salmonids, dependent on summer baseflow. Drought-induced runoff shortages are a global challenge, making accurate prediction critical to balancing conflicting demands. We investigated potential drivers in the California case and concluded that moisture deficits in the bedrock root zone, which must be replenished before runoff generation efficiency returns to normal, were the primary cause. This finding highlights the essential role of deep moisture storage in rock: while soils play a role, upland forests root far deeper than thin mountain soils into the bedrock below to obtain water for transpiration and growth. We partnered with the California Department of Water Resources (CA DWR) to develop observational and modeled products that capture this deep bedrock moisture store, utilizing in situ down-borehole geophysical techniques to characterize local storage and distributed remotely sensed deficits to infer moisture dynamics at large spatial scales. Finally, we reflect on the interface between research and application, detailing lessons learned during the process of translating findings into operational forecasting, and invite additional perspectives on best engagement practices between scientists and water managers.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### An Integrative Bioenergetic Modeling Approach for Evaluating Instream Flow Needs of Juvenile Salmonids in the Lower Shasta River

**Kevin Fitzgerald, M.S.**, Applied River Sciences, Arcata, CA (Presenter);  
and Co-authors: **Suzanne Rhoades** and **Scott McBain**, Applied River Sciences, Arcata, CA;  
and **Eli Asarian**, Riverbend Sciences, Eureka, CA

Understanding streamflows that create habitat conditions sufficient for juvenile salmonid growth and survival during warm summer months is often important for regulated flow management in salmon-bearing watersheds. Practitioners have historically relied on physical habitat-based modeling tools (e.g., PHABSIM and related physical habitat-based methods) to inform what streamflows are needed to create sufficient rearing habitat. More recent tools, such as Bioenergetics HSC (Naman et al. 2020), build upon traditional depth and velocity-based habitat flow curve methods by incorporating mechanistic models of fish drift-foraging behavior. These drift-foraging habitat suitability curves can be linked to instream hydraulic conditions and food resources (drifting macroinvertebrates) to estimate reach-scale net energetic potential of drift-foraging habitats across flows. While Bioenergetics HSC outputs represent a much-needed shift towards mechanistically informed predictions of instream flow needs for salmonids, they currently describe only instantaneous energetic conditions and not the cumulative effects of changing flow and water temperature on fish through time. In contrast, Wisconsin bioenergetic models (Deslaurier et al. 2017) simulate individual fish growth over time by integrating water temperature and food consumption, but are not inherently flow-sensitive because there is no capacity for consumption to be influenced by hydrologic conditions in existing models. In this study, we paired Bioenergetics HSC with a Wisconsin bioenergetics model to create a flow-sensitive, time-series growth modeling tool for evaluating juvenile salmonid growth across a range of flows in the Lower Shasta River. Specifically, we used Bioenergetics HSC to estimate the net profitability of drift foraging across a range of flows, which were then used to scale a proportion of maximum consumption ( $pC_{max}$ ). Flow-sensitive  $pC_{max}$  with empirical water temperature model outputs were input into a Wisconsin bioenergetics model to simulate juvenile salmonid growth trajectories under different flow management scenarios. The resulting modeling tool allows end users to identify candidate flow thresholds associated with relatively higher juvenile salmonid growth and to compare growth trajectories among contrasting flow management scenarios. While no single set of analyses can determine comprehensive instream flow needs for salmonid species, this approach provides a valuable tool by combining several key features of salmonid habitat (hydraulics, foraging profitability, and water temperatures) into a single tool with an interpretable output: fish growth. This approach may be valuable in other rivers where providing good physical habitat and growth opportunities for rearing salmonids is a management goal.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Ecological Risk Assessment to Inform Regional Instream Flow Management

**Kris Taniguchi-Quan**, Southern California Coastal Water Research Project (Presenter) and Co-authors: **Eric D. Stein** and **Lara Jansen**, Southern California Coastal Water Research Project; **Belize Lane** and **Anzy Lee**, Utah State University; **Jacob Morgan**, Paradigm Environmental; **Katie Irving**, **Theodore Grantham**, and **Gabriel Rossi**, University of California, Berkeley

Streamflow alteration can degrade aquatic ecosystem health. Limiting flow impacts to an acceptable degree, however, is difficult, particularly in unregulated systems where streams are affected by multiple, decentralized diversions. Natural resource managers need tools that can be applied over entire watersheds or regions to evaluate potential ecological consequences of flow diversions and to identify protective ranges of alteration. Risk-based approaches provide an advantage over traditional approaches of establishing environmental flow targets by providing the flexibility to adjust management objectives based on risk tolerance, the needs of different species, and trade-offs with other water demands. In this study, we developed an ecological risk framework for identifying acceptable cumulative flow diversion rates, leveraging existing studies and datasets to account for varying risk profiles of specific species and life-stages of interest. We evaluated changes in regional ecological risks associated with incremental increases in diversion from unimpaired flows for different species life-stage needs and under different annual climate conditions and physical channel settings. The framework is designed to protect the habitat needs of salmonids, such as Chinook salmon and steelhead trout, alongside other ecological endpoints, including amphibians, benthic macroinvertebrates, and algal communities. This multi-species approach enables assessment of how flow alteration may affect both species of primary management concern, and the broader ecological functions supported by the natural hydrograph. We applied this framework in a coastal watershed in northern California, USA, synthesizing ecological risk curves to reveal inflection points that suggest levels at which diversion rate limits could be established. These insights can help inform regional policies for managing decentralized water systems that balance human use with aquatic ecosystem protection.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Assessing Subsurface Flow Capacity to Evaluate Reach Potential for Perennial vs. Intermittent Flow

**Luke Hatch**, Staff Restoration Engineer, Steven W. Carothers & Associates Environmental Consultants (Presenter) and Co-authors: **Adam Ward, Ph.D.**, Department Head, Biological and Ecological Engineering, Oregon State University and **Skuyler Herzog, Ph.D.**, Assistant Professor, Natural Resources, Oregon State University

Stream intermittency is becoming increasingly prevalent in semi-arid regions, threatening salmonid habitat by reducing surface water availability and altering the timing of flow during critical life stages. Although non-perennial streams are integral to watershed function, current models struggle to predict where and when drying occurs due to limited integration of subsurface processes. This study evaluates how alluvial subsurface flow capacity influences reach-scale potential for perennial versus intermittent flow within Thirtymile Creek, a semi-arid watershed in north-central Oregon. We combine geophysical, hydrologic, and topographic datasets to characterize subsurface structure and estimate reach-scale subsurface discharge ( $Q_{sub}$ ) using a Darcy-based model. Seismic refraction surveys defined depth to bedrock, while high-resolution DEM-derived (digital elevation model) valley width and slope metrics quantified subsurface transmission capacity. Temporal drying patterns were monitored using stream gauges and temperature loggers, enabling empirical estimation of valley discharge thresholds ( $Q_{valley}$ ) and validation of model results. Across nearly all study reaches, drying occurred when modeled subsurface transmission capacity,  $Q_{sub}$ , exceeded the valley's total discharge,  $Q_{valley}$ , ability to retain flow, supporting the predictive framework. One exception was observed in a geomorphically distinct reach connected to a broader alluvial floodplain and containing a mapped fault zone, features that may facilitate lateral or deeper groundwater exchange not represented in reach-averaged parameters. By integrating mechanistic and empirical methods, this research provides a framework for evaluating reach potential to sustain perennial flow under current and changing hydrologic conditions. This approach allows restoration practitioners to prioritize interventions based on dominant hydrologic constraints ( $Q_{valley}$  vs.  $Q_{sub}$ ), informing long-term habitat resilience planning in climate-vulnerable systems. The framework directly supports agencies and practitioners in identifying stream reaches with the highest capacity to support salmonid recovery efforts now and under projected future hydrologic scenarios.

## Changing the Current: Lightning Tales from a New Generation

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**Session Coordinator:** Ashley Shannon, North Coast Project Manager, California Trout

This is a Lightning Tales session, featuring five- ten-minute talks geared towards young professional development in the world of fisheries and restoration science. It is a space for growth, grit, and claiming your place in a field that does not always look like the future you want to build. This session also highlights how thoughtful, values-based decision-making and emotional awareness are essential to shaping a resilient and inclusive future in fisheries and restoration science. Our speakers will bring fresh perspectives, lived experiences, and diverse career paths to learn from, all while moving forward the values that drive our generation. And we encourage more experienced folks to listen in, because the future of this field depends on listening across generations. These talks will be short enough to keep your attention but packed with insights that will stick with you long after. Together, we will reflect on how we got here, imagine where we are headed, and share the tools and tips to grow our visions, just like healthy rivers grow strong fish.

Towards the end of the session, a facilitated post-talk discussion will be led by session coordinator Ashley Shannon and invited guest Milton Reynolds. This conversation will revisit the themes and topics covered in the session, creating space for reflection, dialogue, and collective processing of the ideas, insights, and details shared.

## Changing the Current: Lightning Tales from a New Generation

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### Womxn in Watershed Science: Taking Space in Male Dominated Fields

**Katherine Stonecypher, M.S.**, Senior Fisheries Research Assistant, U.S. Geological Survey  
California Cooperative Fish and Wildlife Research Unit, Cal Poly Humboldt

Like most fields within science, fisheries and watershed restoration have historically been considered male-dominated fields. While the number of women attaining STEM degrees has increased, these changes are not yet fully reflected within the workforce. Though women hold 47% of jobs in the United States, only 23% of federal scientists, engineers, and technical experts are women. Women account for 52% of biological science degrees awarded each year, and the number of women belonging to the American Fisheries Society has recently increased from 9% to 25%. However, just 26% of federal fisheries scientists are women.

What about the field of habitat restoration and salmon population monitoring? Women often experience barriers to career advancement in these fields, accounting for a large proportion of technicians, but are still underrepresented in leadership and management. Notably, most gender data reporting within the sciences is binary and relies on self-reporting. There is little data available on the number of non-gender-conforming fisheries professionals.

Numerous studies affirm that improving diversity and representation in science enhances innovation and the quality of research. Addressing inequity is critical to the advancement of our field. This lightning talk will explore themes of inclusion and gender equity within the field of salmon habitat restoration and ecology and identify pathways for leadership to include more diverse representation and positive outcomes for groups historically excluded from fisheries science.

## Changing the Current: Lightning Tales from a New Generation

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### Confronting Imposter Syndrome

**Virginia Wala, M.S.**, Fisheries Technician, Redwood National Park

As a young professional, it is easy to feel the effects of imposter syndrome while surrounded by colleagues who have been working in the field for decades. Imposter syndrome can lead to burnout and self-doubt, hampering the creativity and ingenuity that are critical to the future of this field. This talk will aim to facilitate an open conversation on the impact of imposter syndrome and offer strategies to combat imposter syndrome within individuals, among peers, and across the field.

## Changing the Current: Lightning Tales from a New Generation

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### Sweaty Pits and Writing Permits: Environmental Regulation, Anxiety, and Saving Everything

Shannon Husband, Environmental Scientist, California Department of Fish and Wildlife

Anxiety is a force to be reckoned with. When operating at optimal levels in the mind of a young environmental regulator, anxiety spurs productivity, critical thinking, and enhances organizational capabilities. While acquiring permits may be anxiety-inducing for restorationists and project managers, rest assured that your regulators are anxious, too. When you need a three-week turnaround to obtain a Lake and Streambed Alteration Agreement (LSAA) because project funding became available at the eleventh hour, you have environmental regulator anxiety to thank for getting that LSAA before the close of construction season. When the deadlines to review ten development projects converge, anxiety takes the reins and gets those reviews done. How many untold trees have been saved, how many cubic yards of riprap and concrete have been excluded from stream channels, all thanks to anxiety? This is a talk about one young professional's experience entering the field of environmental regulation, and includes ruminations on the motivational influence of capitalism, efforts to reprogram anxiety, and the power and cost of emotional connection to work.

## Changing the Current: Lightning Tales from a New Generation

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### River Partners Fellows Program: Building the Next Generation of Restoration Scientists

Holly Ferrara, Restoration Science Ecologist /Project Manager, River Partners

The River Partners Fellows Program cultivates early-career professionals through hands-on experience in large-scale habitat restoration across California's river systems. The program bridges the transition from academic study to applied conservation by pairing the next generation of conservationists with River Partners' scientists to address real-world challenges in restoration design, monitoring, and adaptive management. Fellows gain mentorship, technical skills, and field experience while contributing directly to projects that enhance biodiversity, climate resilience, and community benefits. This lightning talk will highlight the program's structure, key outcomes, and lessons learned from integrating workforce development with ecological restoration at a large scale.

## Changing the Current: Lightning Tales from a New Generation

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### We Are Being the Power of the River: Restoration Stories from the Riparian Zone of the Trinity River

**Simone Groves**, Riparian Ecologist, Hoopa Valley Tribal Fisheries,  
Trinity River Restoration Program

River science currently underway in the Trinity River watershed is attempting to discover the best strategies for repairing the riparian ecosystem in such a way that restores the historic runs of anadromous fish to the region. Years of experimentation, ecological monitoring, and adaptive management have allowed river restoration practitioners here to refine and improve their efforts, mitigate historic harm to the watershed, and chart a more sensible course for the river and surrounding river communities too. Although much has been learned from this process, there is always more we can understand about how the river functions and how the anadromous fish of the Trinity survive and flourish. What's often left out of this conversation about best river restoration plans, however, are the voices of the river restoration practitioners themselves, who have been working tirelessly on the ground (and in the water) for more than a decade. In the following presentation, we will share stories from field technicians with the Yurok and Hoopa tribes who are working with the Trinity River Restoration Program (TRRP) to restore the riparian zone of the Trinity River. These are the men who for years have been moving the earth and wood within the river's floodplain and planting the seeds of the river's future to bring it back to life. Through their personal reflections on this ongoing work, we hope to learn from their stories about their successes and about their failures, which are also those of the Trinity River.

## Changing the Current: Lightning Tales from a New Generation

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### We Are Being the Power of the River: Restoration Stories from the Riparian Zone of the Trinity River

Chase Niesner, Ph.D., Postdoctoral Fellow, Environmental Science, Policy, and Management, University of California, Berkeley

River science currently underway in the Trinity River watershed is attempting to discover the best strategies for repairing the riparian ecosystem in such a way that restores the historic runs of anadromous fish to the region. Years of experimentation, ecological monitoring, and adaptive management have allowed river restoration practitioners here to refine and improve their efforts, mitigate historic harm to the watershed, and chart a more sensible course for the river and surrounding river communities too. Although much has been learned from this process, there is still more we can understand about how the river functions and how the anadromous fish of the Trinity survive and flourish. What's often left out of this conversation about best river restoration plans, however, are the voices of the river restoration practitioners themselves, who have been working tirelessly on the ground (and in the water) for more than a decade. In the following presentation, we will share stories from field technicians with the Yurok and Hoopa tribes who are working with the Trinity River Restoration Program (TRRP) to restore the riparian zone of the Trinity River. These are the men who for years have been moving the earth and wood within the river's floodplain and planting the seeds of the river's future to bring it back to life. Through their personal reflections on this ongoing work, we hope to learn from their stories about their successes and about their failures, which are also those of the Trinity River.

## Changing the Current: Lightning Tales from a New Generation

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### Quotes Offer Sound Advice and Inspiration to Younger Generations of Stream Scientists and Restorationists

William J. Trush, Ph.D., Adjunct Professor, Cal Poly Humboldt, River Institute

Quotes can be considered advice. These twelve quotes offer sound advice, inspiration, and encouragement to our new generation of stream scientists and conservationists:

No.1. "The first principle is that you must not fool yourself — and you are the easiest person to fool." Richard Feynman, perhaps the best Feynman quote of all (from a 1974 address) and the best advice to scientists and anybody else who seeks the truth about the world. The truth may not be what you'd like it to be, or what would be best for you, or what your preconceived philosophy tells you that it is. Unless you recognize how easily you can be fooled, you will be.

No.2. "Every student who enters upon a scientific pursuit, especially if at a somewhat advanced period of life, will find not only that he has much to learn, but much also to unlearn." Sir John Herschel

No.3. "When we say 'striving,' I think we imply an effort of the mind as well as a disturbance of the emotions. It is inconceivable to me that we can adjust ourselves to the complexities of the land mechanism without an intense curiosity to understand its workings and an habitual personal study of those workings. The urge to comprehend must precede the urge to reform." Aldo Leopold in Round River 1953 (pp.155-156)

No.4. "When I am working on a problem, I never think about beauty... but when I have finished, if the solution is not beautiful, I know it is wrong." Buckminster Fuller

No.5. "Don't think about what you want to be, but what you want to do." Richard P. Feynman

No.6. "Never confuse education with intelligence, you can have a PhD and still be an idiot." Richard P. Feynman

No.7. "Simplicity is the ultimate sophistication." Leonardo da Vinci

No.8. "You can always recognize truth by its beauty and simplicity." Richard P. Feynman

No.9. "Study hard what interests you the most in the most undisciplined, irreverent, and original manner possible." Richard Feynman

No.10. "I'm smart enough to know that I'm dumb." Richard P. Feynman

No.11. "Curiosity and questions will get you further than confidence and answers." Maxime Lagacé

No.12. "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete." Buckminster Fuller

In the power point presentation, many other quotes will be introduced, as well as providing tips for locating more quotes.

## Changing the Current: Lightning Tales from a New Generation

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### Momentum from Mentorship

**Jason White, M.E.S.M.**, South Coast Habitat Restoration, University of California, Santa Barbara, Lecturer, SRF Board Member

For a young professional, being in the right place at the right time can lead to real professional results. After all, you can't catch fish without putting a lure in the water. Reciprocally, experienced professionals risk losing career purpose and momentum by withholding meaningful mentorship to the next generation. This talk aims to reinforce the importance of creating momentum through mentorship and the symbiotic relationship between young and established professionals by highlighting my experience being a bright-eyed, bushy-tailed college student who was introduced to the world of SRF through a mentor. That mentorship experience has led to a beloved career practicing river restoration, a seat on SRF's board, and becoming a college lecturer—all roles that grant me the privilege to excite and share the wonderfully complex world of applied watershed management with the next generation of potential practitioners. This talk will share funny stories, lessons, and odd coincidences that prove momentum gained through mentorship is the perpetual and cyclical energy that fuels our industry.

## Changing the Current: Lightning Tales from a New Generation

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### Science in the Summer? Bringing the Next Generation with Us

**John R. Oberholzer Dent**, Biologist, Karuk Tribe Department of Natural Resources

Despite common interest in nature, youth don't always have a positive relationship with the way science is taught in the classroom. "Science in the summer?!" one student responded to me with a wrinkled nose as I spoke about riparian ecology from the bank of the Klamath River during the Karuk Tribe's annual Summer Youth Gathering. This same student, who spent our lunch hour catching frogs in the river, didn't initially see what we do outdoors as science. Here, researchers can contribute by reframing environmental science outside of the classroom through interactive opportunities for youth in field research. Moreover, connecting the benefits of outdoor education and science education can improve youth confidence, curiosity, and physical and mental well-being. Drawing from over a decade of experience working with youth facing adversity and wilderness education programming, this presentation encourages scientists to find ways of combining hands-on outdoor education opportunities for youth with exposure to the environmental sciences. While the benefits of the outdoors are for everyone, this practice also improves student outcomes for those aspiring to become environmental technicians or scientists, especially in rural areas. By intentionally including youth in our research, we can foster the next generation of scientists while contributing to the communities around us.

## Changing the Current: Lightning Tales from a New Generation

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### Swimming Upstream: How to Navigate a Changing Job Market as a Young Professional

**Megan Kownurko**, Agricultural Enhancement Coordinator,  
Humboldt County Resource Conservation District

Current federal uncertainty has reduced environmental jobs, leaving highly qualified professionals jobless or pursuing jobs for which they are overqualified. This increased competition in entry-level jobs has left many young environmental professionals at a loss. Hear strategies and tips for success to secure the job you want first-hand from a young professional who has navigated this changing job market. This talk will cover networking, job applications, how to build skills, how to make the most of the skills you have, and more!

## Changing the Current: Lightning Tales from a New Generation

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### Changing the Tone for GIS and Empowering Folks for Discovery

**Robert George, M.S.**, North Coast Project Manager, California Trout

Whether you're a fisheries biologist, botanist, or engineer, GIS plays a huge role in river restoration. It's a tool that can be used to drive conversation, discover patterns, and think big. As a river scientist with a background in GIS, I was curious about the potential for using GIS in a restoration design setting. I was hired to do GIS for a restoration company in 2021. After a year, I realized I wanted to empower folks within the company to do their own GIS work. Changing the tone for how GIS is used in restoration and who uses it became a huge priority of mine. This lightning talk will discuss the challenges and rewards of encouraging folks in different fields to do their own GIS work. We'll go over lessons learned, how to set yourself up for success, and where I hope the future of GIS in restoration is going.

## Changing the Current: Lightning Tales from a New Generation

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### Growing a Conservation Coalition in Southern California Using Traditional and Modern Engagement Strategies

Elizabeth Burns, M.S., South Coast Project Coordinator,  
Southern Steelhead Coalition, California Trout

Southern steelhead (*Oncorhynchus mykiss*), federally listed as endangered in 1997, face immense challenges to their long-term survival. This species is a key indicator of the function and integrity of Southern California coastal watersheds. California Trout (CalTrout) developed a collaboration effort in the form of a coalition to bring together community stakeholders to better restore steelhead populations called the Southern Steelhead Coalition (SSC). The SSC's goal is to increase the pace and scale of restoration projects and recover resilient southern steelhead populations in Southern California. SSC holds quarterly meetings to provide a stakeholder forum to better coordinate the conservation efforts between members and partners in the coalition region. SSC's activities were initially focused on one watershed, the Santa Clara River watershed, in the early 2000's. In 2023, the SSC grew to serve the Santa Ynez River and the Santa Clara River watersheds. In 2025, the SSC grew to serve at least nine watersheds: Cuyama River, Santa Maria River, San Antonio River, Santa Ynez River, Santa Barbara Coastal, Ventura River, Santa Clara River, Calleguas, and Santa Monica Mountains Watersheds. The first incarnation of the SSC's meetings, before its expansion, had attendance sizes that were around twelve to fifteen members. SSC's most recent meeting had more than seventy-five members attending. The growth in membership of the SSC was steady over time, but recently grew exponentially due to employing modern and traditional engagement strategies. Due to this growth, we have advanced the SSC's goal through collaboration of watershed restoration projects, coordinating restoration efforts through regional coalitions, collaboration with organizations, and advocacy for fully warranted species protection at the state level. This lightning talk discusses the strategies for growing conservation coalitions in areas that face challenges due to urbanization, scope of work, and climate change.

## Changing the Current: Lightning Tales from a New Generation

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### The Power of Art and Natural History in Fisheries Restoration and Stewardship

Edgar Cruz, Pacific Watershed Associates

In this talk, I will explore how my background as a visual artist and natural historian feed my passion for fisheries restoration and stewardship. Artmaking evokes reflection, emotional expression, and introspection. Through the age-old process of observation and interpretation, natural history teaches us to slow down, match nature's rhythm, and build direct personal relationships with the natural world. As an early-career fisheries biologist, both disciplines have allowed me to build foundational connections with anadromous fish, dynamic rivers and creeks, and inspirational humans. These relationships are the groundwork for discovering growth, inspiration, and meaning in the work.

## Changing the Current: Lightning Tales from a New Generation

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### Political Ecology as a Lens for Understanding Fishery Declines from the U.S. to Gaza

**Stella Baumstone**, Watershed Stewards Program Corpmember,  
Bureau of Land Management, Arcata

The Gaza Strip's fishing industry, once a vital source of livelihood and food security for thousands of people, has been systematically destroyed due to the long-standing Israeli blockade. The blockade imposes severe restrictions on access to the sea, as well as the import of necessary equipment, leading to a catastrophic collapse of the sector. Viewing Israel's blockade of Gaza's fishery through a lens of political ecology is vital for understanding how the control and degradation of marine resources are tools of political power, perpetuating the systematic marginalization of the Palestinian population and contributing to a man-made humanitarian and environmental crisis. This lens is also crucial for drawing connections between the extreme fishing restrictions that Palestinians face and the legacy of the Salmon Wars that Indigenous people fought on the West Coast of the continental United States.

In order to understand the context in which Palestinians in Gaza are losing access to their fisheries, the occupying colonial management regimes from the U.S. to Israel must be named responsible. As the world of fisheries management begins to address the harms caused by the U.S. government here in the States, it is critical that Palestinian fisheries not be forgotten.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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**Session Coordinator:** Ada Fowler, Ph.D., California Trout

A healthy riparian system provides a wide range of ecological benefits, including shade that helps keep stream temperatures cool for aquatic life, escape cover for fish and wildlife, and valuable allochthonous inputs such as leaves, wood, and insects that fuel the food web and add to the diversity of the stream ecosystem. Riparian vegetation also stabilizes banks, filters runoff, and supports diverse habitats. To ensure the conservation and recovery of salmonids and other imperiled native species, it is essential to not only look within the stream itself but also consider the condition of the stream banks. Many of our rivers have been altered by human activities, including altered hydrographs from dams and diversions, channel incision and groundwater extraction that lower the water tables, and livestock grazing, which degrade water quality, habitat complexity, and ecosystem resilience. Riparian restoration is critical, as it helps reestablish native vegetation, improve hydrologic connections, restore habitat structure, and ultimately enhance the resilience and ecological integrity of rivers and streams. Those of us who are practitioners of riparian revegetation efforts know how difficult it is to re-establish functioning riparian ecosystems in these altered environments. In this session, we invite speakers to present research and case studies related to riparian restoration, discussing their challenges and how they were addressed, and what has and hasn't worked in different landscapes. We aim to bring together individuals working on riparian restoration and share this knowledge to support those undertaking similar efforts.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### Willow and Wood: Bioengineering Efforts in Humboldt and Mendocino Counties

**Veronica Yates**, Restoration Ecologist, Native Ecosystems, Inc. (Presenter)  
and Co-author: **Hugh McGee**, Principal Restoration Ecologist, Native Ecosystems, Inc.

Streambank stabilization and bioengineering projects utilizing cuttings from salix species and wood structures have long been an effective method for reducing sediment while restoring riparian and aquatic habitat. The effectiveness of these projects depends heavily on the precise willow collection and installation methods, collaboration between restoration practitioners, engineers, and heavy equipment operators, and post-construction maintenance. Native Ecosystems, Inc. and its staff have been implementing streambank stabilization and riparian restoration projects throughout Northern California for the past decade. In this presentation, we share our lessons learned from streambank stabilization and riparian restoration projects across several creeks and rivers in Humboldt and Mendocino Counties. We will discuss project design, willow cutting collection and storage methods, as well as installation methods for large pole trenched willow construction, willow and wood cluster construction, and installation of willow mattresses in fabric encapsulated soil lifts and rock slope protection projects.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### Success in Collaboration:

#### Combining Science with Agricultural Practices in Riparian Restoration

**Claudia Quintero**, Restoration Biologist and **Kyler Stassi**, Field Manager, River Partners (Co-presenters) and Co-authors: **Michael Rogner**, Director of Restoration Science and **Sarah Gaffney, Ph.D.**, Senior Scientist, River Partners.

Riparian restoration doesn't start from scratch, whether it's on a fallowed agricultural field that's been out of production for years, deep in the tules in an active floodplain, or on an island in the middle of the river. Each restoration site requires a unique perspective to better fulfill the needs of California's diversity of riparian habitats. With projects spanning the State, River Partners has implemented over 20,000 acres of large-scale riparian restoration across every major California watershed. Our success hinges on our collaborations and diverse labor workforce—by bringing together scientists and agricultural experts, we are able to approach challenges together and develop creative solutions. This session will focus on select case studies of projects spanning the length of the Central Valley and discuss the many difficulties, challenges, and lessons learned from both an operations and scientific perspective. Examples include planting in floodways, by boat under tidal influence, and during high river flows, as well as managing fish gates and screens and removing large amounts of rubble.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### Long-term Survival of Riparian Planting on the Shasta River

Ada C. Fowler, Ph.D., Senior Project Manager, California Trout

Riparian woody species restoration is essential for salmon recovery on the Shasta River; riparian trees provide shade that reduces water temperatures, create protective cover and food sources for juvenile fish, and contribute large woody debris that forms high-quality habitat. However, natural recruitment of riparian species on the Shasta is extremely limited in many parts of the river due to altered hydrology caused by Dwinnell Dam and heavy agricultural withdrawals, which prevent successful germination and root establishment. Past planting efforts have had low survival rates, and assessments indicate that insufficient planting depth, along with factors such as high soil salinity, anoxic waterlogged conditions, and variability in planting technique, likely contributed to these failures.

I will present data from the Shasta Big Spring Ranch planting that occurred between 2010 and 2012. We planted over 6000 riparian trees over roughly 10 miles of the Shasta River. Species included red, arroyo, and narrow leaf willow and white alder and western waterbirch. The survival of the trees was tracked for 4 years after planting and the site will be revisited this spring after 12 years to assess long-term survival. Initial annual survival for all species was only about 50%, with arroyo willows having the highest survival rate, over 80%. I will talk about the challenges in the Shasta River and how those could be and are being addressed.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### Restoration of Sycamore Alluvial Woodland Habitat from Conceptual Models to Implementation—the Pacheco Creek Restoration Project

**Chris Hammersmark, Ph.D., P.E.**, Verdantas Eco Engineering (Presenter) and Co-authors: **Evan Pesut, P.E.**, Verdantas Eco Engineering; **Kate Drake** and **Max Busnardo**, H.T. Harvey & Associates; and **Nathan Hale**, Santa Clara Valley Habitat Agency

California sycamore alluvial woodland (SAW) habitat is in decline due to alteration of the abiotic conditions that support this unique habitat type, particularly the reproduction of California sycamores (*Platanus racemosa*). In 2023, the Santa Clara Valley Habitat Agency constructed the Pacheco Creek Restoration Project on the 162-acre Pacheco Creek Reserve in southern Santa Clara County, which is centered around approximately 10 acres of SAW habitat restoration. The restoration effort includes a two-pronged approach: active planting and topographic modification to enhance physical processes that are hypothesized to be important drivers of SAW development. As part of the design process, a novel conceptual model, the “constellation of drivers,” was developed that creates a framework for understanding the confluence of biotic and abiotic factors that result in successful California sycamore regeneration. Key factors addressed in the conceptual model include physical conditions (geomorphic disturbance and suitable substrate and soil conditions), availability of a nearby stand of healthy, genetically pure sycamore trees capable of producing viable seed at the right time of year, and suitable conditions for establishment for several years after seed dispersal. The presentation will provide an overview of the constellation of drivers, an explanation of how the conceptual model was incorporated into the design of the Pacheco Creek Restoration Project, and lessons learned from implementation and the first two years of post-construction monitoring.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### One Method, Many Meadows: How LT-PBR Adapts in Sierra Meadows

**Katie Smith**, California Inland Trout Project Manager, Trout Unlimited (Presenter)  
and Co-authors: **Alec Leonardini, Nick Webber, Jessica Strickland, and Sabra Purdy**

As recognition grew around the critical role that Sierra Nevada mountain meadows play in sustaining California's biodiversity and water supply, Trout Unlimited's Inland Trout Program embarked on a slew of meadow restoration projects across a broad range of ecological settings in the Sierra Nevada. These projects represent a diversity of meadow types—from small high elevation basins just below tree line to the alluvial valley of the South Fork Kern River. Working across this range has provided a unique opportunity to evaluate how low-tech, process-based restoration (LT-PBR) performs under different geomorphic and hydrologic conditions in mountain meadows. Construction strategies, material requirements, and structure type varied depending on meadow gradient, catchment size, sediment availability, channel entrenchment, and the specific hydrology of each system. The environmental context not only shapes immediate project outcomes but also influences early monitoring signals such as water table response, sediment retention, and floodplain connectivity. This presentation will highlight practical lessons learned from implementing LT-PBR in contrasting meadow systems. Emphasis will be placed on understanding how site-specific constraints affect construction logistics and effectiveness, and how early monitoring signals can be interpreted. Collectively, these insights present actionable guidance for practitioners working to restore riparian and meadow habitats in the Sierra Nevada.

## Restoring Riparian Habitats: Successes, Challenges, and Practical Guidance for Practitioners

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### Uncovering a Lost Meadow: Preliminary Lessons from Stage 0 Restoration on Corral Gulch

**Josh Smith**, Director, Watershed Stewardship Program and **Bridger Cohan**, Meadow and Riparian Restoration Specialist, The Watershed Research and Training Center (Co-presenters)

The Corral Gulch Restoration Project, implemented in fall 2025, used heavy equipment to restore over 20 acres of 'lost' meadow by creating a new Stage Zero floodplain surface, removing encroaching conifers, and placing logs and slash to disperse flows. While Stage Zero techniques have been used at several locations in California, the Corral Gulch Project presented several interesting challenges, including a very high density of large conifers and a lack of available fill outside the valley surface. These conditions are common to degraded and 'lost' meadows in the Klamath Mountain region, and throughout California, so the long-term outcomes of Stage Zero techniques under these conditions can help inform the siting, design, and implementation strategy for similar restoration projects. Presenters will discuss the Project's background, goals, and present an initial assessment of its effectiveness. They will also identify key lessons learned from Corral Gulch's design process, implementation, and aftermath, including the value of local site knowledge, modern GIS tools, and tribal and agency partnerships. Trade-offs and synergies between equipment-based and low-tech restoration techniques will also be explored.

## Restoration Strategy, Implementation, and Collaboration

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**Session Coordinator:** Gwen Santos, Environmental Science Associates

This session highlights collaboration and how resources can be leveraged to achieve restoration goals and harmony amongst landowners, regulators, and practitioners. Seven projects will touch on topics including navigating private land ownership, land acquisitions, water rights, regulations, dam removal, and mitigation, and ultimately how multiple interests can come together to support salmonid restoration throughout the Santa Clara River, Napa River, Sacramento River, the Klamath Mountains, and Klamath River in California.

## Restoration Strategy, Implementation, and Collaboration

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### Pickell's Dam Removal: Directing Mitigation Resources to High Value Species Recovery Actions

Jeff Lewis, Valley Water

Implementation of projects to restore streams and recover salmonid populations often requires collaboration and creative problem solving. Little Arthur Creek is a stream in Santa Clara County that is a tributary to Uvas Creek and the Pajaro River. Little Arthur Creek has a population of South-Central California Coast steelhead (*Oncorhynchus mykiss*). Pickell's Dam was a dam on Little Arthur Creek on private land that is thought to have been constructed prior to 1924 for the purposes of irrigation and recreation. Although the dam was no longer fulfilling these functions, it remained a total passage barrier for migrating steelhead, preventing access to approximately 3.5 miles of potential steelhead habitat upstream of the dam. The dam was also degrading the ecological function of the creek by blocking the transport of gravel and large woody debris to the downstream portions of the creek and altering geomorphic processes both upstream and downstream of the dam.

Valley Water is a public agency in Santa Clara County with a mission that includes water supply, flood protection, and environmental stewardship. Valley Water maintains its streams under its Stream Maintenance Program (SMP), which may require mitigation in some cases, including when the work impacts habitat features such as gravel or large woody debris. In the past, these impacts have generally been mitigated by direct replacement of the impacted habitat features (e.g., mitigation of impacts to large woody debris through direct replacement of large woody debris). However, Valley Water hoped that these mitigation needs might offer opportunities to direct resources toward higher-value recovery actions where there are opportunities to do so. Valley Water became aware of Trout Unlimited's work to develop a project to remove Pickell's Dam from Little Arthur Creek. Trout Unlimited had designed the dam removal project and built relationships with private landowners and other relevant parties, such as the Amah Mutsun tribe.

Valley Water and Trout Unlimited realized that there was an opportunity to collaborate by using the resources that Valley Water has committed to mitigation, partnering with Trout Unlimited to actualize the Pickell's Dam removal project. After extensive coordination with the resource agencies regulating the SMP, Valley Water secured an agreement that the removal of Pickell's Dam would meet the mitigation needs for SMP, thereby allowing Valley Water to direct mitigation resources to a higher ecological value project.

Valley Water was then able to provide funding, environmental planning and permitting, and biological support for the implementation of the Pickell's Dam removal project. Pickell's Dam was removed in 2024, and early monitoring shows a creek that is now open for the return of steelhead migration and adjusting to more natural geomorphological processes. This project exemplifies how local governments can use collaboration and creativity to effectively allocate limited public resources for mitigation, thereby achieving the best possible species recovery outcomes.

## Restoration Strategy, Implementation, and Collaboration

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### Sulphur Creek Fish Passage Restoration (Part 2) —Lesson Learned from Implementation and Post Project Monitoring

Aaron Sutherlin, WRA Environmental Consultants

This presentation will expand on a presentation that was given at the SRF Conference in 2024, which included support from WRA Environmental Consultants, Caltrout, and the Napa County Resource Conservation District. Since then, the Project has been constructed, and the intent will be to provide lessons learned to practitioners for construction and post-construction monitoring.

The Sulphur Creek watershed supports Central California Coast steelhead, which are listed as threatened under the U.S. Endangered Species Act (ESA). In addition, three native migratory fish species are known to occur in the system: Chinook salmon, river lamprey, Pacific lamprey, as well as prickly sculpin, and threespine stickleback. The Sulphur Creek watershed was identified as an “essential stream” in a ranking of bay area streams where steelhead still occur. Essential streams were defined as those having ecological significance for the long-term survival of steelhead within the region. Spawning has been documented throughout much of the Sulphur Creek system, but the highest quality spawning habitat is located upstream of the fish passage barrier at the Project site. Juvenile rearing is limited to the upper watershed where cool perennial flow is present.

The Sulphur Creek Fish Passage Restoration Project (Project) focused on replacing a poorly functioning fish ladder in Sulphur Creek, immediately downstream of a narrow private road bridge near the City of St. Helena, California. The design approach removed the non-functioning fish ladder and replaced the bridge to provide modifications along over 600 feet of channel corridor conducive to ingress and egress, allowing access to approximately three miles of vital spawning habitat and channel refugia. Design elements included engineered stream bed and bank material, replacement of the narrow bridge with a full span bridge, strategic placement of woody material and high flow refugia boulders, and the installation of a robust riparian revegetation plan. Challenges included working late into the season and facilitating dewatering efforts, navigating through local permitting, working with multiple landowners, managing implementation funding with uncertainty, and managing changes from a long design to implementation timeframe, including changes to site conditions and turnover across multiple facets of the implementation team. Lessons learned include the criticality of documentation during construction, the essentials of communication of technical results to laypersons with local context in mind, and the need for clear lines and frequent communication to manage project variables.

## Restoration Strategy, Implementation, and Collaboration

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### Acquiring Land

#### —a Foundation for Large-Scale Habitat Restoration and Salmon Recovery

**Maggie Blankinship**, Director of Acquisitions, River Partners

Land protection is an effective strategy for restoring streamflow and managing water supplies in California's Central Valley. In River Partners' 27-year history, we have permanently protected 7,770 acres of riparian lands in the Sacramento and San Joaquin Valleys. By 2030, we plan to grow that protected footprint to 30,000 acres of riverside lands—and scale to 5,000 acres of restoration per year—to benefit rivers and fish habitat at a watershed scale. Land acquisition is the cornerstone of River Partners' strategy to expand riverway restoration work, facilitating landscape-scale conversion to habitat and critical permanent protection of water resources to benefit fish and wildlife.

This presentation will highlight the importance of permanent land protection to watershed health and explore River Partners' innovative land acquisition strategy: from identifying willing sellers and navigating uncertain funding to transitioning thousands of acres from degraded farmland into restored, thriving habitat that supports salmon and other species recovery. We will dive deeper into pathways for permanent water dedication on protected lands, including Section 1707 and forbearance of water use, highlighting the critical nature of fee-title ownership to provide the flexibility to pursue these strategies. Independently, each of River Partners' land acquisition and restoration projects has highly localized value—but taken as a whole, our constellation of land protection efforts accumulates to provide critical migration pathways and meaningful amounts of protected instream flows.

## Restoration Strategy, Implementation, and Collaboration

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### Utilizing Private Capital to Advance Large-scale Floodplain Restoration at the Butte Sink Mitigation Bank

Ashley Zavagno, CERP, CSE, WRA Environmental Consultants

Central Valley salmonid runs are struggling due in large part to a lack of floodplain rearing habitat. Levees, dams, and development have significantly reduced access to these food-rich environments, making it difficult for juvenile fish to grow and develop to a sufficient size before outmigrating. The Butte Sink Mitigation Bank Floodplain and Salmonid Habitat Restoration Project aims to restore approximately 300 acres of floodplain rearing habitat within the Butte Sink region of the Central Valley. This project is uniquely located along both Butte Creek, which supports the largest wild population of Central Valley spring-run Chinook salmon, and the Colusa Bypass, which transports floodwaters from the Sacramento River into Butte Creek. Because of this location, the Project has the opportunity to benefit all four runs of Chinook salmon by increasing floodplain connectivity from both rivers.

The majority of the project site is currently in agricultural production, but remnant patches of riparian habitat left by the landowner offered a glimpse of what the site and region once looked like. Using that as a reference, we developed a restoration plan for the project that removes anthropogenic constraints, such as culverts, berms, and irrigation canals, and encourages natural processes. The design includes grading to remove berms and increase floodplain connectivity, a mix of active planting and natural recruitment, and wood structures to trap woody and vegetative debris and increase physical complexity. The project has faced challenges being within a flood bypass and accommodating adjacent agricultural uses, however, it also represents the unique opportunity to utilize private funding to advance large-scale restoration through the mitigation banking framework. Given the challenging public funding environment for restoration projects, finding alternative funding sources is more crucial than ever to advancing this important work.

This presentation will discuss the challenges and successes of this project to date and plan for construction in 2026. Lessons learned to reduce barriers for similar projects in the Central Valley will also be explored.

## Restoration Strategy, Implementation, and Collaboration

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### A Collaboration for Fish, Farms, and Neighbors: Scott River Restoration Farmers Ditch Company Project

P. Travis James, P.E., Senior Civil Engineer, Yurok Tribe

On June 15, 2023, the Yurok Tribe (YT), California Trout (CT), and Farmers Ditch Company (FDC) entered into a memorandum of understanding (MOU) to establish a framework for collaboration and cooperation to promote functional ecosystems and sustainable water supplies for the Scott Valley.

The Scott River supports a wide range of aquatic species including steelhead and the largest cohort of state and federally listed coho salmon in California but conditions through the “tailings” reach, which a large portion is owned by FDC, suffers from poor surface water connection, excessive loss of surface flow to the groundwater system, reduced access to rearing habitat, poor water quality, degraded riparian habitat, and poor floodplain connection. The FDC property also includes the downstream portion of Sugar Creek, which is a critically important tributary for aquatic species. FDC’s point of diversion (POD) on the Scott River supports the ranching operations of nine landowners. The POD conveyance ditch permitted fish access to the first 1,700 feet before reaching the CDFW screen facility. During low flow periods, the screen bypass would discharge to less-than-favorable main channel conditions (sometimes dry), and FDC needed to hand-stack rocks to direct flow towards the POD inlet, which was time-consuming and could impact aquatic species movement. When water was no longer permitted to be diverted, entrained fish would be susceptible to mortality unless a large fish relocation effort was completed.

In 2015, a flow event destroyed portions of the FDC ditch and inlet structure. Once repaired, the infrastructure was still susceptible to damage as only a thin berm separated the ditch from the main stem river flow. Lastly, the POD inlet was located on a neighboring property and the landowner was interested in having it moved to the FDC property.

In 2023, a joint application between the MOU partners and others was submitted to CDFW for funding to address these long-standing issues. This presentation will focus on the road from the beginning of design in late 2023 to the end of the first phase of implementation in late 2025. In addition to the challenging timeline, technical design, and construction aspects, the project required working closely with neighbors, regulatory agencies, defining new FDC diversion rules, overcoming unavoidable impacts to some of the favorable habitat features within the project reach, and the relocation of over 7,300 coho, 3,700 steelhead, and many other aquatic species.

The resulting first phase of implementation included the construction of a 456-foot long, 140-foot wide roughened channel on the Scott River; a 288-foot long, 40-foot wide roughened channel on Sugar Creek; two large rearing and high-flow refuge habitat features; two lowered floodplains; a constructed terrace; and the construction of a new 36 cfs diversion facility that removes fish access to the conveyance system and improves water deliver.

The presentation will conclude with a glance at the 2026 phase of implementation, including the construction of hyporheic control structures to limit the excess loss of surface flow to the subsurface.

## Restoration Strategy, Implementation, and Collaboration

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### From Fragmented to Functional

#### —A Multi-Disciplinary Approach to Restoration on the Little Shasta River

Adrienne Chenette, M.Sc., American Rivers

Restoring stream flow and reconnecting habitat and migratory corridors in coldwater streams is vital to sustaining biodiversity hotspots and special status species in California, as well as supporting a thriving salmon fishery important to tribes and others along the entire west coast of the United States. Spring-fed streams are especially valuable given their natural chemistry, stable flows, and climate resilience to projected warming (Lusardi et al. 2021). Located in the Klamath River watershed, the Little Shasta River has intact, high-quality stream habitat in its headwaters and foothills. Historically, off-channel springs were connected via natural channels and wetlands to the Little Shasta River and functioned as habitat for anadromous fish. Moreover, volcanic cold-water springs in the upper reaches of the Little Shasta River may provide climate refugia for cold-water species, including salmonids.

Due to 19th century water rights allowing for full diversion of several springs, as well as multiple surface-water diversions from the mainstem Little Shasta, off-channel spring-fed habitat is generally disconnected from the main river year-round and existing mainstem river habitat is disconnected seasonally from May to November (Lukk et al. 2019, Willis and Lusardi 2021). Research from UC Davis concluded that the primary limiting factor on salmon production in the Little Shasta River is the current lack of aquatic connectivity (Lukk et al. 2019). All this makes restoration of the Little Shasta River a potentially important recovery action for salmonids in the Klamath system. However, given the extensive and complex water rights associated with various diversions, it is difficult to identify a viable water management strategy that would re-establish the ecological function of the Little Shasta River and support the community's agricultural activities.

Local landowners, tribes, non-governmental organizations, and regulatory staff have worked together to address these limitations by finding solutions that reconnect habitat, increase flows and agricultural efficiency, and build lasting partnerships. Through monitoring stream temperature, flow, and other water quality parameters and the latest science, including the Water Temperature Transaction Tool (W3T), our team is working on restoring the Little Shasta through:

- Negotiation of safe harbor agreements that include dedication of water for instream flows
- Design and implementation of projects that include habitat restoration combined with instream flow dedication and reconnection.
- A common theme in our efforts is an attempt to find solutions that simultaneously work to restore aquatic resources and ecosystem function and promote improved agricultural practices compatible with large-scale ecosystem restoration.

## Restoration Strategy, Implementation, and Collaboration

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### Strategic Land and Water Acquisitions in the Klamath to Increase Streamflows and Improve Habitat

**Amy Campbell**, Senior Project Director, The Nature Conservancy

In 2023, The Nature Conservancy's (TNC) California Water Program launched a Klamath Basin Acquisition Program in the Scott and Shasta River Watersheds. The goal of this program is to identify and acquire properties in these watersheds to increase streamflow and enable floodplain and habitat restoration projects. To date, TNC has acquired three properties with water rights in the Scott River Watershed along French Creek and on Parks Creek in the Shasta River Watershed. This presentation will provide an overview of this acquisition program, the work to date on prioritizing acquisitions, as well as provide details on how TNC is approaching changing water management and enabling partners to restore habitat on these important properties.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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**Session Coordinators:** Bob Pagliuco, Marine Habitat Resource Specialist, NOAA Fisheries Restoration Center and Mike Belchik Sr., Water Policy Analyst, Yurok Tribe

The Klamath River once supported the third-largest salmon runs on the U.S. West Coast. Between 1918 and 1962, PacifiCorp built four hydroelectric dams — Iron Gate, Copco Nos. 1 & 2, and J.C. Boyle, and — that blocked migratory fish passage and degraded river ecosystems. After decades of advocacy by tribal nations and environmental groups, the Klamath Hydroelectric Settlement Agreement was reached, paving the way for dam removal. Physical removal began in mid-2023 and was completed in September 2024. The removal of the Klamath River dams marks a historic step toward restoring one of the West Coast’s most important salmon runs, but success won’t be measured in months—or even just a few years. Restoration and monitoring need to occur to understand the outcomes of this landscape scale project. This session will highlight the current and future restoration efforts in the footprints of the former reservoirs on the Klamath River and highlight what the first year of physical and biological monitoring has revealed thus far after the largest dam removal in history.



Free flowing Klamath River

*Photo: Shane Anderson*

## River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### The Klamath River Renewal Project Molecular Library, Describing Landscape-scale Aquatic Biodiversity Change Following Historic Dam-Removal and Restoration

**Dylan J. Keel**, Fisheries Ecologist, Resource Environmental Solutions (Presenter) and Co-authors: **Katie Karpenko**, **Scott M. Blankenship**, and **Gregg Schumer**, Genidaqs Laboratory of Cramer Fish Sciences; **Oshun O'Rourke**, Yurok Tribal Fisheries; **Carl O. Ostberg** and **Jeffrey J. Duda**, U.S. Geological Survey; and **Daniel A. Chase**, Resource Environmental Solutions

Global restoration and conservation of freshwater biodiversity are represented in practice by works such as the Klamath River Renewal Project (KRRP), the largest dam removal and river restoration in the United States, which has reconnected 640 river kilometers. With dam removals, many biological outcomes remain understudied due to a lack of pre-impact data and complex ecosystem recovery timeframes. To avoid this, we created the KRRP molecular library, an environmental specimen bank consisting of over 1,000 environmental samples collected along 114 river kilometers, for long-term curation of environmental nucleic acids collected from the restoration project. As an initial application of the KRRP molecular library, we used a Before-After Reference-Impact (BARI) study design and environmental DNA (eDNA) metabarcoding to evaluate changes in fish and herptile biodiversity in the Klamath River and tributaries between 2023 (pre-dam removal), 2024 (mid-dam removal), and 2025 (post-dam removal). Pre-dam removal, stream habitats had significantly greater native fish diversity and richness than reservoir sites. Although at the time of writing, laboratory analyses of 2024 and 2025 samples are still underway, we anticipate analyzing fish and herptile community composition changes following dam removal and ecosystem restoration.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Occupancy Estimation from Juvenile Salmonid Summer Snorkel Surveys in Newly Accessible Klamath River Tributaries

Ben King, M.S., Biologist, California Department of Fish and Wildlife

In fall 2024, the largest dam removal project in world history was completed on the Klamath River. Shortly afterward, anadromous fish returned to ancestral habitats that had been inaccessible for sixty to one hundred years. During summer 2025 (July-September), the California Department of Fish and Wildlife's Klamath Watershed Program conducted juvenile salmonid snorkel surveys in newly accessible tributaries to assess early patterns of establishment, spatial structure, and life history diversity.

Coho salmon generally exhibit a stream-type life history, making summer snorkel surveys an effective tool for evaluating re-establishment. These surveys help identify the presence of over-summering habitat and track changes in its use over time. Observations of juvenile Chinook salmon persisting in tributaries during summer may also indicate a stream-type life history, providing additional insight into life history diversity as populations re-establish.

Tributaries were divided into 200-m reaches from the Klamath River confluence to the presumed extent of anadromy. Habitat units (pools and flatwaters) within a randomly selected 50% of reaches were surveyed, and coarse habitat data were collected. Surveys were completed by one to two snorkelers moving upstream and enumerating all salmonids to species and age class, with every other unit receiving a second, independent pass. We fit single-season occupancy models to estimate detection and occupancy probabilities for juvenile Chinook and Coho salmon.

Juvenile Chinook salmon were observed up to 1.6 and 3.2 river kilometers (RKM) from the Klamath confluence in Jenny and Shovel Creeks, respectively. Coho salmon were observed up to 2.6 and 4.8 RKM in those same tributaries. Coho occupancy probabilities were estimated to be 0.53 (95% CI = 0.37–0.68) in Jenny Creek and 0.78 (95% CI = 0.64–0.87) in Shovel Creek. Estimated Chinook occupancy probability in Shovel Creek was 0.20 (95% CI = 0.11–0.32); data were insufficient to estimate Chinook occupancy in Jenny Creek.

As anadromous salmonids continue to re-establish in their ancestral habitats, ongoing monitoring will be essential for understanding the response of juvenile distribution, spatial structure, and life history diversity to dam removal, and for guiding future restoration actions.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Immediate Responses of Chinook Salmon Spawning in the California Mainstem Klamath River Upstream of Iron Gate

**Stephen Gough**, U.S. Fish and Wildlife Service (Presenter)

and Co-authors: **Leanne Knutson**, Yurok Tribal Fisheries Program and **Toz Soto**, Karuk Tribe

Two years of spawning adult Chinook salmon returning to the mainstem Klamath River have now been monitored upstream of Iron Gate following dam removal in September 2024. Redd and carcass surveys from the California-Oregon state line to Iron Gate have been added to existing annual surveys downstream of Iron Gate to estimate abundance, map distribution, and collect data on run characteristics. Spawning distribution and abundance in the mainstem Klamath River downstream of Iron Gate for the 2001–2023 period of record before dam removal is compared to available data from 2024 and 2025, including the newly re-accessible section of the mainstem river in California. Prior to 2024, spawning activity was concentrated in the area directly downstream of Iron Gate Dam. Immediately following dam removal in 2024, over 300 fall-run Chinook salmon spawned in the section of the mainstem river between the CA–OR state line and Iron Gate. In 2025, escapement to this area increased to over 700 fish, with most spawning between Shovel Creek and K'utárawáx-u (Grizzly Hill), which includes the former Copco Reservoir footprint. The ongoing and dynamic response of fish to the changing river has prompted us to adapt existing survey methodologies to best monitor salmon populations in this area.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Monitoring Klamath Adult Salmon Abundance and Movement in Newly Available Habitat Post- Dam Removal

**Bob Pagliuco**, NOAA Restoration Center and **Alex Corum**, Karuk Tribe (Co-presenters) and Co-authors: **Cyril Michel**, University of California, Santa Cruz, National Marine Fisheries Service (NMFS), Southwest Fisheries Science Center Affiliate; **Toz Soto**, Karuk Tribe; **James Whelan** and **Damon Goodman**, California Trout; **Mark Hereford** and **Carolyn Malecha**, Oregon Department of Fish and Wildlife; **Jordan Ortega** and **Ryan Bart**, Klamath Tribes; and **Ben Grassman**, Cal Poly Humboldt

The removal of the four lower hydroelectric dams on the Klamath River—Iron Gate, Copco 1, Copco 2, and J.C. Boyle—represents the largest dam removal and river restoration project in U.S. history. A critical component of the ecological recovery is the re-establishment of anadromous fishes into historically blocked habitats. This project focuses on monitoring the initial abundance, movement, and spatial distribution of adult salmon into the newly accessible upper Klamath River Basin above the former site of Iron Gate Dam. A project of this size and complexity requires a significant number of partners, including multiple tribes, state agencies, federal agencies, universities, and NGOs, each playing a unique role in this historic monitoring project.

To confirm the abundance of the overall returning population, a split-beam SONAR station was deployed downstream of the lower-most dam site during the migration season. We used tangle netting techniques to capture, tag, and determine species apportionment passing by the SONAR station. We established a comprehensive radio telemetry network to track the upstream migration of tagged adult salmonids. The telemetry network consisted of 15 stationary receiver stations strategically placed along the mainstem Klamath River in CA and OR and at the outlet of and tributaries of Upper Klamath Lake. Additionally, mobile tracking was conducted each week using portable receivers to confirm tag locations, investigate areas of prolonged residency, and recover archival tags.

The preliminary findings from the radio telemetry monitoring and SONAR counts indicate that the removal of these 4 dams has successfully opened historical habitat to adult salmon. The swift utilization of the upstream habitat provides early validation for the ecological goals of the Klamath Dam Removal Project. This talk will highlight the estimated abundance of fish passing by the SONAR station in 2024 and 2025 and some of the movement observations of these fish during the fall of 2025. These data are critical for adaptive management strategies and future restoration efforts in the basin.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### Repopulation of Chinook Salmon in Upper Klamath Lake and Its Major Tributaries

Jordan Ortega, Ph.D., Ecologist, Klamath Tribes

Following the removal of Klamath River dams, Chinook salmon (*Oncorhynchus tshawytscha*) are repopulating the Upper Klamath Basin for the first time in over a century. The Klamath Tribes, in collaboration with the Oregon Department of Fish and Wildlife and CalTrout, are leading a coordinated monitoring effort to document this historic comeback in Oregon. We conducted foot-based, boat, and stand-up paddleboard surveys across Upper Klamath Lake and its major tributaries to map spatial patterns of repopulation, count live salmon, count redds, and collect carcasses. We also used stationary telemetry receivers at major tributary junctions and mobile tracked radio-tagged fish to assess spatio-temporal patterns in movement. Live fish counts inform temporal trends in run timing and peak spawning timing, while redd counts will be used to estimate total escapement. Carcass collections enable evaluation of sex ratios and jack life-history proportions, determination of run genotype (fall, spring, or heterozygous), reconstruction of early life-history trajectories using scales and otoliths, and assessment of disease pressure through kidney and intestinal screening for *Ceratomyxa shasta*. To evaluate reproductive success, we will operate rotary screw traps in spring 2026 to assess juvenile production and characterize rearing patterns in tributaries of Upper Klamath Lake. This presentation will summarize preliminary findings from the first year of Chinook salmon repopulation monitoring in the Upper Klamath Basin and outline how these data will inform future restoration, management, and monitoring strategies across tribal, state, and federal partners.

## A River Reborn: Restoration and Monitoring in the Former Footprint of Klamath Dams

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### What Does Success Look Like? A Vision for Klamath River Salmon

**Thomas Williams, Ph.D.**, National Marine Fisheries Service,  
Southwest Fisheries Science Center, Santa Cruz Laboratory

Following the removal of four dams on the Klamath River, communities reliant on salmon seek the successful restoration of fish populations throughout the basin. However, defining restoration success remains a critical question for fisheries, tribal communities, agencies, communities supporting fisheries, and other stakeholders and user groups. Does success constitute a specific numerical target of fish, a certain level of fishing opportunities, or a resilient baseline fish abundance capable of offering a range of user opportunities? Do the success metrics across communities converge or conflict? This presentation will focus on the proposed conceptual framework for determining the successful reduction of extinction risk for Klamath River salmon populations and achieving a broader recovery of fish to support the varied expectations of the communities dependent on or invested in Klamath salmon and steelhead populations.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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**Session Coordinators:** **Monty Schmitt**, Sr Project Director, TNC California Water Program, The Nature Conservancy and **David Dralle, Ph.D.**, U.S. Forest Service Pacific Southwest Research Station

No single project or parcel can restore streamflow on its own—lasting change happens at the watershed scale, where small and large efforts alike add up to healthier rivers and more reliable water supplies. Consequently, progress depends on the accumulation of work across scales—from focused site-specific projects to broader watershed planning.

This session will highlight a diversity of approaches that collectively support watershed health and salmon recovery. Topics will include groundwater and recharge work, streamflow restoration projects, and the role of local and regional water management policies in shaping outcomes for salmon and communities. Presentations will showcase case studies where practitioners are linking science, modeling, and monitoring with policy and on-the-ground action.

By bringing together researchers, managers, and community partners, this session will provide insights into how both small-scale efforts and watershed-scale strategies can restore and protect flows, improve water security, and advance salmon recovery.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Restoring Hydrologic Function in California Coastal Watersheds: Lessons from Lower Flynn Creek

**Mia van Docto**, Trout Unlimited (Presenter) and Co-authors: **Kryisia Skorko**, **Troy Cameron**, **Anthony Modena**, **Katie Robbins** and **Anna Halligan**, Trout Unlimited; **Brock Dolman**, OAEC; **Linda MacElwee**, MCRCD; **Monty Schmitt**, **Jen Carah**, and **Nicole Schmitt**, The Nature Conservancy

Across California's coastal watersheds, Trout Unlimited (TU) and partners have documented widespread summertime streamflow declines, revealing chronic disconnection, reduced baseflows, and vulnerability of salmon-bearing streams, highlighting the need for flow enhancement strategies that address both local and watershed-scale hydrologic processes. In the Navarro River watershed, the Navarro River Streamflow Enhancement Partnership, along with Occidental Arts and Ecology Center, Northern Hydrology, and Prunuske Chatham Inc., is applying this approach in tributaries. One example is the Lower Flynn Creek Groundwater Infiltration Pilot Project, which integrates low-tech, process-based restoration with groundwater enhancement to reconnect floodplains, increase groundwater levels, and reduce near-channel flashiness. Six years of monitoring (WY2020-2025) show elevated groundwater, longer floodplain inundation, and shifts from losing to gaining reaches, demonstrating strengthened surface-groundwater exchange. This project illustrates how slowing, spreading, and sinking water in small tributaries can enhance downstream flow persistence, offering a transferable model for linking regional science, watershed-scale planning, and low-tech restoration to support salmon recovery across California's coastal basins.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Groundwater is Streamflow

#### —Modeling Water Resources Management in the Scott Valley

**Nicholas Murphy**, The Nature Conservancy (Presenter)  
and Co-author: **Monty Schmitt**, The Nature Conservancy

Functional flows for streams and rivers (with an emphasis on dry season baseflows), groundwater well ordinances that are protective of public trust resources, and sustainable groundwater management protecting groundwater-dependent ecosystems at a statewide level, all rely on an in-depth understanding of surface water-groundwater dynamics. Currently, technical gaps exist that limit our ability to evaluate streamflow depletion impacts due to groundwater pumping. This work explores modeling approaches to estimate streamflow depletion due to groundwater pumping in the Scott Valley, as well as the effectiveness of water resources management strategies in restoring ecologically functional instream flows. Working with experts in both analytical and numerical groundwater modeling techniques, the pilot projects presented act as case studies that inform the development of unified modeling frameworks. Through integrated management and innovative approaches, this work seeks to balance the needs of agricultural and environmental stakeholders, enabling the restoration of aquatic habitat and key ecosystem services in the Scott River.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### A Method to Implement Natural Flow Regimes for Regulated Rivers

**Nicholas A. Som**, U.S. Geological Survey (Presenter)  
and Co-author: **Seth W. Naman**, NOAA Fisheries

Rivers throughout the world have been dammed for flood control, irrigation, hydropower, and water storage for centuries. Dams service the economic and development needs of societies, but degrade the ecology of rivers. To conserve diminishing aquatic species and their habitats, methods are needed to help managers implement flow releases with timescales and patterns that are relevant to aquatic species and physical processes. We present a method to synchronize flow releases from dams with local hydrology, while ensuring compliance with flood control and water allocation constraints. We demonstrate an optimization technique that scales flows of a proximal unregulated river and results in discharges from dams that are synchronized with natural hydrologic patterns. Importantly, our method preserves operational and regulatory requirements such as water allocation volumes, flood control thresholds, and maximum and minimum river flows. This technique can be used at various timescales and can incorporate many system-specific constraints. We selected the Trinity River, California, as an example, and scaled flows according to a proximal gage on the Salmon River in California. We evaluated our technique using an array of metrics from the literature, and our method produced hydrographs with greater flow variation throughout a larger portion of the water year than current management strategies, with flow metrics more similar to those from unimpaired flow patterns. We close with a discussion of our results in the context of other management methods and metrics. Our framework is a new tool that can be implemented to improve the health of rivers and the aquatic species that depend upon them.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Integrating Water Rights, Hydrology, and Flow Enhancement in California Watersheds

Sara Sternberg, M.S., Creek Lands Conservation (Presenter)  
and Co-author: Aleks Wydgza, M.S., Creek Lands Conservation

To successfully develop and implement innovative stream flow preservation and enhancement solutions, small nonprofit organizations are increasingly being asked to step into complex roles that require an understanding of water rights, water quality and quantity assessments methods, short and long-term monitoring strategies, and a variety of stream flow preservation and enhancement project types. Creek Lands Conservation (CLC), founded in 1983, operates in Central Coastal California from Santa Cruz to Ventura, where dry season flow patterns limit local populations of steelhead. CLC utilizes an integrated, science-driven approach and leverages diverse funding sources to achieve measurable stream flow benefits on both working private and public lands. The presentation will highlight how over the last decade, CLC and their partners have combined (1) multi-year hydrologic studies to quantify dry-season baseflow sensitivity in historical steelhead rearing habitat under current land and water management conditions and (2) detailed riparian and appropriative water-right investigations to deliver diverse streamflow preservation and enhancement actions such as storage and forbearance, groundwater recharge, habitat restoration, and collaborative water-release agreements including the acquisition and dedication of recycled water. Together, these components provide a replicable framework for small nonprofits working at the intersection of science, policy, and restoration. By centering on local partnerships, practical solutions, and rigorous data, CLC demonstrates how community-rooted organizations can influence regional water policy, support compliance and planning under California Water Code §1707, and deliver meaningful ecological outcomes in watersheds where even modest flow gains matter.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Approaching Flow Management from the Top-Down: Using Site-Specific Models to Develop Risk-Informed Percent-of-Flow Diversion Thresholds

Suzanne Rhoades, Ph.D., Applied River Sciences (Presenter)

and Co-authors: Tim Caldwell, Ph.D., Scott McBain, M.S., Erin Suenaga, M.S.,

and Kevin Fitzgerald, M.S., Applied River Sciences;

and Gabe Rossi, Ph.D., University of California, Berkeley

Instream flow studies typically focus on flow thresholds (also referred to as bypass flows, minimum instream flows, or floors), which answer the question, “How much water does a river need?” We present an analytical framework using site-specific habitat models to instead ask, “What is the acceptable degree of departure from the natural hydrograph?” (Tharme 2003). This framework results in a maximum allowable percent-of-unimpaired flow (POF) diversion rate, which, if implemented, results in modified hydrographs that protect key functions of natural flows. We applied this analytical framework in nine watersheds throughout Northern California, ranging from small, intermittent streams to snowmelt-driven rivers. The analytical framework uses flow-ecology models that represent habitat for focal salmonid species at different life stages (e.g., spawning adults, rearing juveniles) to compare the amount of habitat created under unimpaired flow conditions to habitat created under POF diversion scenarios. Thresholds for the amount of habitat maintained under diversion scenarios can be pre-determined depending on risk tolerance. Here, we adopted a low level of risk tolerance to identify maximum POF diversion rates that maintain > 90% of unimpaired habitat for focal species and life stages. Across the 25 life stages and locations assessed, there were 5 that were not sensitive to flow diversions (POF diversions >50% maintained >90% unimpaired habitat). For the flow-sensitive metrics/locations, POF diversions between 8-30% (mean of 15%) were identified to maintain 90% of unimpaired habitat. Lower allowable POF diversion rates were typically observed in low-flow months and in streams with lower dry-season baseflows. POF diversion rates of <10% protected habitat for all the flow-sensitive metrics/locations, and POF diversion rates of <20% protected habitat for 80% of the metrics/locations. These POF diversion rates mirror the thresholds suggested by Richter et al. (2012) and could be regionally transferable, as providing very conservative (<10%) or moderately conservative (<20%) thresholds for low risk of ecological harm. Using these low-risk diversion rate thresholds could preclude the need for costly and lengthy site-specific flow-habitat models at every stream with ongoing or future flow modifications. Additionally, POF diversion rates can be combined with more commonly used minimum flows to provide additional levels of protection for key ecological functions (e.g., spawning for sensitive species, or dry season water quality). We present a case study for how POF diversion rates and flow thresholds were combined into flow recommendations for the Upper Eel River to allow consumptive use while protecting the shape of the natural flow regime and minimizing risk of harm to sensitive anadromous species. In summary, we (1) suggest an analytical framework for developing protective POF diversion rates from flow-habitat models, which could be applied widely to a diversity of flow metrics, and (2) summarize results from our synthesis of POF diversion rates across hydrologically diverse streams and rivers, supporting “presumptive standards” of protective flow alteration (Richter et al. 2012). Both the analytical framework and resulting POF diversion standards provide tools that could be used to inform risk-based streamflow management decisions.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### Meeting the Dry-Season Challenge: Sanctuary Forest's Approach to Late-Summer Streamflow

**Walker Wise**, Water Program Director, Sanctuary Forest (Presenter)  
and Co-authors: **Tasha McKee**, Sanctuary Forest; **Joel Monschke, P.E.**, Stillwater Sciences;  
and **Campbell Thompson**, Mattole Salmon Group

For 20 years, Sanctuary Forest has explored nearly every method imaginable to enhance instream flows in the Mattole River headwaters—from groundwater recharge and floodplain reconnection to forest thinning—yet one goal has remained elusive: increasing streamflow at the very peak of the dry season, when fish need water most.

We are now implementing a strategy that meets this challenge by enhancing late-summer streamflow in key headwater tributaries through a growing network of lined storage ponds, groundwater-recharge ponds, and subsurface “underground” ponds. Flow releases are managed with low-tech siphons, solar-powered pumps, and passive delivery systems that reliably supply water during the most critical low-flow periods. In 2025, these releases prevented thousands of juvenile coho salmon and steelhead from becoming stranded as streams approached dry-out conditions—reducing mortality and minimizing the need for resource-intensive fish-rescue operations. This presentation will cover the nuts and bolts of Sanctuary Forest's flow-release program, including system design, operation, and effectiveness monitoring.

## It Takes a Watershed: Projects, Approaches, and Strategies for Restoring Streamflow and Managing Water Supplies

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### A Decision Support Tool for Co-Managing Well Permitting and Streamflow Protection at the Watershed /County Scale

**Ben Kerr**, Founder & Chief Executive Officer, Foundry Spatial

In Siskiyou and Sonoma counties, recent legal decisions have highlighted the importance of considering impacts from groundwater withdrawals on surface water resources. Rooted in the principle of the public trust, which extends to salmonids and their habitat, counties and other local government agencies tasked with managing groundwater withdrawals through the creation of well ordinances and permitting processes should ensure that impacts on public trust resources are considered in the decision-making process, to avoid similar legal challenges.

Principles and guidance have been developed by the Salmon and Steelhead Coalition to do this, which include the development of decision-support tools to help consider public trust impacts when evaluating well permit applications. This presentation will highlight the components of a decision-support tool, including critical datasets and processes to incorporate science-based assessment of streamflow depletion impacts from groundwater withdrawals. It will also identify gaps and research needs across data, science, and public policy domains.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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**Session Coordinator:** Keiko Mertz, M.S., Friends of the River

This session will examine how environmental nonprofits are shaping—and being shaped by—the regulatory and political landscape that determines the future of California’s rivers and salmon. Environmental decision-making is not confined to scientific data and agency reports; it is a contested battlefield where community voices, legal frameworks, and public trust values intersect with powerful economic and political forces.

Speakers will provide updates on the status of California water policy with a nexus to salmonids, highlighting current proceedings such as major water rights hearings, Delta operations, and dam removals and re-licensings. The session will feature case studies illustrating how non-governmental organizations and tribes leverage science, law, and advocacy to influence outcomes in these arenas. Presenters will also explore the broader implications for democracy and accountability when critical ecological decisions are made through complex regulatory processes that are often inaccessible to the public.

Through analysis of recent policy battles and relevant fisheries science, this session will shed light on both the obstacles and opportunities facing those working to protect salmon and rivers. The discussion will provide participants with a deeper understanding of the frontline role nonprofits play, the strategies being deployed, and what is at stake for salmon recovery in California.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### Restoring Leverage in an Era of Deregulation

**Chris Shutes**, Executive Director, California Sportfishing Protection Alliance

This presentation will discuss the essential role of nonprofit organizations in opposing the weakening of foundational environmental protections and in enforcing laws and regulations when the decisionmakers in government agencies fail to measure up. It will examine various types of actions and some of the language and framing of regulatory secession or surrender.

The second Trump administration is unabashedly and aggressively anti-regulatory. Four days after taking office, the President issued an executive order on “Water Resources in California,” calling on the secretaries of Commerce and Interior to “immediately take actions to override existing activities that unduly burden efforts to maximize water deliveries.” Similarly, the Administrator of the federal Environmental Protection Agency issued a press release on March 12, 2025, boasting: “EPA Launches Biggest Deregulatory Action in U.S. History.” On November 12, 2024, an activist U.S. Supreme Court stacked by the first Trump administration issued the *Marin Audubon v. FAA* decision, declaring that the U.S. Council on Environmental Quality lacked Congressional authority to set regulations governing the implementation of the National Environmental Policy Act (NEPA).

Regrettably, the recent history of actions by the State of California does not provide a clear or consistent contrast. At worst, the State has joined the anti-regulatory bandwagon in weakening laws and regulations. More consistently, the Newsom administration has intensified the efforts of prior administrations in supplanting regulatory requirements for water management with “voluntary” substitutes. State regulators of water quality and water rights have explicitly favored cooperative compliance in opposition to strong enforcement.

Fisheries agencies, state and federal, used to present strong evidence before the State Water Board during major proceedings like the update of the Bay-Delta Plan and major water rights cases like the Delta tunnel. Today, their role is minimal, tacitly supporting voluntary outcomes largely defined by water users.

In these conditions, environmental and fisheries nonprofits are developing leverage so that they can successfully step into the roles officially delegated to government agencies:

- To deploy science and other evidence to zealously advocate for fish and wildlife.
- To enforce laws relating to water quality.
- To deeply engage in regulatory processes, with much less authority and generally with far fewer resources than those available to government agencies.
- The discussion will present a series of examples and case studies that demonstrate some of the problems and the ways in which nonprofits are working together to fill the regulatory vacuum.
- Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### From the Ridges to Riffles of California Salmon Policy

**Molli Myers**, Chief Operations Officer, Ridges to Riffles

This presentation examines the role of Ridges to Riffles Indigenous Conservation Group (R2R) as an indigenous-led nonprofit working at the intersection of fisheries science, tribal sovereignty, and environmental policy. R2R supports tribes in navigating and shaping regulatory processes by pairing applied science with legal and policy advocacy, helping translate community priorities into outcomes that are durable within formal decision-making frameworks. Drawing on case studies from dam removals and hydropower relicensing, post-dam removal fisheries monitoring, water and habitat protection efforts, and collaborative policy initiatives, I will highlight how R2R engages in proceedings that directly influence flow regimes, infrastructure operations, and accountability for ecological outcomes. These examples illustrate how nonprofits can serve as technical partners, conveners, and advocates—bridging tribes, agencies, and the public while reinforcing tribal authority rather than substituting for it. The talk will conclude by reflecting on what these efforts reveal about the opportunities and limits of nonprofit engagement in regulatory systems, and what is at stake for democratic accountability and salmon recovery when Indigenous-led organizations help reshape how decisions about rivers are made.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### From Science to Sovereignty: Elevating Tribal Voices in California's Salmon Governance

Stephanie Quinn-Davidson, Science and Policy Director, Ridges to Riffles

Across California's rivers, the future of salmon is increasingly shaped by regulatory and political processes governing water, infrastructure, and habitat—not just by ecological conditions alone. For indigenous communities, these decisions carry deep cultural and spiritual significance, yet tribal knowledge systems and sovereignty are often marginalized within environmental governance.

This talk explores what it means to meaningfully incorporate tribes within contested policy and regulatory arenas and the role nonprofits can play in elevating Tribal voices. Using case studies from dam removals and hydropower relicensing, fisheries management, and environmental advocacy, I show how centering Tribal leadership and knowledge in regulatory processes can strengthen climate resilience, democratic accountability, and salmon recovery. Ultimately, I argue that durable solutions for California's rivers require not only better science but transformed governance systems that determine whose knowledge counts and who leads environmental decision-making.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### Building Political Will Through Field-Based Science Explanation

**Aaron Zettler-Mann, Ph.D.**, Executive Director, South Yuba River Citizens League (SYRCL)

Opportunities for meaningful engagement in shaping California's water policy are increasingly buried behind labyrinthine regulatory processes and attorney-driven decisions. This regulatory process increasingly marginalizes environmental nonprofits and public participation by creating complex rules around when, how, and who can engage in the decision-making process, and what information is considered valid. As decisions affecting salmon and water are increasingly made via back-and-forth comment letters and rebuttals, the space for democratic engagement and collaborative problem-solving shrinks. Consultants create thousands of pages of analysis, burying environmental nonprofits in incomprehensible reports with pages of tabular data. The reports require equal effort and expertise to understand and determine the validity of the claims made, but environmental advocates are limited by 30-day comment windows.

At the heart of the bureaucratic letter-fueled ping-pong sits the interactions between science communication, conflicting resource management priorities, and the erosion of trusting relationships between environmental nonprofits and the army of consultants and attorneys paid for by water managers. As these battles are increasingly fought by attorneys rather than practitioners, and via letters and online workshops rather than in-person discussions, finding the common ground to expand on shared goals and objectives is lost. SYRCL tries to counteract this trend by pairing rigorous science communication with field-based education that brings decision-makers directly to restoration sites. This presentation will discuss how SYRCL has employed this strategy in the Yuba River watershed to boost community engagement related to a fish passage project around Daguerre Point Dam, the multi-benefit opportunities with funding for nature-based solutions through Prop 4, and effective advocacy around the successfully defeated public lands sale proposal. Science communication alone will not solve California's water policy and salmon extinction crisis. But through shared language and common understanding, we can build the political will necessary to effect positive change.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### Whose Balance? Public Voice, Political Pressure, and Science in California Water Governance

**Patrick Koepele**, Executive Director, Yosemite Rivers Alliance (Presenter),  
and Co-author: **Peter Dreke**, Policy Director, Yosemite Rivers Alliance

California's water and salmon policy arena sits at the nexus of science, economics, law, and politics. Regulatory agencies such as the State Water Resources Control Board are legally required to balance multiple and often competing uses of water—including public trust resources, agriculture, urban demands, and ecosystem health. While this framework implies objectivity, the process of “balancing” is inherently subjective. Decisions that should be driven by ecological evidence are often shaped by sustained political influence, economic power, and institutional inertia. In this context, the question is not whether politics will influence water policy, but whose voices will shape the balance.

Environmental nonprofits are increasingly stepping into this space not only as scientific translators but as advocates for democratic participation. To ensure that environmental protections and salmon recovery receive meaningful weight in policy deliberations, broad public engagement is essential. The voices of frontline communities, tribes, anglers, educators, young people, and river-dependent economies provide a counterweight to well-resourced interests and remind decision-makers of their legal and moral responsibilities.

Drawing from the work of Yosemite Rivers Alliance (formerly Tuolumne River Trust), this presentation will highlight how organized grassroots participation has influenced key decisions, including the Bay-Delta Water Quality Control Plan, Governor Newsom's recent budget trailer bills, and regional flow and habitat policies affecting Central Valley rivers and salmon populations. These examples demonstrate a consistent pattern: when only agencies and powerful water users participate, outcomes tend to favor the status quo. When community members testify, submit comments, attend hearings, and engage elected officials, the definition of the “balanced public interest” shifts.

Protecting salmon, river ecosystems, and water justice in California requires more than sound science—it requires a healthy democracy. By building community power, lowering barriers to participation, and connecting lived experiences with policy outcomes, environmental nonprofits can help ensure that regulatory decisions reflect ecological necessity, public trust, and intergenerational responsibility. This talk will offer strategies, lessons learned, and a vision for a more participatory and equitable water governance system—one in which science, democracy, and community leadership share responsibility for shaping California's future.

## Democracy in the Balance: Environmental Nonprofits on the Front Lines of California Water and Salmon Policy

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### Tipping the Balance: Partnering to Restore the Merced River

**Keiko Mertz**, Policy Director, Friends of the River and **Meghan Quinn**, California Dam Removal and Hydropower Director, American Rivers (Co-presenters)

On January 20, 2025, the Trump Administration issued a slew of executive orders aimed at deregulation, including one directly calling river restoration work “radical environmentalism.” These orders, and the current environment, seem to have emboldened water interests in the state, requiring environmental NGOs and tribes to step in, in creative and intersecting ways, particularly on the Merced River. The Merced River is deeply impacted by California consistently over allocating water rights, without regard for climate change, river habitat, native peoples, and rural communities. The Merced River has gone dry or close thereto on multiple occasions over the past decade. Now, river advocates have taken up the mantle to present a collaborative solution to protect the river and the communities, fish, and people this hard-working river supports.

This session will explore the ongoing litigation and fight to reopen fish ladders on the Crocker-Huffman Diversion Dam, hydropower relicensing work, and its relationship to a growing group of Agreement signatories focused on restoring this once vibrant river with headwaters in one of the nation’s most treasured national parks. The Merced River proceedings are collectively instructive on the intersecting strategies and tactics that NGOs and tribes are using throughout California to bring our rivers back to life, despite significant political pressure to maintain a status quo that disregards changing hydrology.

## Exploration of Native Fishes in California Waters

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**Session Coordinator:** Marisa McGrew, Master's Candidate, Cal Poly Humboldt

This session will cover the often-unsung fish heroes that share the salmon space in the nearshore environment, estuaries, and rivers. Broadly speaking, the focus is on non-salmonids. Speaker topics include green sturgeon presence along the North Coast and the use of citizen science, long walks on the beach with night smelt, the return of Pacific lamprey to a central coast river, Clear Lake hitch and others. The goal of this session is to encourage salmon scientists and restoration practitioners to remove the salmon goggles, learn about the many other fish species that share space alongside salmon, and have the opportunity to ask experts about how to consider them in projects.



Redband trout in the Upper Klamath give us an indication of how salmonids will repopulate the Klamath.

*Photo: Jonny Armstrong*

## Exploration of Native Fishes in California Waters

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### Using Size-Spectrum Analysis to Explore Nursery Function and Habitat Use in the Eel River Estuary

**Rachel Hein, MS**, Cal Poly Humboldt, Fisheries Department (Presenter)  
and Co-authors: **Darren Ward, Ph.D.**, **Jose Marin Jarrin, Ph.D.**,  
and **Andre Buchheister, Ph.D.**, Cal Poly Humboldt, Fisheries Department

Estuaries serve as nurseries for fish and invertebrate species and play a crucial role in supporting many fisheries along the Northern Coast of California. Estuaries offer a diverse mosaic of rearing habitats yet are among the most degraded and altered coastal environments. The Eel River Estuary (Wiyá't) has a legacy of extensive modification resulting in significant changes to important rearing habitats. In this study, we used size-spectrum analysis to infer ecological characteristics of different habitats in the Eel River estuary. From February to September 2025, we utilized beach seines to sample fish communities along a salinity gradient across seven regions, which included both restored and unrestored habitats. By interpreting slope and intercept values of abundance against body mass size-spectra regression, we assessed how factors like productivity, predation risk, habitat, and environmental characteristics influence fish distribution patterns and community composition across the estuary. Our findings suggest that the size structure was variable across habitats, indicating spatio-temporal shifts in fish communities and nursery capacity. Size-spectra coefficients varied seasonally across the ecotone and indicated key differences in nursery function between restored and unrestored regions, and between freshwater and brackish habitats. The results from this study will provide insights into the effectiveness of recent and future habitat restoration initiatives in creating suitable rearing environments for native fish species that hold economic, cultural, and ecological significance. Additionally, these findings highlight the critical role of habitat diversity and connectivity in the estuary ecotone for preserving biodiversity.

## Exploration of Native Fishes in California Waters

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### Following the Smelt: Using Traditional Methods to Assess Day Fish Spawning Patterns Along Yurok Coastline in Northern California

**Michelle Kunst**, Marine Natural Resources Manager and **Tylor Jones**, GAP Manager, Pulikla Tribe of Yurok People (Co-presenters) and Co-author: **Daniel Montoya**, Fisheries Biology Master's Candidate, Cal Poly Humboldt

As part of a longstanding cultural subsistence practice, coastal Yurok people in Northern California have traditionally used A-frame dip nets to fish for surf smelt (*Hypomesus pretiosus*), a once-abundant species that comes ashore to spawn in dense runs along sandy beaches. As forage fish, surf smelt also play a critical ecological role as prey for seabirds, marine mammals, and predatory fish, including salmonids. However, a 2017 study found that 90% of local tribal interviewees reported that surf smelt availability is now worse or significantly worse than when they were children. Despite their cultural and ecological significance, as well as supporting small commercial and recreational fisheries, surf smelt have largely been overlooked by western science and fisheries managers. Consequently, they are considered a data-poor species, making it difficult to assess their population status, the factors driving their decline, or their vulnerability to climate change. In an effort to revitalize stewardship and to establish the first biological assessment of the species on California's north coast, the Pulikla Tribe of Yurok People (PTYP) is leading a study in collaboration with Cal Poly Humboldt, which aims to (1) identify environmental factors influencing spawning timing and location, and (2) study the biological parameters of the species, to understand their population status and distribution. Over two field seasons, our team conducted research at traditional harvest sites throughout ancestral lands, collecting data on ecological and environmental variables and sampling surf smelt using A-frame nets. Specimens at each site were retained for laboratory analysis, while the rest were counted and released or kept as food. Preliminary results generated from two years of field and lab work show mixed trends in tidal and lunar cycle influence on spawning timing; therefore, more research is needed to detect potential patterns. However, we documented interesting spatial preferences in spawners along the beach, as well as significantly larger fish during the 2025 season compared to the 2024 season. Lastly, we documented strong correlation between ecological indicators and active spawning runs. Integrating indigenous traditional knowledge with western scientific methods has enriched our understanding of the evolving relationship between surf smelt and their dynamic sandy beach ecosystem, and continued collaboration between PTYP and our academic partners will be essential for guiding future adaptive management and stewardship of the species.

## Exploration of Native Fishes in California Waters

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### Presence, Distribution, and Movement of Green Sturgeon (*Acipenser medirostris*) in Humboldt County, California

**Olivia S. Boeberitz**, M.S. Student, Cal Poly Humboldt (Presenter) and Co-authors: **Darren Ward**, **Jose Marin Jarrin**, and **Nicholas Som**, Cal Poly Humboldt; **William Matsubu**, Blue Lake Rancheria; **John Kelly**, California Department of Fish and Wildlife; **Nann A. Fangué**, University of California, Davis; and **William Pinnix**, U.S. Fish and Wildlife Service

Green sturgeon (*Acipenser medirostris*) is a long-lived, anadromous, iteroparous species that spawns in large West Coast North American rivers but ranges widely in the coastal ocean, where its distribution and habitat use are understudied. For coastal California Native American Tribes, green sturgeon are a vital part of cultural heritage and food security. Two genetically distinct population segments (DPS) are recognized: a southern DPS listed as “threatened” under the Endangered Species Act, and a northern DPS considered of “conservation concern.” Although green sturgeon are known to use large estuaries and bays in the summer months, little is known about their seasonal behavior and spatial distribution in Humboldt County, California—a region undergoing rapid ecological change due to aquaculture and planned onshore/offshore wind development. Acoustic telemetry, drone and visual surveys, community outreach, and pop-up satellite archival tags were used to record the seasonal presence, habitat use, and movement patterns of adult green sturgeon from both populations within Humboldt Bay (Wigi), the Mad River (Baduwa’t), and the Eel River (Wiya’t) in Northern California. Twenty-two acoustically tagged green sturgeon, 4 currently identified as northern DPS and 8 southern DPS, were monitored over a 3-month period in 2024 (Aug—Nov) and an 8-month period in 2025 (May—Nov) in Humboldt Bay. To date, 375 visual surveys and 123 drone surveys documented 1,193 green sturgeon breaching events exclusively in North Humboldt Bay. Although no acoustically tagged fish have been detected in the Mad or Eel Rivers, visual observations indicate interannual variation in both presence and spatial distribution. This project is part of the Northern California Tribal Fisheries Collaborative, a partnership between tribal, university, state, and federal personnel, and is imperative for advancing our understanding of green sturgeon ecology and monitoring capabilities. It will also contribute to better-informed stewardship and management of tribal and state natural resources in the face of habitat alteration and climate change.

## Exploration of Native Fishes in California Waters

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### The Return of Pacific Lamprey to the Lower Santa Ynez River Basin, Santa Barbara County, CA

**Timothy H. Robinson, Ph.D.**, Fisheries Division Manager, Cachuma Operation and Maintenance Board (Presenter) and Co-authors: **Scott B. Engblom** and **Scott J. Volan**, Project Biologists, Cachuma Operation and Maintenance Board

Pacific lamprey (*Entosphenus tridentatus*) were seldom observed prior to 2000 and not at all through 2024 within the Lower Santa Ynez River (LSYR, downstream of Lake Cachuma and Bradbury Dam) basin in southern Santa Barbara County. Their unexpected return to the LSYR in 2025 was documented when lamprey of various age classes were observed. Water years 2023 and 2024 were classified as higher-than-average precipitation and river discharge years, enough to fill Lake Cachuma and produce controlled spill into the LSYR throughout the dry season after several consecutive years of drought and low lake elevations. In the spring of 2025, ammocoetes (juvenile lamprey) were observed approximately 5 miles below Bradbury Dam. Shortly thereafter, adult lamprey were observed spawning in various reaches of the LSYR mainstem (14 miles and 40 miles upstream of the ocean). Eight adult lamprey were also captured in migratory traps within Hilton Creek, which is 49 miles from the ocean and the upstream-most tributary just below Bradbury Dam. Field observations were documented with photographs and videos, which will be shared to provide visual evidence of spawning activity, migration, and the condition of the individuals observed. How they were discovered, their distribution, and their spawning activities will be described. Speculation of their life-history strategy, timing of return to the fresh water, basin migration, and spawning locations will be provided in the context of other lamprey populations observed within the central and southern regions of the state, specifically within San Luis Obispo Creek and the Santa Clara River. The results of genetic analyses from tissue samples will be presented to further our limited understanding of this elusive and mysterious species.

## Exploration of Native Fishes in California Waters

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### Lampreys in California: Characterizing Diversity Using Genomic Tools

**Grace Auringer**, Ph.D. Student, University of California, Davis (Presenter)

and Co-authors: **Matthew A. Campbell, Ph.D.**, University of California, Davis and University of Alaska, Fairbanks; **Pascale A. L. Goertler**, California Department of Water Resources; and **Amanda J. Finger, Ph.D.**, University of California, Davis

At least six species of lamprey (*Entosphenus spp.* and *Occidentis spp.*) occur in California watersheds. All are listed as California Species of Special Concern, yet little is known about the interspecific and intraspecific genetic structure of lamprey populations throughout the state. In this study, we applied restriction-site associated DNA sequencing (RADseq) to lamprey samples collected opportunistically through several ongoing fish monitoring surveys in 2020-2024. Our dataset captures individuals from various species, life stages, and geographic locations throughout northern and central California. Analysis of 446 individuals genotyped at variable SNPs (single nucleotide polymorphisms) throughout the genome supports the presence of undescribed species diversity in California, specifically two candidate species found in Alameda Creek and Napa River that are most closely related to *Occidentis ayresii*. For many sampling locations, multiple lamprey species were found at the same site during the same sampling period, suggesting sympatry is common for lamprey in California. Genomic differentiation was high between lineages within the *Occidentis* genus, but lower between lineages within the *Entosphenus* genus. Within *E. tridentatus*, we observed no population structure by geographic location; however, we found diversity at a known chromosomal inversion across *E. tridentatus* individuals in California. Similarly, we observed no population structure by geographic location in *O. ayresii* within California. Within freshwater-resident "brook" lamprey species, particularly *E. lethophagus*, some genetic differentiation was observed between sampling locations. This lack of gene flow between geographically separated populations is expected, given that these species do not migrate and exhibit limited dispersal. The study results provide a fundamental framework for future genetic work and for establishing genetically distinct units for management in California.

## Exploration of Native Fishes in California Waters

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### Advancing c'waam and koptu Recovery: Ambodat's Recovery Strategy and Future Considerations in a Changing Upper Klamath Basin

Ryan Bart, Fisheries Biologist, The Klamath Tribes, Ambodat Department

The Klamath Tribes Ambodat Program is advancing a recovery effort for the culturally and ecologically important c'waam (Lost River sucker) and koptu (shortnose sucker) of the Upper Klamath Basin. Decades of annual recruitment failure, environmental stressors, and habitat degradation have left both species functionally dependent on conservation propagation to maintain population structure. In response, the Ambodat Program is implementing a refined rearing and release strategy aimed at increasing early post-release survival, strengthening year-class formation with the ultimate goal of rebuilding populations to a level that can once again support ceremonial and subsistence harvests for the Klamath tribes.

A central component of the current strategy is extending the rearing period to produce juveniles that exceed 300 mm total length prior to release. Research within the basin and across other sucker populations indicates that larger-bodied juveniles experience substantially higher survival rates following release, particularly in systems with high predation pressure and variable water quality. By focusing on size-at-release rather than solely on age, the program seeks to improve the probability that each cohort contributes meaningfully to natural recruitment and long-term demographic stability.

To evaluate and optimize release success, the program is conducting spatially distributed releases across multiple habitats, including nearshore boat ramps and offshore lake habitats. These releases are designed to parallel ongoing acoustic tagging studies, enabling direct comparison of movement patterns, habitat use, and early survival among different release groups. Together, these data will inform adaptive adjustments to release strategies, timing, and habitat selection for future cohorts.

The coming years introduce a new ecological factor: the return of fall Chinook salmon (*Oncorhynchus tshawytscha*) to the upper basin following the Klamath River dam removals. In the fall of 2025, fall Chinook were observed upstream tributaries within the c'waam and koptu habitat for the first time in over a century. While juvenile Chinook and juvenile suckers historically coexisted in the basin, their renewed overlap in contemporary conditions carries uncertainties. Potential interactions, including habitat competition, shifts in food web structure, predator attraction, and cumulative stressors, represent emerging questions for management.

The Ambodat Program's integrated approach, combining propagation, telemetry-guided release strategies, and ecological monitoring, positions the Klamath tribes to respond adaptively to both longstanding and novel challenges related to c'waam and koptu recovery. As environmental conditions continue to evolve and anadromous fish return to the watershed, this recovery framework provides a path toward restoring resilient, self-sustaining c'waam and koptu populations capable of supporting future harvest and cultural continuity.

## Exploration of Native Fishes in California Waters

### Native Fishes of Clear Lake

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**Luis Santana**, Fish and Wildlife Director, Robinson Rancheria of Pomo Indians

Clear Lake, California—the oldest natural lake in North America—supports a unique assemblage of native fish species, including the Clear Lake Hitch (*Lavinia exilicauda chi*), Clear Lake Tule Perch (*Hysterothorax traski lagunae*), Sacramento Sucker (*Catostomus occidentalis*), Sacramento Blackfish (*Orthodon microlepidotus*), and Western Brook Lamprey (*Lampetra richardsoni*). These species form the ecological foundation of the lake's food webs, contribute to nutrient cycling, and hold deep cultural significance for Pomo tribal communities who have stewarded these waters since time immemorial.

In recent decades, native fish populations have experienced a substantial decline due to altered hydrology, habitat fragmentation, warm-water invasive predators, harmful algal blooms, and migration barriers that disconnect tributaries from the lake. As climate change intensifies drought cycles, stream intermittency has further compromised spawning and juvenile rearing habitats, particularly for the potamodromous Clear Lake Hitch.

This presentation provides an integrated overview of the current status, ecological roles, and life histories of Clear Lake's native fishes, drawing on recent monitoring data from the Danoxa Fish and Wildlife Department of the Robinson Rancheria Pomo Indians, multi-tribal collaborations, fyke-net and electro-fishing surveys, and water-quality assessments across the watershed. Emphasis is placed on identifying limiting factors, understanding trophic interactions, and evaluating how watershed-scale stressors—including harmful cyanobacterial blooms and low-flow disconnection—shape population trajectories.

The talk also highlights emerging partnerships between tribal nations, state agencies, and academic institutions to implement restoration strategies such as beaver-based hydrologic recovery, reconnection of migration corridors, invasive predator management, cultural burning, and climate-resilient streamflow enhancement. By centering Tribal Ecological Knowledge (TEK) alongside Western science, Clear Lake fisheries practitioners are developing a holistic path forward for native fish conservation that benefits both ecosystems and tribal communities.

## Assessing Restoration Outcomes

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**Session Coordinator:** Lisa DeRose, McMillen, Inc.

This session highlights how long-term monitoring and data-driven approaches are being used to evaluate watershed and river restoration outcomes across California. Through case studies spanning floodplain restoration, fish population monitoring, and instream habitat enhancement, presenters share lessons learned and insights to inform adaptive management and future restoration efforts.

## Assessing Restoration Outcomes

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### Characterizing Ecosystem Response to Stream Crossing Removal in Redwood National and State Parks

**Rylee Rawson**, Master's Student, California Polytechnic State University, Humboldt (Presenter) and Co-authors: **Andrew Stubblefield, Ph.D.**, Department of Forestry, Fire and Rangeland Management, California Polytechnic State University, Humboldt; **Alison O'Dowd, Ph.D.**, Department of Environmental Science & Management, California Polytechnic State University, Humboldt; and **Chad Anderson**, Redwood National and State Parks

Process-based restoration projects act as both disturbance and recovery mechanisms, intentionally disrupting existing conditions to reestablish the hydrologic and ecological processes that sustain salmonid ecosystems. From an ecological perspective, these interventions initiate successional trajectories in which channel form and biological communities reorganize over time toward greater stability and resilience. Redwoods Rising, a watershed-scale initiative in Redwood National and State Parks, California, USA, applies this approach by recontouring historic logging roads and “daylighting” streams buried by Humboldt road crossings — reopening channels that in many cases were buried for decades. Using the National Park Service Klamath Network Wadeable Stream Monitoring Protocol, we surveyed nine treatment sites one to five years post-restoration, comparing them with old-growth reference reaches and available pre-treatment data. Preliminary analyses indicate strong successional trends in riparian ground cover recruitment and the development of in-stream habitat complexity, including increased cover and a narrowing and deepening of channels. We also observed an overall reduction in fine sediment relative to pre-treatment conditions and, in fish-bearing reaches, an increased presence of coastal cutthroat trout (*Oncorhynchus clarkii*) within daylighted segments. Together, these results suggest that process-based restoration can reinitiate geomorphic and ecological processes that drive recovery in disturbed headwater systems. Continued, long-term monitoring is essential to document these ecological trajectories, evaluate restoration effectiveness, and refine implementation practices that promote resilient watershed processes.

## Assessing Restoration Outcomes

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### Evaluating Floodplain Restoration Projects Through Long Term Population Monitoring Datasets

Katherine Stonecypher, Cal Poly Humboldt

Contained almost entirely within the boundaries of Redwood National and State Parks, the Prairie Creek watershed is considered a salmon stronghold. Despite retaining extensive stands of remnant old growth coastal redwood (*Sequoia sempervirens*) and high-quality salmonid habitats, much of lower Prairie Creek has been altered. Channelization led to steep, incised channels and disconnected Prairie Creek from its floodplain, degrading stream habitats for threatened salmon species. This led to targeted large scale floodplain restoration efforts on lower Prairie Creek, which were completed in 2025. In partnership with the Yurok Tribe in a historic land back agreement, CalTrout, Save the Redwoods League, Redwood National and State Parks, and other project partners completed the Prairie Creek floodplain restoration at O'Rew. This project improved floodplain habitat in lower Prairie Creek through the addition of large wood features, restored access to 18 acres of floodplain and backwater habitat, and restored 15 acres of emergent wetland and 28 acres of riparian vegetation.

Appropriate monitoring of restoration projects is an evolving topic within the field of salmon habitat restoration and monitoring. Large scale restoration efforts like the Prairie Creek floodplain restoration require a sufficient scope through which to evaluate response of threatened salmon populations. Fortunately, Prairie Creek has a long history of population-scale monitoring of ESA-listed Southern Oregon-Northern California Coast (SONCC) coho salmon, providing a 10-year baseline dataset through which to evaluate population-level effects of restoration. We evaluated the effects of large-scale floodplain restoration on SONCC coho salmon in Prairie Creek using a full Life Cycle Monitoring framework from 2022-2025 and compared these results to pre-restoration population metrics. Findings can be used to assess the value of floodplain restoration for threatened salmon and further understanding of appropriate scoping for biological monitoring of restoration projects.

## Assessing Restoration Outcomes

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### A Decade of Monitoring Scott River Coho Salmon

**Erich Yokel**, Scott River Watershed Council (Presenter)

and Co-authors: **Charnna Gilmore** and **Betsy Stapleton**, Scott River Watershed Council; and **Harrison Morrow**, University of California, Davis

The Scott River supports the strongest population of SONCC coho salmon (*O. kisutch*) in the Klamath Basin.

The Scott River Watershed Council (SRWC) and collaborators have performed extensive monitoring of coho salmon throughout the mainstem and tributaries of the Scott River over the last decade.

Through a concerted monitoring program of direct observation surveys of adult spawners and rearing juvenile coho, combined with a robust PIT tag mark and recapture fish handling and remote detection program, the SRWC has documented immediate utilization of constructed and enhanced habitats, as well as a series of successful freshwater juvenile coho life strategies and coho salmon inhabiting areas outside of their traditionally understood range.

At its inception, the SRWC's monitoring program was centered around Beaver Dam Analogue (BDA) structures installed in Lower Sugar Creek in 2014. From this beginning, biological and water quality monitoring of restoration projects, including BDAs in multiple tributaries, constructed off-channel slow water habitats, large wood structures, and spawning ground habitat enhancement projects, and a complex off-channel restoration project in the Scott River Yuba Dredge Tailings Reach has been performed.

The observations garnered from the monitoring program have increased the understanding of adult and juvenile coho salmon utilization of restoration projects and natural habitats throughout the Scott River watershed. Direct observation surveys of adult spawners and juvenile rearing have increased the documented distribution of coho salmon in over 10+ miles of stream.

The PIT tag fish handling effort has documented the movement, survival, and growth of coho salmon in the freshwater environments of the Scott River. This program has illuminated complex life strategies, including yearling coho salmon rearing for a second summer base flow period.

Monitoring of coho salmon in the Scott River has been performed for over twenty-five years by the California Department of Fish and Wildlife, U.S. Forest Service, NOAA Fisheries, Siskiyou RCD, Quartz Valley Indian Reservation, and others, documenting the population trends and trajectories of this iconic fish. Recognizing the need to bring together the extensive data sets generated in these efforts, the SRWC participated in the development of the Klamath Basin Fisheries Collaborative, a group that facilitates the coordination of fisheries monitoring efforts throughout the Klamath.

The monitoring program has documented the immediate utilization of constructed and enhanced habitats by juvenile and adult coho salmon and the wide extent of coho distribution in the Scott River.

## Assessing Restoration Outcomes

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### Synthetic Evaluation of Riverine Restoration for Chinook Salmon Spawning and Rearing Habitat in the Central Valley

**Louise Conrad, Ph.D.**, California Department of Water Resources (Presenter) and Co-authors: **Lucy Andrews, Ph.D.**, **Pascale Goertler**, and **Ryon Kurth**, California Department of Water Resources; and **Brian Crawford**, Compass Resource Management.

The Healthy Rivers and Landscapes (HRL) Program proposes a novel approach to meeting environmental regulations for supporting native fishes through integration of environmental flows, habitat, collaborative science, and multi-entity governance. The proposal includes 155—825 thousand acre-feet of environmental flows and over 20,000 acres of habitat across major tributaries to the Bay-Delta watershed, from upper watersheds (below rim dams) to tidal wetlands in the Delta. Tributary systems include the Tuolumne, Mokelumne, Yuba, Feather, American, Sacramento Rivers, and Putah Creek. Habitat restoration commitments in the tributary systems for Chinook salmon include approximately 270 acres of in-channel rearing, 1,850 acres of tributary floodplains, and 175 acres of spawning habitat. The balance of the restoration commitments will be comprised of low elevation floodplains in the Yolo and Sutter Bypasses, as well as tidal wetlands and managed floodplains in the Sacramento-San Joaquin Bay-Delta. The full HRL program is under consideration as part of the State Water Resources Control Board's (SWRCB) update to the Bay-Delta Water Quality Control Plan. In a proactive effort to get projects underway, several hundred acres have already been restored, as "Early Implementation" of the HRL Program.

The comprehensive science program for HRL has developed a hypothesis-centered Science Plan that articulates specific metrics for evaluating each type of restoration project. The goal is that the Science Plan drives the HRL program toward a consistent approach for evaluation and analysis that allows synthetic, multi-watershed reporting on a regular basis to the SWRCB on the outcomes of restoration projects. However, because of the complexity of the program and the planned restoration, as well as variable resources for monitoring, it is not possible to design a clean experiment in which restoration projects are constructed concurrently and reference sites are consistently available for comparison purposes. In addition to these challenges, an independent peer review of the HRL Science Plan resulted in a recommendation that it be revised to include anticipated effect sizes for restoration actions; that is, quantitative expectations for how metrics such as redd and juvenile salmon densities will respond to restoration actions.

To provide guidance for tributary science leads on project evaluation, the HRL Science Committee produced a framework for restoration project evaluation, which provides a range of monitoring design intensities ranging from full before-after-control-impact designs to simpler levels of comparison. This presentation will show the range of monitoring designs being selected for different restoration project types and across systems, setting the stage for the scale of reporting that can be expected of the HRL program in the coming years. To pilot this framework, we use existing datasets from the Feather River to illustrate responses to spawning habitat restoration and the generation of effect sizes. This presentation will highlight the collaborative science approach of the HRL program, which is at a stage of setting the foundation for synthetic reporting for all participating systems. The importance of examples and iterative development of the framework will be a point of emphasis in this presentation.

## Assessing Restoration Outcomes

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### Data Science to Understand Watershed-Scale Restoration Outcomes: A Framework

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Evaluating restoration effectiveness across a watershed is challenging when projects vary widely in design, monitoring approaches, data availability, and implementation timelines. The Healthy Rivers and Landscapes (HRL) program, a multi-agency effort linking restoration, environmental flows, and adaptive management across the Sacramento River watershed and Bay-Delta estuary, faces this challenge as it seeks to synthesize ecological outcomes resulting from pairing environmental water provision with dozens of spawning, rearing, floodplain, and tidal wetland restoration projects to inform management and policy decisions.

This presentation introduces a data science framework developed in HRL to support timely, reproducible, and rigorous evaluation of environmental flows and restoration outcomes for salmonids and other native aquatic species. The framework addresses three intertwined needs: (1) improving data quality and accessibility through shared data governance and management standards; (2) enabling reproducible and comparable analyses across agencies and geographies; and (3) supporting rapid synthesis of heterogeneous datasets to understand ecological responses at project and watershed scales.

I will outline the analytical challenges—numerous projects, diverse metrics, varied monitoring designs, information gaps, and uneven analytical capacity—and describe how HRL is addressing them through standardized workflows, shared metadata requirements, and conventions for publishing data in FAIR-aligned formats. I will also highlight how consistent code style, collaborative development practices, and modern data engineering and data science tools enable multiple agencies to contribute to, iterate on, and publish shared analyses.

Using an example from the Feather River, I will demonstrate how this approach supports transparent, extensible analysis of restoration outcomes and enables cumulative assessment across projects. I will conclude by highlighting how coordinated data governance and reproducible workflows allow watershed-scale programs to link site-specific actions with system-level improvements in habitat and streamflow resilience.

## Assessing Restoration Outcomes

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### Observations and Lessons Learned from Implementing Two Accelerated Recruitment Projects in the Santa Cruz Mountains

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The Resource Conservation District of Santa Cruz County (RCD) completed two “accelerated recruitment” projects in the fall of 2025 in two coastal stream systems in Santa Cruz County. This approach involves strategically felling trees in the riparian zone directly into the channel using manual hand-felling techniques. Felled trees can be strategically oriented to make them “knit” in place, avoiding the need for artificial anchoring. This approach is significantly cheaper and has a much smaller project impact footprint than engineered large wood projects yet has been shown to still be effective in terms of providing targeted ecosystem benefits. This approach is generally more feasible and applicable in low-risk areas that are undeveloped, and which also usually have difficult access due to remoteness and steep slopes. A secondary but important co-benefit was improving forest climate resilience, as felled trees were selected from overstocked stands of redwoods, thereby allowing the dominant trees that remain more space to grow faster and larger.

The two streams where these projects were completed (as with many streams in the region) lack large wood and deep pools and have poor channel complexity and floodplain connectivity. The 2023 NMFS 5-Year Review: Summary & Evaluation of Central California Coast Coho Salmon, confirmed that this is still the case: “The greatest opportunity to advance the recovery of CCC coho salmon in the Santa Cruz mountains Diversity Stratum is to...design and implement restoration projects to create or restore alcove, floodplain, backwater channel, ephemeral tributary, or seasonal habitats.” The projects aimed to seed these systems with a significant amount of large wood to create more spatially complex channel morphology and restore habitat conditions benefiting several coho life stages. In total, 142 large (18-48” dbh) redwoods were dropped over 2 miles of stream between the two projects.

This presentation will give an overview of the planning and implementation of these two projects, observations from the first winter, and lessons learned in planning and implementing this type of project.

## Assessing Restoration Outcomes

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### Lessons from the Trinity: Channels and Habitats Change as a Function of Geomorphic and Ecological Processes... So How Do You Build Process?

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The Trinity River was dammed in 1960, taking 90% to the Central Valley. Even the regional flood of 1964 was held by Trinity and Lewiston Dams. The loss of hydrology had extreme impacts on the geomorphology and riparian ecology of the river that translated into a loss of habitat for juvenile salmonids. Restoration efforts began in less than a decade with a focus on channel form: pools, spawning beds, depth, and velocity. We said, "if we build it, they will come." Yet the river reverted to degradation... a few salmon might come for a moment, but the population continued to suffer. Then we recognized that hydrology was the problem. The 1990s saw a major study on flows for restoring the river that led to a decision to keep half the water for scheduled restoration flow releases. It was a major advance in river restoration, but our knowledge of hydraulic ecology was young and water usage compromises were required. Resulting spring-only releases doubled Chinook Salmon adult to smolt production, but the juveniles were smaller and production didn't expand adult populations. We now understand that limiting flows to the spring lacks function, and that "habitat" is more than depth, velocity, and cover... ecological processes such as benthic macroinvertebrate succession are vital. We now understand how to construct channel restoration projects that don't just recreate a form, but function with the hydrology. We now have forecasts that enable release of water in winter without over-using the available water. We now know the saying is invalid... building "it" (restoring form alone) is useless. We now build to restore *process*. As of December, 2024, we now implement flow releases in winter to gain function and ecological processes with better timing. This journey with "environmental flows" is just beginning, but indications are positive.

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