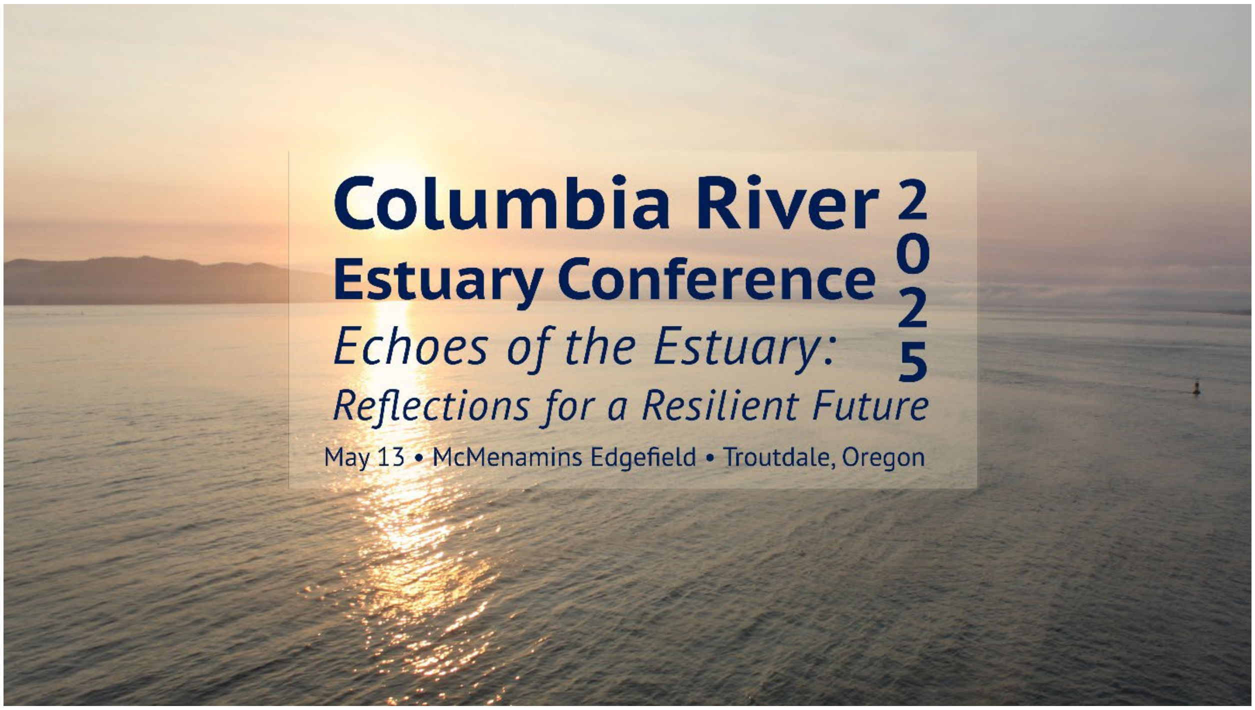

Columbia River Estuary Conference 2025

Abstract Booklet

2025 Conference Steering Committee

This conference was organized by the Columbia River Estuary Conference Steering Committee, led by Catherine Corbett of the Lower Columbia Estuary Partnership. Without the continued participation, guidance, and support of the Steering Committee members, this conference could not have occurred. Steering Committee Members include (alphabetically):

- Amy Borde, Columbia Land Trust
- Carla Cole, Lewis and Clark National Historical Park, National Park Service
- Catherine Corbett, Lower Columbia Estuary Partnership
- Chanda Littles, U.S. Army Corps of Engineers
- Charles Seaton, Columbia River Inter-Tribal Fish Commission
- Curtis Roegner, NOAA, National Marine Fisheries Service
- Elaine Harvey, CRITFC and Yakama Indian Nation
- Jason Karnezis, Bonneville Power Administration
- Jason Smith, Columbia River Estuary Study Taskforce
- Joe Needoba, Oregon Health & Science University
- Laura Brown, Washington Department of Fish and Wildlife
- Mark Bierman, U.S. Army Corps of Engineers
- Sean Payne, USGS
- Tawnya Peterson, Oregon Health & Science University

2025 Conference Sponsors

Thanks to our many sponsors, we are able to put on the 2025 Columbia River Estuary Conference for no cost to participants. Without their continued support, this conference would not have been such a great success! We are tremendously grateful to our sponsors:

ABSTRACTS

Becoming the Voice of the River:
how to speak passionately about restoration science

Janine Castro
Technical Director, River Restoration Professional Certificate Program
PSU Environmental Professional Program

Just because we are scientists, engineers, and project managers, does not mean that our presentations and communications must be serious, dry and boring. The work we do is important and exciting, and our passion must shine through. Using a set of relatively simple guidelines, your talk can go from merely interesting to truly memorable.

If the thought of getting up in front of an audience makes you shudder, join the crowd! According to many somewhat dubious internet polls, public speaking is the number one human fear. And yet public speaking is defined as speaking to more than four people at any given time. Hence, you are a public speaker more than you may realize. Given this seemingly natural fear, it is not surprising that addressing a large, or even small, audience can be frightening, overwhelming, and intimidating, but it can also be extremely rewarding and gratifying. When we, as scientists, engineers, technical experts and project managers, have the opportunity to reach out to dozens or hundreds of people, we must embrace that we are the voices of the river. *Make the most of your moment, wherever that moment may be.*

"The problem with most bad presentations I see is not the speaking, the slides, the visuals, or any of the other things people obsess about. Instead, it's the lack of thinking." Scott Berkun, 2010

Bio
Janine Castro, Ph.D., R.G.
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Janine Castro provides national and international training on stream restoration, river science, geomorphology, and public speaking for scientists. She is co-founder and Technical Director of Portland State University's River Restoration Professional Certificate Program and is a member of the Columbia Estuary Ecosystem Restoration Program's Expert Regional Technical Group, which reviews ecosystem restoration actions in the floodplain of the lower Columbia River and estuary. Janine recently retired from Federal service where she worked as a geomorphologist and supervisory scientist for the US Fish and Wildlife Service for 24 years and spent the preceding 10 years working for the Natural Resources Conservation Service. Janine is one of the five founding members of River Restoration Northwest and the co-founder of Science Talk.

Education: BS Geology and BA Geography, 1991, CSU Chico; MS Interdisciplinary Studies, Environmental Geomorphology, 1993, CSU Chico; PhD Geosciences, 1997, Oregon State University, Corvallis.

Specialties: Aquatic Habitat Restoration, Geomorphology, Science Communication

Restoring Relationships: Human Dimensions and Climate Resilience Considerations for Managing Pacific Lamprey in the Columbia River

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Across the United States, including the Pacific Northwest, Native American communities are demonstrating extraordinary ways of transforming environmental racism and cultural genocide into environmental justice and cultural revitalization. The Columbia River Plateau people choose to live in accordance with *Nami Tamanwit* or Creators Law. Water, Wild native fishes, Wild game, Wild roots that are dug from the ground, and Wild berries, are gathered seasonally and cared for as medicine to the body, heart and spirit since time immemorial. The traditional food system of the Yakama Nation symbolizes complementary environmental and social health. Columbia River Indigenous Traditional Ecological Knowledge (ITEK) is interdisciplinary with equally great respect and care for each of these cultural keystones. “Sustainability” of wild anadromous fishes today is an inadequate objective, restorative thinking via an Indigenous Knowledge framework can bring together culturally significant Yakama stories with actionable science. This thesis considers human dimensions of Pacific Lamprey (*Asum* in Sahaptin language) management in the Columbia River Basin based on generations of social-ecological reciprocity with this species. *Asum* is a traditional dietary staple that is harvested, cured, prepared and shared in traditional ceremonies of the Yakama, Warm Springs, Umatilla and Nez Perce tribes. Biocultural sovereignty is significant in restoration of an ancient social relationship with *Asum*. Drawing on eighteen interviews with respected tribal Elders raised along the Columbia River in the time of Celilo Falls, this collaborative project is designed to share ITEK with future generations. Testimony from Elder interviews begins at the intersection of the Pacific Ocean with the Columbia river, and extends to Bonneville Dam and up through the confluence of the Yakima and Snake River tributaries.

Supporting diverse Pacific NW marine data access needs via the NANOOS Visualization System

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Jonathan Allan, Oregon Department of Geology and Mineral Industries
Charles Seaton, Columbia River Inter-Tribal Fish Commission
Michael Kosro, Oregon State University

The Northwest Association of Networked Ocean Observing Systems, NANOOS, is the Pacific Northwest Regional Association of the U.S. Integrated Ocean Observing System (IOOS). For over 20 years, NANOOS has been making observation and model data available to a diverse set of stakeholders throughout the region through a user-friendly data visualization tool called the NANOOS Visualization System (NVS, http://nvs.nanoos.org). NVS is a web-based suite of thematic apps sharing a coherent user interface, common application components, and common capabilities for regional data processing, aggregation, subsetting and homogenization. We will discuss NVS capabilities, user experience, and NANOOS data services that support this suite of tailored NVS apps developed to serve the following NANOOS priority areas: Climate: Climatology and anomaly products from regional buoys, satellite time series, and shoreline change statistics to improve understanding of climate variation and change. Ecosystem assessment: Time-series and real-time observations and data products used to evaluate and forecast Harmful Algal Blooms (HABs), hypoxia, ocean acidification and water quality. Fisheries and biodiversity: Forecasts and data on the bio-physical environment enabling better-informed management decisions by fishers (from tuna fishers to shellfish growers) and regional managers. Mitigation of coastal hazards: Observations and analysis of topographic beach profiles, shoreline change, near-shore bathymetry, sea level change and waves to improve planning and response to coastal hazards, assist with engineering design and enhance coastal resiliency. Maritime operations: Water, wave and weather observations and forecasts to assist ship and boat operators with safe operations and planning. New features include the Snapshot tool that allows users to define or “customize” what information is displayed; a Dynamic Range capability that allows users to set their own min and max values for various datasets, and can also be used for higher resolution displays when conditions are similar across the region by selecting “Fit Range to Data”; new forecast overlays for fishers, including bottom oxygen concentrations and SST/Surface Currents set to the optimal temperature for salmon.

Seasonal and Interannual Temperature Variability along the Columbia River Estuary

Eliza Lerman
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Melanie Fewings and James Lerczak, Oregon State University

Estuaries are ecologically important systems, supporting many species with high degrees of nutritional, cultural, and economic significance that rely on specific conditions to survive. Over recent decades, extreme atmospheric temperatures and marine heatwave events in coastal waters have been recorded, potentially putting estuarine species under threat. The precise relationship between these warm events and water temperature in estuaries is difficult to discern, however, since estuarine water temperature can be influenced by ocean, riverine, and atmospheric conditions. To determine the sensitivity of estuarine temperature to changes in these external conditions, the present-day variability of temperature in estuaries and the physical processes which modulate it must first be described.

Here, we focus on the Columbia River estuary. Previous studies in this system include work on salmonid migration, biogeochemical fluxes, harmful algal blooms, circulation, salinity intrusion, impact of wind induced mixing, and more. Work has also been done demonstrating warming in the Columbia over the past two centuries. However, we still lack comprehensive understanding of how temperatures vary on tidal, seasonal, and interannual scales within and along this system, and which physical drivers matter most when and where.

In this study, we begin to answer these questions by characterizing and comparing seasonal cycles and non-seasonal variability on sub-seasonal to interannual timescales at five sites along the Columbia River estuary and one site offshore of the mouth, using data from the Coastal Margin Observation and Prediction's SATURN moorings and the National Buoy Data Center. To determine how the annual cycle of water temperature varies along the estuary, we first calculate the average annual cycle in near-surface temperature at each site, then identify the observed seasonal range of temperatures and typical onset dates of warming and cooling in each location. Then, we examine how the non-seasonal temperature variability differs among sites, and work to identify which forcings might be responsible. In this way, we seek to understand how changes in ocean, river, and atmosphere affect temperature and temperature gradients along the Columbia River estuary.

A Novel Method for Columbia River Estuary Environmental Measurements – Bathymetry, Temperature, and Surface Currents from Tagged Cormorants

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Adam Peck-Richardson, Jessica Garwood, Xiaohui Liu, Leilane Passos, Rachael Orben, Alexa Piggott, and Greg Wilson, Oregon State University

We present methods for collecting and analyzing environmental data in the Columbia River estuary from sensors attached to tagged cormorants. Starting in 2014 and continuing through 2022, approximately 64 Brandt's, double-crested, and pelagic cormorants were tagged in the lower Columbia River estuary as part of the Cormorant Oceanography Project (https://www.osudashcams.com). Over this period, tags have evolved and advanced and currently include pressure, fast-response thermistor, conductivity, IMU, and GPS sensors. The tags are equipped with solar cell charged batteries and data is transferred via cell phone networks. As part of this program, a total of approximately 380,000 dives were made by tagged birds within the estuary or nearby coastal waters. In this presentation, we describe the Cormorant Oceanography Project; the tags developed under this program; the data collected; and analysis methods developed to produce environmental data products including bathymetry soundings, water-column temperature profiles, and surface currents. We also summarize the resulting data products for the Columbia River estuary that have been produced and the utility of these data for various applications, including data-assimilative modeling of the estuary.

The Wisdom of the Aged: Learning from Older Restoration Projects to Inform Future Design - Part 1

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Matt Cox, Inter-Fluve Inc
Amy Borde, Columbia Land Trust

Over the 20 years of the Columbia Estuary Ecosystem Restoration Program, our understanding of ecosystem processes and biological response within the complex and dynamic Columbia River Estuary (CRE) has grown. We still have much to learn, however, about how this knowledge plays out in projects on the ground. We now have the opportunity to learn from projects implemented 20 years ago and to compare them to those implemented more recently, with varying levels of design complexity. In this two-part presentation we will cover what we have learned from four restoration projects spanning a range of ages and design features. Using monitoring data on hydrology, temperature, topography/morphology, sediment accretion, channel cross sections, and vegetation we will reflect on what we have learned and how it can inform future restoration design.

Part 1 - Perspectives on vegetation community development, sediment accretion, topographic complexity
This part of the presentation will provide background to the four restored sites in the lower Columbia River estuary being discussed in this session: Devils Elbow (2004), Deep River (2005), Kandoll (2005 and 2014) and Kerry Island (2016). Two of the projects were hydrologically reconnected by dike breaching without channel excavation or significant planting efforts, and two had channel excavation, topographic complexity (mounds and surface roughening), revegetation, and limited large wood installation. Quantitative and observational perspectives will be shared regarding vegetation community development with and without planting efforts, the impact of topographic complexity has on vegetation, sediment accretion rates and deposition patterns, and how wood (including installed, naturally recruited, and by beavers) appears to be influencing the tidal wetland development.

Part 2 – Lessons learned from the examination of tidal channel evolution
Tidal floodplain restoration projects often include the re-activation or construction of tidal channels. Many tidal restoration projects have used levee breaching into existing tidal channel scars to increase floodplain connectivity. Other projects have utilized the construction of new tidal channels within re-connected tidal floodplains to increase hydraulic connectivity and complexity. Long term monitoring data from the four floodplain restoration sites in the CRE, which vary in age from 9 to 21 years, will be examined to understand channel evolution dynamics at both types of restored sites. Two of the sites (Kerry Island and Kandoll) have constructed tidal channels, while the other two sites (Deep River and Devils Elbow) involved levee breaching into existing tidal channels. We will present an examination of channel network planform development post-construction at each site. Analysis of long-term repeat channel cross section measurements will be presented to provide insight into both within-channel and near-channel sediment dynamics as both reconnected and constructed tidal channels evolve over time. These channel evolution insights will be connected to the sediment accretion information at the four sites discussed in Part 1 of this presentation. Lessons learned and considerations for tidal channel design on future projects will be discussed.

The Wisdom of the Aged: Learning from Older Restoration Projects to Inform Future Design - Part 2

Matt Cox
Inter-Fluve
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Ian Sinks and Amy Borde
Columbia Land Trust

Over the 20 years of the Columbia Estuary Ecosystem Restoration Program, our understanding of ecosystem processes and biological response within the complex and dynamic Columbia River Estuary (CRE) has grown. We still have much to learn, however, about how this knowledge plays out in projects on the ground. We now have the opportunity to learn from projects implemented 20 years ago and to compare them to those implemented more recently, with varying levels of design complexity. In this two-part presentation we will cover what we have learned from four restoration projects spanning a range of ages and design features. Using monitoring data on hydrology, temperature, topography/morphology, sediment accretion, channel cross sections, and vegetation we will reflect on what we have learned and how it can inform future restoration design.

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Lightning!

Identifying high priority barriers to salmon: Lower Columbia Fish Passage Inventory and Barrier Correction Decision-Support Tool

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Amelia Johnson, Lower Columbia Fish Recovery Board

The Lower Columbia Estuary Partnership and the Lower Columbia Fish Recovery Board will complete a barrier inventory and accompanying GIS-based decision-support tool this spring with the goal of assisting with the identification of the most critical fish passage limitations to salmon and steelhead at population and species-scale. The barrier inventory is a compilation of federal, state, and local data sources with field verification by the Lower Columbia Estuary Partnership and Lewis Conservation District using Washington Department of Fish and Wildlife (WDFW) barrier assessment protocols. The decision-support tool is adopted from similar scoring and ranking models that have recently been implemented across Washington. Development was supported by the work group that included representatives from federal, state and local agencies across southwest Washington that manage and address fish passage projects and data needs. The decision-support tool includes a set of metrics that represent top passage constraints to recovering salmon and steelhead at population and species scales, including barrier passability ratings, salmon and steelhead population priorities for recovery, disconnected miles of salmon and steelhead habitat, and watershed-scale connectivity. In this presentation we discuss the development of the GIS-based decision-support tool, planned adaptive management and illustrate the potential use by restoration practitioners of the tool for identifying passage correction projects that will maximize benefits for recovering salmon and steelhead. Preliminary results pertaining to the number of anadromous barriers remaining and anadromous stream miles blocked will be presented.

Examining the benefits of full floodplain restoration (Stage 0 target condition) for juvenile salmonid recovery – a case study in the Gibbons Creek Watershed and the Lower Columbia River Estuary.

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Alex Morton and Curtis Loeb, Wolf Water Resources, Portland, OR
Chris Collins and Doug Kruezer, Lower Columbia Estuary Partnership

The Lower Columbia Estuary Partnership and City of Washougal are partnering to restore Campen Creek, a tributary to Gibbons Creek which is a critical hydrologic component of the recently completed Steigerwald National Wildlife Refuge Floodplain Reconnection Project (2022) located southeast of Washougal in Clark County, Washington. The Campen Creek Subwatershed, 1.8 square miles in size, has been substantially altered through residential, light industrial, and other developments, posing hydromodification risks to the broader Gibbons Creek Watershed. Improving the hydrologic resilience of Campen Creek has potential to attenuate peak storm events and associated stream erosion, siltation, turbidity and other adverse downstream impacts in Gibbons Creek and the Refuge. This presentation discusses a straightforward, full-floodplain connectivity design approach (Stage 0 targeted condition – following the Cluer and Thorne (2014) Stream Evolution Model) and the intended benefits on peak flow attenuation, water quality, wetland and primary productivity, and ultimately Lower Columbia River Estuary habitat for rearing and overwintering juvenile salmonids. The design approach highlights several novel elements that retain and integrate with existing stream features and habitats including a beaver dam, pedestrian bridge, the adjacent golf course, and reaches of the creek that are not appropriate for the full connectivity design approach. The presentation will also elucidate a common challenge with reestablishing historic floodplains of small, low gradient creeks and the potential for streampower to be reduced below thresholds that sustain beneficial scour and deposition processes. The presentation will further highlight stream habitat monitoring results from Gibbons Creek and other similar creek systems restored to valley-wide base-flow connectivity. Lessons from Campen Creek are intended to be relevant to other Lower Columbia River tributaries, which are increasingly understood to be critical not just as physical habitat, but also for their cumulative role in supporting estuarine water quality, cold water refugia, food web productivity, and other indirect benefits to salmonids.

Assessing Wetland Resilience in the Lower Columbia River Estuary

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Heida Diefenderfer, PNNL, Amy Borde, CLT, Shon Zimmerman, PNNL, Jason Karnezis and Alex McManus, BPA, Rod Moritz and Rachel Stolt, USACE

The Columbia Estuary Ecosystem Restoration Program (CEERP) restores tidal wetland habitat to meet requirements of the Biological Opinions for the Federal Columbia River Power System. This investment faces risk from changing environmental conditions. The management of existing wetlands and the selection of future restoration projects requires a systemic understanding of wetland resilience in the face of the changing environment.

Wetland resilience requires that elevation relative to the water surface remain stable. Under non-stationary conditions (when statistical properties of a time series are changing), this means that the rate of change of wetland elevation is approximately equal to the rate of change of the water surface elevation. This adjustment in wetland surface levels with background sea level change can be seen in sediment cores at and near the mouth of the Columbia River through the Holocene epoch. Water level changes in the Lower Columbia are complex, being driven by both changes in discharge from Bonneville Dam and oceanic conditions. While physical and biogeochemical processes play a role in changing wetland elevations along the tidal-fluvial gradient, the primary driver is sediment accretion rate. Therefore, the necessary characteristic of a resilient wetland is an accretion rate that is comparable to local relative sea level change. Evaluating the resilience of Lower Columbia wetlands requires a comparison between wetland accretion rates and estimates of future water level changes.

This evaluation of resilience has spatially heterogeneous results because of the varying relative influences of the Columbia River, tributaries to the Columbia River Estuary, and the ocean at any given point on the floodplain. We present measurements of sediment delivery to wetlands, water properties, and co-located long-term accretion rates collected using both Surface Elevation Table and Sediment Stake methods. Accretion rates are compared to observed and future estimates of water level change, to evaluate resilience. Future rates of water level change throughout the estuary are produced using two hydrodynamic models (Delft3D-FM and Adaptive Hydraulics); modeling inputs include estimates of sea level change together with future projections of discharge at Bonneville Dam in multiple scenarios. Using the future water levels, we project future wetland distribution from the known current empirical relationship between water levels and distribution of wetland communities. We provide estimates of the amount of elevation change necessary to maintain wetlands throughout the system. The information resulting from these analyses is compared to the CEERP project prioritization planning tools in Geographic Information Systems, to inform programmatic planning.

Keeping Invasives at Bay
Youngs Bay Aquatic Invasive Plants Project Ownership

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Carla Cole, Lewis and Clark National Historical Park
Graham Klag, North Coast Watershed Association

We are excited to present our collaborative approach to locating, targeting, and treating invasive wetland vegetation in Youngs Bay! Keeping Invasives at Bay (KIAB) is a collaboration between the North Coast Watershed Association (NCWA), Lewis and Clark National Historical Park (LEWI), and Columbia River Estuary Study Taskforce (CREST).

This project came about through a collaborative agreement between NCWA and LEWI. CREST was invited into the project to lead the field work and ground truthing element of the project. Keeping Invasives at Bay includes not only a collaborative approach to treating invasive species but also expensive flying machines with fancy sensors, GIS wizardry with artificial intelligence, and eradication of beautiful but invasive plants, efficiently!

The Area of Potential Effects (APE) within Youngs Bay to conduct this work encompasses 11,644 acres. The majority of the land in the APE is privately owned. The Stakeholder properties account for 561 acres and include Lewis and Clark National Historical Park, Oregon Department of Forestry, North Coast Land Conservancy, and Columbia Land Trust.

To LOCATE the target species Purple loosestrife (Lythrum salicaria) and Yellow flag iris (Iris pseudacorus), we used a Department of Defense (DoD) National Defense Authorization Act (NDAA) compliant drone and sensors. The Unmanned Aerial Systems are operated by CREST to map strategic wetlands in Youngs Bay. Flying takes place in late spring or early summer when Purple loosestrife and Yellow flag iris are in flower. The orthomosaic basemaps are created from the imagery of the RGB and multispectral sensors.

To TARGET the prolific beauties, patches of the species are delineated into polygons in ArcGIS Pro using the collected orthomosaics. Utilizing GeoAnalytics, Spatial Statistics and the power of AI, raster imagery is analyzed using the Forest-based and Boosted Classification and Regression tool. The tool trains a model based on known locations of each plant species that are delineated as part of the training datasets. As more known locations of the plant are identified from the drone imagery, the model can then be used to predict unknown values in the dataset that have the same explanatory variables. The tool can then create plant area models by generating predictions on the locations of other plant areas using supervised machine learning. Once these patches are determined, delineated and prioritized they are then added into a web map for use in Esri's Field Map application.

To TREAT the invasive weeds, a tablet loaded with the KIAB Field Map is supplied to the project's Invasive species herbicide applicator contractor. With the Field Map the contractor may observe their location in relation to the polygons. This allows the applicator the ability to target and track specific treatment areas. Tracking the distance and time the applicator spends moving between target areas will help to validate the GIS imagery analysis while also allowing the NCWA and NPS to clearly understand where work occurred, along with the time and cost associated with area treatment size.

Keeping Invasives at Bay is a multi-year pilot project with enormous potential to use the framework in other watersheds. The first year of KIAB was a learning year that was successful at a smaller scale. In the second year we look to ramp up and attempt to fly, map, and annihilate double the acreage as year one!

Lightning!

Tracking Soil Dynamics to Understand Plant Community Development in Restored Tidal Wetlands

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Ian Edgar, Ona Underwood, and Katarina Lunde, Lower Columbia Estuary Partnership
Sneha Rao and Sarah Kidd, Lower Columbia Estuary Partnership (*formerly*)

Through monitoring soil conditions, this research aims to help us better understand the ecological mechanisms driving plant community development within tidally restored wetlands. Pre-restoration agricultural sites typically consist of well-drained soils with high oxygen concentrations. Reintroducing tidal flooding saturates the soil, creating an anaerobic wetland environment. In more saline sections of the estuary, this shift in soil oxygen levels is also accompanied by a shift in salinity. The restoration of these tidal wetland dynamics causes a cascade of biogeochemical and microbial reactions in the soil—ultimately affecting plant community establishment. In this study, we monitor these biogeochemical changes using in-situ soil ORP (oxygen reduction potential), pH, and salinity probes across multiple restoration and reference sites throughout the Lower Columbia River Estuary. These data provide insight into factors that drive the continued dominance and spread of Reed canarygrass (*Phalaris arundinacea)*. In contrast to successful native plant communities, Reed canarygrass (*Phalaris arundinacea)* was found to thrive primarily in soil with lower pH and salinity values, and higher ORP levels. The results and methods developed from these soil monitoring efforts can be used to guide continued native plant community restoration and adaptive management efforts throughout the estuary.

Lightning!

Bioenergetic responses of subyearling Chinook salmon in the Lower Columbia River and Estuary

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Jason Toft, University of Washington
Joseph Needoba, Oregon Health & Science University, Oregon
Curtis Roegner, NOAA Fisheries, Northwest Fisheries Science Center, Pt. Adams Research Station, Oregon
Tawnya Peterson, Oregon Health & Science University, Oregon
Catherine Corbett, Lower Columbia Estuary Partnership

Since 2008, the Ecosystem Monitoring Program group of the Lower Columbia Estuary Partnership has monitored the status and trends of rearing conditions for subyearling Chinook salmon in the Lower Columbia River and Estuary (LCRE), including Chinook diets and prey availability. We calculated stomach fullness, energy consumption, and metabolic costs associated with water temperature and Chinook size. Our long-term diet, water temperature, and fish size data primes us to model the bioenergetics of subyearling Chinook salmon to 1) address their spatial and temporal growth trends in the LCRE, and to 2) identify the contribution of variables like temperature, prey quantity and quality to consumption and growth.

Here, we present results from our initial modeling, in which we used the package Fish Bioenergetics 4.0. Ultimately, we intend to calculate the bioenergetics of subyearling Chinook by stock, origin, site, through time, and predictively for changing water temperatures regimes.

Lightning!

The Utility of Tableau for Data Sharing and Analysis

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Derek Marquis, Derek Marquis, Ona Underwood, and Katarina Lunde, Lower Columbia Estuary Partnership

Effectively sharing and analyzing environmental data is essential for guiding restoration and adaptive management efforts. Researchers in the estuary have compiled over a decade of wetland habitat monitoring data, including water surface elevation, temperature, vegetation plots, soil statistics, and sediment accretion measurements. To improve accessibility and usability, we have developed interactive Tableau dashboards that allow project partners to explore site-specific data, download datasets, and engage with pre-structured meta-analyses. These dashboards streamline data exploration, enabling users to visualize trends, compare sites, and assess restoration outcomes without requiring advanced technical expertise. This presentation will demonstrate Tableau's functionality for automating analyses, standardizing reporting, and enhancing data transparency across monitoring programs. By showcasing this approach, we highlight how Tableau can improve efficiency in environmental data sharing and support evidence-based decision-making for restoration practitioners and researchers.

Lightning!

Launching the CEERP Website: Information Access for Science and Practice

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Shon Zimmerman, Heida Diefenderfer, Pacific Northwest National Laboratory
Mark Bierman, U.S. Army Corps of Engineers, Portland District
Jason Karnezis, Bonneville Power Administration
Chanda Littles U.S. Army Corps of Engineers, Portland District
Allan Whiting Bonneville Power Administration

For over two decades, the Columbia Estuary Ecosystem Restoration Program (CEERP) has been pivotal in restoring the Columbia River Estuary, fulfilling the requirements of the Biological Opinions for the Columbia River System. CEERP aims to understand, conserve, and restore estuarine ecosystems to improve habitat quality and capacity, increase access for aquatic organisms, and enhance ecosystem functions for juvenile salmonids and bull trout. In large-scale ecosystem restoration programs such as CEERP, effective science communication improves information access by decision-makers and provides them with efficient information sharing tools. Until now, CEERP lacked a centralized, public-facing platform to communicate its restoration, research, and monitoring outcomes, and connect its communities of practice. To bridge this gap, we developed an external communications plan featuring the launch of a new, comprehensive CEERP website. This website will serve as a public information hub, engaging partners, local organizations, and the general public in the operations of CEERP throughout the estuary. The website will be a repository of information and offer links available from CEERP partners, including published reports and scientific articles. We will showcase CEERP's successful collaborative process and engage with action agencies, restoration sponsors, subject matter experts, and other key contributors to tell the program's story. The presentation will highlight how to navigate the CEERP website and how it enhances public visibility, improves transparency, provides comprehensive programmatic information and visual tools, and establishes a hub for up-to-date information sharing by CEERP partners. The team will also discuss options to leverage creative communications channels to expand the website's reach and further highlight the science-based program to those audiences connected to the Columbia River Estuary and beyond.

Posters

Tidal Swamp Restoration: Progress and Lessons Learned in Oregon and Washington

Jason Nuckols
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Joan Drinkwin, Pacific Marine and Estuarine Fish Habitat Partnership

The Pacific Marine and Estuarine Fish Habitat Partnership (PMEP) has completed a project that serves as a baseline of information on the emerging field of tidal swamp restoration along the U.S. West Coast. This project highlights the rarity of these once common habitats, the importance of these habitats to salmon, the ability of these habitats to store carbon, and the work being done to restore tidal habitats. This presentation will focus on the results of a survey of tidal swamp restoration practitioners.

The field of tidal swamp restoration is new and uncommon, with the earliest documented restoration occurring in 1999, but most others occurring after 2010. This project identified 13 sites that included tidal swamp restoration (usually as a part of a larger tidal marsh restoration project) and surveyed the practitioners involved in that work. Nine projects were located in Oregon and four were located in Washington. This work is particularly important in the Columbia Estuary, where loss of tidal forested wetlands has been extensive (Brophy, et al., 2019). Restoration of these important habitats is critical to fully restore the mosaic of tidally influenced habitats in the Columbia Estuary for the benefits of multiple species.

Information gathered in the surveys included the year and acreage of the swamp restoration project; the methods used; if a reference site was used in the design; the design elevation for the restoration plantings; the vegetation species planted; the presence of invasive species, beaver and large wood; monitoring efforts and any lessons learned.

Since most of this work has occurred relatively recently, the long- term success and the ability of these restoration areas to persist with sea level rise is still unknown. However, survey results inform restoration practitioners about the scale, techniques and project monitoring currently incorporated into these tidal swamp restoration projects. The survey establishes baseline information on tidal swamp restoration sites that can be can be revisited and augmented as new projects are initiated. PMEP has committed to revisiting these projects periodically.

Improving access to ocean and coastal data: How the Northwest Association of Networked Ocean Observing Systems serves the Pacific Northwest

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The Northwest Association of Networked Ocean Observing Systems (NANOOS), the regional association of U.S. Integrated Ocean Observing System (U.S. IOOS) for the United States Pacific Northwest, developed its NANOOS Visualization System (NVS - http://nvs.nanoos.org/) to provide users with a rich interface to access observations, forecasts, and satellite overlays from a wide range of ocean and coastal assets in a user-friendly format. This rich assortment of data streams NANOOS has been able to harness can be overwhelming to users, so we focus on an improved interface for access to ocean and coastal data and models that allows user interface applications (apps) for specific user groups. The technical structure of NVS was made in a way that simplifies the process for developing new and more targeted web apps, saving time and money to program and design apps in the future, thus enabling NANOOS to develop applications tailored to meet specific user needs more readily, such as the NVS Boaters, Fishers, Shellfish Growers, etc. apps. Updates to these apps are made based on feedback from regular user engagement. These new features include the Snapshot tool that allows users to define or "customize" what information is displayed; a Dynamic Range capability that allows users to set their own min and max values for various datasets, and can also be used for higher resolution displays when conditions are similar across the region by selecting "Fit Range to Data"; new forecast overlays for fishers, including bottom oxygen concentrations and SST/Surface Currents set to the optimal temperature for salmon.

Looking Just Upstream: The Palensky Wildlife Underpass

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Palensky Wildlife Underpass exemplifies landscape-scale restoration by enhancing habitat connectivity for multiple species within the Columbia River Estuary. Initially, the Palensky Wildlife Area project focused on fish habitat restoration, bringing together diverse organizations to rejuvenate aquatic ecosystems. Building upon this collaborative success, the underpass project was conceived to address the migratory challenges faced by the Northern Red-legged Frog (Rana aurora), a species of concern in Oregon. By providing a safe passage beneath U.S. Highway 30, the underpass reconnects fragmented upland and wetland habitats, facilitating amphibian movement and contributing to broader ecosystem resilience. This initiative aligns with the conference theme by building on past restoration efforts and expanding their impact to support diverse wildlife populations at landscape scale.

The underpass was strategically located based on years of amphibian migration data collected by ODFW, identifying high-risk road crossings. The final design includes a 54-inch culvert with a natural substrate to mimic existing soils, eight strategically placed light shafts to maintain moisture and visibility, and 600 feet of directional walls to guide amphibians and mammals into the crossing.

Completed in summer 2024, the Underpass marks a step forward in regional habitat connectivity. Early monitoring efforts have already recorded small mammals and amphibians utilizing the crossing, indicating its potential success in reducing road mortality. Post-construction monitoring includes motion-triggered wildlife cameras and amphibian egg mass surveys to track population trends and underpass use.

Looking ahead, additional crossings are being planned at other high-risk sites along Highway 30, including the Harborton Wetland Amphibian Underpass and Crabapple Creek project. Future research will focus on refining design elements, optimizing wildlife usage, and tracking population trends. This project serves as a model for integrating wildlife-friendly infrastructure into regional transportation planning, demonstrating how estuary restoration can extend beyond aquatic habitats to support a range of species and enhance ecological resilience.

Tidal restoration through barrier removal from East to West

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Commonly, tidal restoration practitioners work to remove barriers like roads, levees, and railroads. In doing so, the aim is to improve hydrologic connectivity, allow aquatic organism passage into marsh habitats, increase nutrient and sediment cycling, create storm buffering, and other similar benefits. In collaboration with multiple project sponsors, Inter-Fluve ecologists, engineers, geomorphologists and others work on estuary restoration on the East and West coasts. Restoration in both regions is sensitive to human communities in coastal areas, including infrastructure, ecological values, recreation, and history.

In the Columbia River Estuary projects commonly emphasize endangered salmonid species habitat restoration, whereas in Maine, projects tend to focus primarily on community and infrastructure resiliency in the face of sea level rise. While regional ecosystems, funding, programs, and sometimes even language can differ, restoration values are often more similar than different. Estuary restoration practitioners learn as we go – integrating lessons from implemented projects to new ones. This talk uses multiple project examples from the Columbia Estuary Ecosystem Restoration Program in Oregon and CoastWise program in Maine to share lessons learned across the continent.

New continuous ocean acidification monitoring in the lower Columbia River estuary

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Ocean acidification and hypoxia (OAH) pose serious and increasing threats to coastal ecosystems. In the Northern California Current upwelling system, summertime wind-driven upwelling periodically brings deep, low-oxygen, high-CO2 waters to the coastal zone, where tides can transport them into the lower Columbia River estuary. These OAH events can be stressful or lethal for marine life and have been linked to mass die-offs and shellfish hatchery losses in the region. Long-term monitoring by the Columbia River Inter-Tribal Fish Commission's Coastal Margin Observation and Prediction (CMOP) program has revealed recurring upwelling-driven hypoxia in the lower estuary each summer, with dissolved oxygen concentrations frequently dropping to levels that induce physiological stress in Pacific salmon. However, until now, no parallel long-term ocean acidification monitoring program has been established in this region. Here, we present new continuous ocean acidification data from the lower Columbia River estuary. In late 2023, the Burke-o-Lator ocean acidification analyzer was installed at a dock-based station near Hammond, OR. This system continuously pumps estuary water from ~8.2 meters depth into the analyzer, where it collects high-frequency (sub-minute) measurements of partial pressure of CO2 (pCO2), hourly measurements of total dissolved inorganic carbon (TCO2), and continuous temperature and salinity data. These parameters enable precise, real-time calculations of the full carbonate system. The resulting dataset is publicly available and updated in near real-time, providing a new resource for regional scientists, stakeholders, and policymakers. Observations from the 2024 upwelling season show that the highest pCO2 levels at this station coincided with high salinity and low dissolved oxygen saturation, consistent with the tidal delivery of upwelled waters into the estuary. During these periods, the saturation state of aragonite (Ωarag)—a key parameter for calcifying organisms—sometimes dropped below saturation in the high salinity water. However, the lowest Ωarag values in the dataset were associated with low-salinity, low-alkalinity Columbia River water, indicating that calcifying organisms near the estuary mouth may experience Ωarag stress from both upwelled high-pCO2 ocean water and low-alkalinity river water. The fast-flowing river and strong tidal exchange in the lower Columbia River estuary create a carbonate system that varies dramatically over tidal and upwelling/relaxation cycles. Long-term, continuous ocean acidification monitoring in this system will provide new insights into how ocean acidification interacts with physical and biogeochemical variability in a highly dynamic, river-dominated estuary. These data will be valuable for tracking long-term trends, improving regional models, and informing climate adaptation and resilience strategies.

Assessment of Present Sea Level Trends Affecting US Coasts and Resilience of LCR Wetland Habitats

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Relative sea level change along the US West Coast is not uniform due to regional variations in both vertical land movement and ocean circulation. Over the past 80 years, sea level trends observed at many Pacific Northwest (PAC-NW) tide gauges have indicated a lowering of mean sea level relative to the land surface, due to tectonic uplift. However, present relative sea level trends along the PAC-NW coast indicate that mean sea level is rising relative to land.
If the recent regional trend for relative sea change continues into the future, implications for PAC-NW shorelands could be profound. Instead of realizing a stable or aggregating coastal margin as in the past (i.e., when relative sea level was observed to be falling), many PAC-NW coastal areas could instead exhibit future recessional trends due to relative sea level rise. The PAC-NW coast may be entering an era of sea level rising faster than vertical land movement (tectonics), and the region could be confronted with issues of shoreland loss and coastal habitat squeeze similar to systems along the east and gulf coasts.

The poster will summarize past and present sea level change rates at 18 coastal locations distributed along the US West Coast, Hawaii, Alaska, East Coast, and US Gulf Coast; with a focus on sea level change at Astoria, OR. The poster will compare relative sea level change rates for 1960-2007 and 2007-2024, for all 18 locations. Results will illustrate that present relative sea level rise rates for all 18 locations (2007-2024) appear to be 2-3x greater than during the previous 40+ years (1960-2007). This apparent change in relative sea level rise rate may be due to an inter-decadal cycle or a new long-term trend. In either case, we should be situationally aware.
The poster will provide examples for how different wetland habitat zones within the LCR riparian zone may exhibit resilient capacity to self-adapt in response to future relative sea level change, depending on the terrain characteristics of a given site.