2016 Science to Policy Summit: Climate Change

How vulnerable is the lower Columbia River?

What are we doing about it?

Introduction

The Lower Columbia Estuary Partnership (Estuary Partnership) hosted the ninth annual Science to Policy Summit on Climate Change on Friday, June 17, 2016 at the Vancouver Hilton in Vancouver, Washington. One hundred scientists, community leaders, and natural resource practitioners joined the discussion. Regional experts presented emerging scientific data on climate change impacts on the Pacific Northwest; impacts to tribal culture and landscapes; and the need to improve our decision-making processes. Participants identified how those climate change impacts affect our ability to implement Estuary Partnership actions and how we might adjust activities to adapt to climate changes.

The Science to Policy Summits expand dialog among scientists, practitioners, and community leaders. Each year, we tackle an emerging issue that needs regional attention. Topics covered include habitat restoration, climate change, the Columbia River Treaty, accountability, and toxics.

The Issue

The lower Columbia River is vulnerable to the effects of climate change. Already we are seeing increases in mainstem water temperatures, alterations to flow patterns, losses to valuable snowpack, and shifts in the quality of habitats and the species that live in them. In the lower reaches of the estuary, hypoxia and sea level rise can pose threats to ecological and human communities.

Debrah Marriott, Estuary Partnership Executive Director, opened the day with a charge: Climate change will require us to change our approach to how we protect ecosystems. Rather than making decisions on past impacts, we now must make decisions based on projections. We cannot wait until the damage is done and mitigate for it. We need to gather more data but also act now to protect our natural systems and communities.

After our 2011 Summit on Climate Change, the Estuary Partnership updated our Management Plan actions to incorporate climate change. Since then, National Estuary Programs across the country started examining how specific climate change stressors will affect their ability to implement actions in their Management Plans. And we have learned more. We return to the Climate Change discussion to keep the conversation going, share what we have learned in the last five years, and to gain input from regional scientists and decision makers so we can define specific activities for our implementation strategies and workplans.

Charge for the Day

The Honorable Suzanne Bonamici, United States House of Representatives

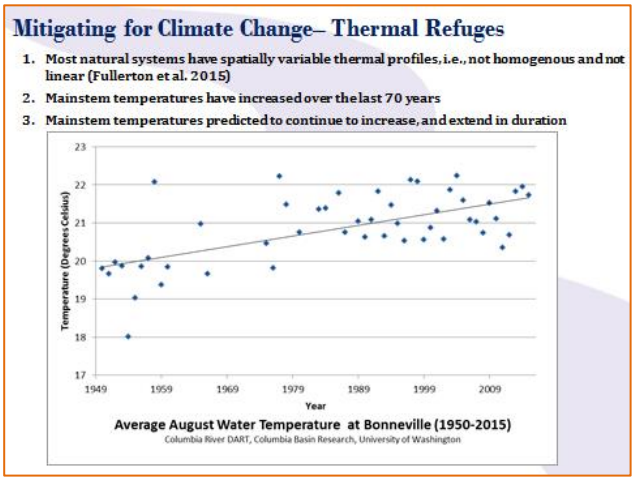
As a member of the Committee on Science, Space, and Technology and the top Democratic member on the Subcommittee on the Environment, Congresswoman Bonamici is working to address causes and risks of climate change and to ensure science-based policy decisions. She encouraged us to help overcome individuals in the House of Representatives - and elsewhere - that still deny climate change. We can promote the science and data that clearly show the climate has changed and will continue to change. We can share how these impacts will affect, directly and personally, businesses and individuals. We can join other voices, like those at a recent Science Committee hearing in which each person who testified was in agreement that humans are a major cause of climate change. She encouraged us in the work ahead. There is a great need to come together to mitigate for climate-related issues.

The Science: Emerging Climate Change Data and Impacts on Columbia River

Catherine Corbett, *Chief Scientist and Technical Programs Director, Estuary Partnership*

Cold Water Refugees Assessment

Predicted climate change impacts on the lower Columbia River include sea level rise, changes in the upwelling patterns, warmer temperatures, changes to precipitation patterns, and vast changes to native habitats. Aquatic organisms, such as salmonids, require specific conditions such as cool water temperatures to survive.



Over the past 70 years, temperatures in the mainstem of the Columbia River have risen and will continue to increase and extend in duration with climate change. Mainstem thermal refuges will be necessary to support migrating juvenile salmonids and returning adult salmonids. Thermal refuges are characterized by pockets of water found at the confluence of tributary streams that are at least 2°C cooler than mainstem water, with a tributary maximum of 19°C, a water depth greater than 0.5 m, and a spatial area large enough to be detected by migrating salmonids. Formation of a thermal refuge is influenced by multiple factors including mainstem and tributary discharge, water temperature differences, bathymetric profile, and atmospheric effects.

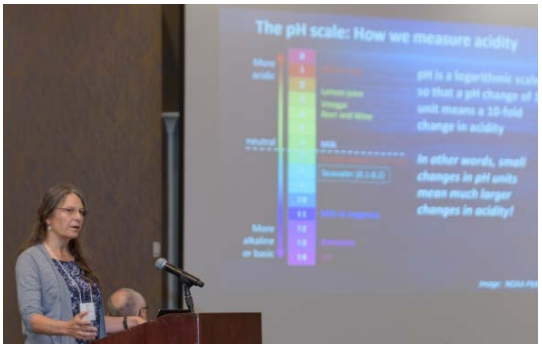
The Estuary Partnership began assessing cold water refuges located at the mouths of Columbia Gorge tributaries in 2015. Preliminary results indicated the presence of cold water refuges on five out of fifteen tributaries surveyed in the assessment. On-going and future cold water refuge monitoring will characterize salmonid use of cold water refuges, identify additional locations, and prioritize actions to protect, restore, and enhance cold water refuge areas.

A paradigm shift in resource management is necessary to mitigate for climate change to maintain flood plain habitats and identify ways to support species ability to adapt to new environmental conditions. To accomplish this, knowledge and leadership is paramount; we need a proactive transition instead of abrupt reactive change.

Jan Newton, *Senior Principal Oceanographer, University of Washington*

Ocean Acidification & Hypoxia

The chemistry of the world's oceans is changing. Anthropogenic carbon dioxide (CO_2) is increasing and causing seawater to become more acidified, threatening the health of coastal ecosystems and industries that depend on them. The threat of progressive lowering of seawater pH (known as ocean acidification) is compounded by climate change and by intensification and expansion of low dissolved oxygen conditions, or hypoxia. Ocean acidification has been shown to affect the survival of some marine organisms, such as oysters, clams, mussels, and planktonic pteropods that use ions dissolved in seawater to form calcium carbonate shells. With rising CO_2, seawater pH drops and the availability of carbonate ions decreases, making it more difficult for these organisms to produce and maintain their shells. Scientists are concerned about impacts to these species and those higher in the food web that prey on these organisms.



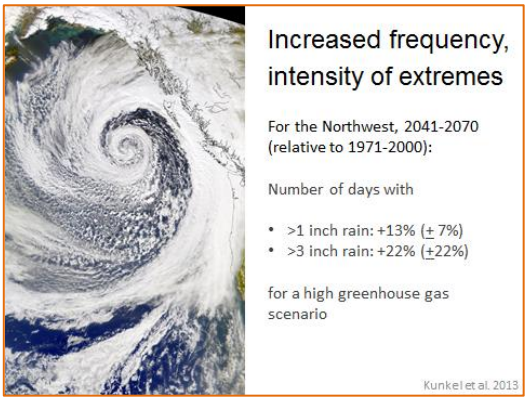
A small change in water pH makes a huge difference in fish survival. Lower pH changes the chemistry within the blood of a fish, requiring it to work harder and burn more energy to excrete excess acid through its gills, kidneys and intestines. It can also alter a fish's behavior, their homing mechanisms, and how they avoid predators.

Effects on aquatic organisms and the food web will be amplified with coastal hypoxia and warming; conditions we are finding in Pacific coast estuaries, including the lower Columbia, through tidal exchange. Additionally, increasing acidification has been shown to make harmful algal blooms grow faster and more toxic. Submerged aquatic vegetation and photosynthesis can offset impacts at the local site scale, but ocean acidification is a global issue and can only be addressed through decreases in CO_2 emissions.

Lara Whitely Binder, Senior Strategist, *University of Washington Climate Impacts Group*

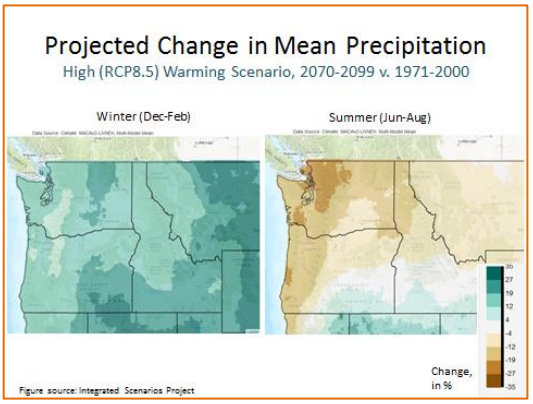
Projected Changes in Regional Climate, Hydrology, and Sea Level Rise

The University of Washington Climate Impacts Group conducts research to provide scientific information to aid in climate science decision making. A series of key physical climate impact drivers exist for natural systems, such as changes to precipitation patterns, hydrology, sea level rise, and ocean conditions.



All climate scenarios currently point to a general warming across the Pacific Northwest (5-10°C increase). Precipitation is more difficult to predict, but scenarios suggest wetter winters and warmer, drier summers in the future, with increased frequency and intensity of extreme events. Pacific Northwest snowpack is particularly sensitive to warming and large-scale losses of snowpack will likely result from even modest temperature increases.

The Columbia River Basin will likely transition from a snow-dominated to a more rain-dominated basin by the 2080s and the Willamette River basin could experience more intense flood events, both of which will affect streamflow patterns in the lower Columbia River. Increased water temperature and changes to flow patterns will impact aquatic life, including salmon stocks that migrate through the estuary. Sea level rise is very place-specific and at a local-scale can depend on a range of factors including land subsidence and tectonic processes.



A key uncertainty is the human response to climate change. Currently, we typically aim to maintain, protect, and preserve what we have today and base restoration actions on historical conditions. We should begin thinking about how to adjust what we are doing now to plan for future scenarios and start restoring habitats for the future.

Michael Karnosh, *Ceded Lands Program Manager, Confederated Tribes of the Grand Ronde*

Climate Change Impacts in the Tribal Cultural Landscape

A Tribal Cultural Landscape is defined as a place that is closely connected to the cultural practices, beliefs, and identity of a group of indigenous people. The Columbia River estuary is considered a Tribal Culture Landscape, with its history as a regional trade highway that connected multiple cultures, villages, and gathering sites. The estuary is an important basis of culture in modern, historic and Ikanham (myth time before Creation) times. Climate change and associated impacts such as sea level rise will likely have detrimental effects on archeological sites, gathering practices, and hunting and fishing grounds. Resources will be lost to rising water levels, and pollutants that already exist in the system could potentially increase from new sources. The risks of climate change are compounded by increasing population and development, and pressure to protect infrastructure and production. The degree and scope of these impacts to cultural resources is not fully known nor are the mitigation measures that will be successful.

There are things we can do. We can learn through research, monitoring of natural and cultural resources, and collaboration. We can put effort into prioritizing and triaging resources, investigating prevention and mitigation tools, promoting awareness among the public, and adapting our actions to prepare for changes ahead.

Tony Grover, *Fish & Wildlife Division Director, Northwest Power & Conservation Council*

We Have the Data & Science, It's Time to Act

The data and science clearly show that climate change is happening and the associated impacts are occurring at an accelerated rate. Yet, we are not taking the action required to account for future conditions that will result from climate change. Humans have a propensity for "folly" that leads us to carry out self-destructive acts despite the availability of a recognized and feasible alternative.

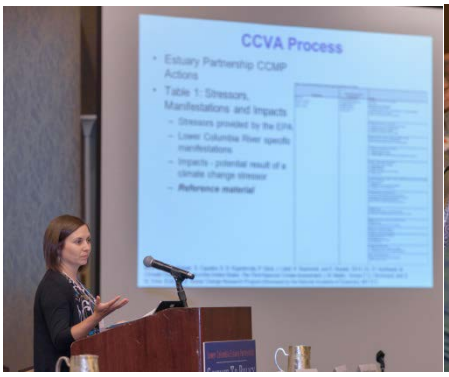
We can do better. We have the opportunity for change in the region's work to restore Columbia River estuary habitat. We can integrate climate change and resulting impacts (such as sea level rise) into restoration planning and accept uncertainties of climate change scenarios into our planning. We can develop new criteria that prioritize habitat actions with both near-term and long-term benefits – even if those benefits are approximate and might change over time. Actions that do not have a clear succession of near- to long-term benefits should not be implemented. We have the data and science at our fingertips; we can choose to act in such a way that takes future conditions into account, leading to better outcomes for habitat and for fish and wildlife.

Key Message

The Honorable Earl Blumenauer, U S House of Representatives

The Honorable Earl Blumenauer joined us to talk about what is ahead for the United States. He feels passionately about the role that the Estuary Partnership plays in Oregon and Washington and was encouraged by the meeting of scientists and the policy experts in the room. He noted that if the membership in Congress changes, there is potential for significant gains in climate change policy decisions. Attitudes toward climate change across the nation are changing and he notes that we soon will look back on this period in time and wonder why we debated so long over these issues. Congressman Blumenauer envisions some of the most important climate change policies will be enacted in the next decade. He challenged us to continue to do our part and to maintain focus because every portion of this work is vital to our long term health and vitality as a region and nation.

The Science to Policy



Attendees convened in small groups to discuss how climate change stressors can affect the ability to implement the Estuary Partnership Management Plan actions; what the Estuary Partnership can do to address impacts; and the barriers and challenges that exist to address climate change. Several themes emerged.

How does climate change affect our ability to implement CCMP actions?

- Shifts in habitat conditions will lead to changes to how we prioritize, inventory, and monitor habitats and the species that use these habitats in the lower Columbia River.
- Some habitats will be more susceptible to change than others, such as inland movement of wetlands and increased salinity intrusion due to sea level rise, indicating potential losses to previously restored habitats and habitat function.

- Altered timing and reduced flows in the Columbia River basin will impact the availability of water to a range of users, change sediment dynamics, and modify habitat and migration corridors needed by species we strive to manage and conserve.
- Increased water temperatures could negatively affect aquatic species health and allow for non-native species to invade and outcompete native, cool water species.
- Changes to frequency and magnitude of precipitation events, could overwhelm stormwater and wastewater systems, increase erosion, and suspend pollutants into the waterways that we are attempting to keep clean.

What can the Estuary Partnership do to address climate change?

- Education is key. Reach out to the public, policy makers, and land owners about the potential effects of climate change and how to prepare for a changing environment to leave a better legacy for our children. Introduce younger generations to the issues surrounding climate change so they will be the voices of the future.
- Encourage collaboration and strengthen relationships between regional entities (states, municipalities, tribes, develop a citizen science monitoring network) to ensure policies and regulations are applied to warrant greater effectiveness of climate change planning and management actions. Develop outreach aimed at land users, integrate regional monitoring and research plans, and establish a data sharing network.
- Focus on preserving and restoring ecosystem function as a marker of restoration success and continue to monitor and track habitat restoration success over the long-term.
- Increase monitoring and data collection (e.g., hydrodynamic and groundwater modeling, contaminant source and vector monitoring, cold water refuges areas). Ensure that decision makers are provided with the most current scientific data so they can make sound adaptive management decisions.
- Promote and develop comprehensive management plans for sediment placement, contaminants and conventional pollutants, and floodplain management that account for climate change stressors (sea level rise, flow alterations) and incorporate new targets to balance new norms with ecological needs.
- Support and promote ecologically sensitive components and recommendations under regulatory actions such as the FCRPS Biological Opinion and Columbia River Treaty. Support elected officials who have aligned interests and connect climate change impacts to economics and industries that politicians care about.

What are Challenges and Barriers?

- Lack of available monitoring and research data will challenge our ability to plan for stressors associated with climate change (e.g., ground water, contaminant and conventional pollutant sources, invasive species responses).
- Limited funding, resources, and staff currently available for monitoring, research, climate change planning, and education programs.
- A high degree of uncertainty about future conditions and ecological complexity exists within the lower river, making it difficult to plan for climate change and to predict which actions will most effectively reduce or mitigate impacts.
- It can be difficult to change mindsets and behaviors about climate change and to overcome the business-as-usual inertia to effectively plan for the future.
- Out-dated infrastructure such as storm water and wastewater facilities could be overwhelmed by impacts associated with changes to precipitation patterns, river flow, and sea level rise. The cost of upgrading to more sustainable designs or re-building facilities can be very high.
- Climate change may not be compatible with regional conservation goals, funders' interests, or mitigation requirements. Collaboration could be a slow process given that priorities and protocols can differ widely between agencies.
- The pressures of increased population growth will intensify climate change impacts by reducing available land, increasing pollutant levels, and water use demands.

Closing: The Challenge

Dan Opalski, *US EPA Region 10, Director of Office of Water and Watersheds*

Where do we go from here?

Dan closed the summit with a challenge, asking us to consider four things.

1) Think aquatically, but act terrestrially

This year's Summit provided a wealth of important details about current climate science in the Pacific Northwest. We each have a significant role to play in addressing emissions, but even under the best-case climate scenario; it will take many of us working together and individually to reduce emissions.

2) Think estuarily, but act tributarily

There is great uncertainty surrounding the functions that tributaries are providing which will help recover the mainstem Columbia River. A collection of projects on the tributaries may be the factor that saves critically impaired species.

3) Think ecologically and act electorally

We all need to engage ourselves to find out which political representatives are on what side of the issues related to climate change. Attend policy forums, public hearings, and *participate*.

4) The Positives

One of the strengths of the Estuary Partnership structure is that brings scientists from across the region together – with decision makers. Much of the emerging data on climate change and sea level rise are not available to the EPA yet. Forums like this Summit allow for conversations to build momentum and form a robust consensus on decisions needed to move forward to address climate change.

Dan highlighted the importance of education and outreach to understand the concerns, questions, and processes of builders and other communities that will be impacted by climate change. Providing informed communication about climate change to our children will be their legacy. What we learn and teach will be the foundation of knowledge needed to address the problem.

Next Steps: Where We Go from Here

National Estuary Programs are assessing the impacts of seven climate stressors in our local areas and how those stressors might affect our ability to implement actions in our Management Plans and workplans. By 2020, all NEP workplans will incorporate goals and actions that mitigate for climate change stressors. The Climate Change Stressors: warmer summers (overall climate); warmer winters (overall climate); warmer water; increasing drought; increasing storminess; sea level rise; and ocean acidification.

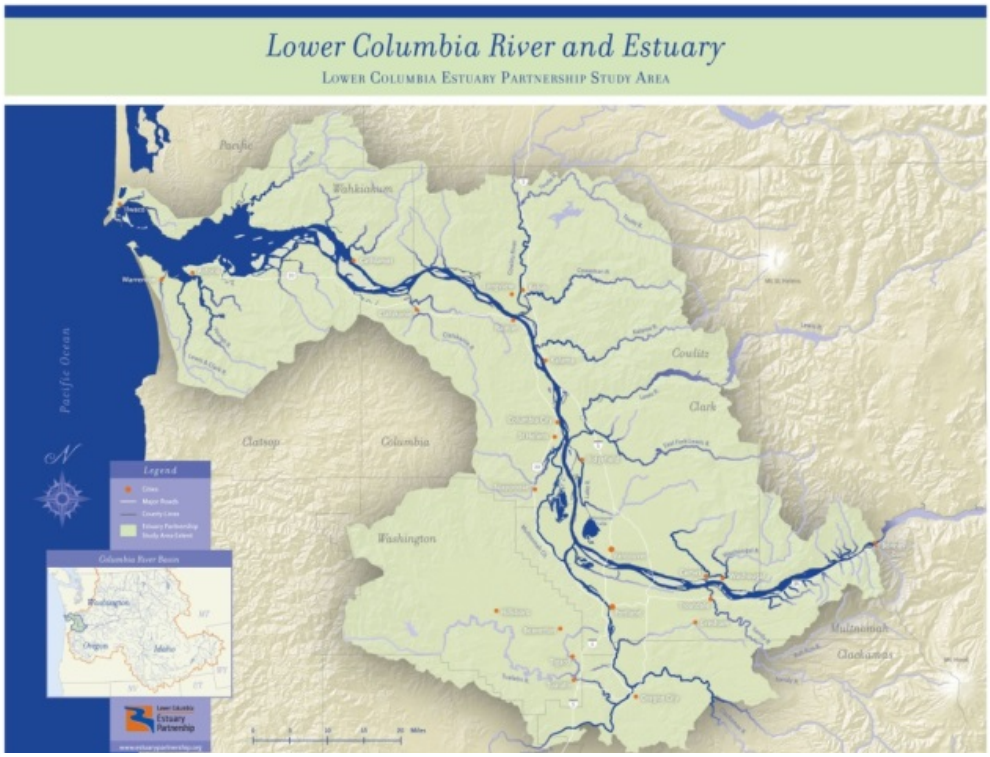
This is our part of the NEP climate change assessment process. We have identified the current and potential impacts of the climate stressors. We will look at risks and characterize the consequence to our actions, the likelihood of the risk occurring, the spatial extent, the time horizon, and the habitat types impacted. We then will take a closer look at the risks to determine which ones we can move forward to address.

The Estuary Partnership Board of Directors will develop the next six year implementation strategy for 2018 – 2024. This assessment and the discussions at this Summit will help the Board decide which climate changes stressors are affecting the lower river the most, and which are affecting our ability to implement our actions. This will shape the activities for the Estuary Partnership for the next six years.

The Estuary Partnership

The Estuary Partnership was created in 1995 by the governors of Washington and Oregon and the US Environmental Protection Agency when the lower Columbia River was designated 'an estuary of national significance,' making it one of 28 National Estuary Programs. To address the more than 50% habitat loss and contaminated water, sediment and fish tissue, they wanted an entity to provide regional collaboration, unify efforts, and fill gaps to advance on-the-ground improvements.

We develop and manage habitat restoration projects, working with hundreds of partners to restore over 22,685 acres of habitat since 2000. We developed a scientific framework to assure our investments in restoration are strategic and cost effective. We monitored toxics in the lower river and focus on reducing toxics. We provided 67,219 students with over 332,125 hours of instruction in outdoor education programs; helping over 2,985 teachers meet science benchmark requirements. Over 12,064 volunteers and students have planted over 92,760 native trees and shrubs to protect riparian corridors and restore habitat.



Estuary Partnership Study Area:
The lower 146 miles of the Columbia River from Bonneville Dam to the Pacific Ocean.

For more information about the Estuary Partnership, please visit our website: www.estuarypartnership.org.

Lower Columbia Estuary Partnership