

RECLAMATION

Managing Water in the West

Technical Report No. SRH-2013-02

Summary of Elwha Science Symposium Event – August 2012



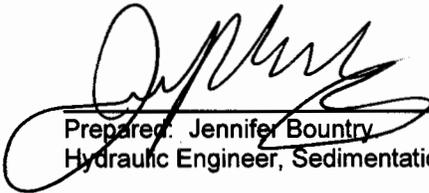
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BUREAU OF RECLAMATION
Technical Service Center, Denver, Colorado
Sedimentation and River Hydraulics Group, 86-68240

Technical Report No. SRH-2013-02

**Summary of Elwha Science Symposium Event –
August 2012**


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1-8-13
Date


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1-8-2013
Date

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Overview

The Elwha Science Symposium occurred the week of August 20, 2012 in Port Angeles, WA. The planning committee consisted of members from Bureau of Reclamation, USGS, NOAA, USFWS, NPS, Elwha Tribe, and local support from Peninsula College and Nature Bridge. Planning occurred from November 2011 to August 2012 with mostly monthly meetings at first that increased to weekly meetings the month before the event. Funding was provided by the Science and Technology program for Reclamation to help with the planning, for a few participants to attend the event, and to test a remote broadcast tool to allow greater access to the event for people interested but not able to travel. From the Technical Service Center Jennifer Bountry, Tim Randle, and Paula Makar attended. Rob Richardson from the PN Regional Office attended. Substantial in-kind assistance from other committee members contributed to the success of this event.

Goals

The goals of the symposium were identified by the planning committee as follows:

- Develop a cross-disciplinary understanding of the status of the Elwha River Restoration Project through sharing and discussing research monitoring results.
- Provide forums to share and discuss research status and plans.
- Encourage cross-discipline and inter-agency/institutional collaborations.
- Listen and learn from other dam removal projects.
- Provide outreach to the public (lectures, media).
- Provide outreach to scientific colleagues (lectures, media).
- Facilitate these outreach events with real-time web-broadcast lectures and interactive feedback using technology transfer.
- Document important conclusions from the Symposium.

Agenda and Feedback

The symposium consisted of two public events that were remotely broadcast and video taped, a field trip, and two days of science workgroups where there was a mix of speakers and discussion time [see Appendix A for detailed agenda and Appendix B for press release for event]. There were about 200 unique people that attended the various events in person. About 100 came to the 2-day science conference at Nature Bridge. The online attendance was: 25 unique viewers on the Monday night event (average watch time was 1 hour), and 34 unique viewers for the Wednesday morning event (confirmed from WA, CA, CO, ID, NC and one from Sweden! - all stayed for the entire event). Overall feedback heard from participants was:

- Event was well run and participants enjoyed having the Elwha Tribe bring their cultural perspective to the event
- Participants really appreciated having an interdisciplinary approach to presentations that allowed everyone to interact and all hear the same information

Approximately 50 people attended an all day field trip, including Congressman Norm Dicks and his staff who has been a long supporter of the project. Many scientists from other dam removal projects also attended, and then later had a chance to tell the Elwha workgroup about their lessons learned and provide feedback on data gaps and interdisciplinary integration ideas. The field trip offered an interdisciplinary look at real-time project responses in sediment, vegetation, fisheries, ecology, and cultural components.

A poster session offered another opportunity for scientists to share ongoing work, including many students. This is another opportunity that allowed peers to engage in productive discussions and share ideas that could not be easily broadcast.

Outreach Tool Evaluation

Testing of a remote broadcasting tool, Blackboard Collaboration, was accomplished by funding Peninsula College to broadcast the Monday evening and Wednesday morning presentations, and further allow participants to submit questions during the Wednesday event that were then posed to the speaker panel during a discussion period. Appendix C provides information and feedback from the technical lead for this component. General lessons learned included –

- The technology is readily available to support live broadcasting of presentations and allow remote participants to submit questions and participate in the discussion. It requires adequate internet connections and someone knowledgeable with the selected tool to run the event. This type of event requires adequate notification of the event and the tool to be established ahead of time for both participants and presenters to test it out and become familiar with it.
- Even with an experienced programmer, we lost some of the video capture component that did not affect real-time broadcast but affected the ability to share presentations to other non-attendees down the road.
- It is important to use microphones to capture speaker and local audience questions to allow online participants to clearly hear discussions. It is important to have someone monitoring online questions and be charged with working with a moderator to integrate the questions into the discussion.
- With the Blackboard Collaboration tool utilized, presentation file size had to be limited in size or load time at beginning of presentation delayed start up. Video or live broadcast with a video camera could be broadcast real-time but animations within a powerpoint could not be utilized.
- The event encouraged sharing of hot off the press monitoring and research findings from the real-time dam removal without having to wait until information was officially published.
- Remote participation was broad in geographical extent, including one international person. However, not many Reclamation staff participated. It is hypothesized that it is difficult for someone in the office to take time for training provided remotely when other pressing deadlines and priorities are present. It is assumed that when people register and take the time to travel to a conference they are more committed to watching and engaging in the presentations. There is also a valuable component to interacting with other professional peers not just during presentations but during other events that took place at the symposium. This helped spur future collaborations that will take place on the Elwha and other projects.

Appendix A Symposium Agendas

2012 Elwha Science Symposium Public Forum

Date: Monday August 2012, 6:30-9:00 PM

Location: Peninsula College Little Theater

THIS EVENT WILL BE FILMED AND MADE AVAILABLE FOR PUBLIC VIEWING ON THE INTERNET. SEE <http://www.pencol.edu/events/elwha-science-symposium> FOR MORE INFORMATION

6:30-7:00 Doors Open/Poster Viewing

7:00 – 7:05 Welcome by host, on behalf of Symposium Committee (Dean Butterworth, ONP)

7:05 – 7:20 Introductions to Elwha River Restoration

- Todd Seuss, Acting Superintendent, Olympic National Park
- Dr. Luke Robins, President, Peninsula College
- Frances Charles, Chair, Lower Elwha Klallam Tribe

7:20 – 7:40 A Visual Tour of the Elwha River Restoration (John Gussman)

7:40 – 8:10 The Elwha River Restoration – Perspectives (Lynda Mapes, Seattle Times)

8:10 – 8:25 The Science Behind the Story (Jeff Duda)

8:25 – 8:40 Questions and Discussion (Dean Butterworth moderates)

8:40 – 9:00 Poster Session and 1-on-1 Q&A with science community

Host/Facilitator: Dean Butterworth, ONP

Tech Support: Eric Waterkotte, Peninsula College

2012 Elwha Science Symposium

Wednesday Science Forum

Date: Wednesday 22 August 2012, 9:00 – 11:30 AM

Location: Peninsula College Little Theater

THIS EVENT WILL BE SIMULCAST ON THE INTERNET, AND RECORDED FOR LATER VIEWING. MORE INFORMATION AVAILABLE AT: <http://www.pencol.edu/events/elwha-science-symposium>

9:00-9:15 Introduction and Project Overview (Jeff Duda)

9:15-10:45 10-minute presentations by Panelists with a focus on representing the breadth of work in their discipline

- 9:15-9:30: Brian Krohmer (Dam Removal/Engineering)
- 9:30-9:45: Tim Randle (Reservoir/River)
- 9:45-10:00: George Pess (River Geomorphology)
- 10:00-10:15: Guy Gelfenbaum (Coastal Geomorphology)
- 10:15-10:30: Mike McHenry (Ecology/Fish)
- 10:30-10:45: Josh Chenoweth (Vegetation)

10:45-11:30 Questions to panel from the live and on-line audience

Technical Support: Eric Waterkotte

Question Screener: Jennifer Bountry/Others

2012 Elwha Science Symposium

Wednesday & Thursday Workgroups

Wednesday

August 22, 2012

2:00 PM **Welcome and Reservoir Session Introduction - J. Warrick (USGS), J. Bountry (Rec)**

2:15 PM **Andy Ritchie** (NPS) - *Evolution of Aldwell and Mills reservoir reaches during dam removal - Water Year 2012*

2:30 PM **Tim Randle** (Rec) - *Elwha River Restoration Sediment Management*

2:45 PM **Josh Chenoweth** (ONP) - *Vegetation Development in the Newly Exposed Surfaces of the Former Lake Aldwell and Lake Mills Reservoirs*

3:00 PM **Heidi Hugunin** (NPS) - *From a reservoir to a river: observations of a rapidly changing environment.*

3:15 PM **Reservoir discussion**

3:30 PM

3:45 PM **Break**

4:00 PM **Lessons Learned Session Introduction - Jon Warrick (USGS)**

4:15 PM **Andrew Wilcox** (U Montana) - *Experiments in sediment pulses and geomorphic response: lessons from the Milltown and Condit dam removals*

4:30 PM

4:45 PM **Jon Major** (USGS) - *Sediment dynamics during the Marmot and Condit dam removals.*

5:00 PM

5:15 PM **Rod Engle** (USFWS) - *The Condit Dam Fish Story - Removal preparations and recolonization*

5:30 PM

5:45 PM **Lessons Learned Discussion**

6:00 PM

6:15 PM **Dinner**

2012 Elwha River Science Symposium - Speaker Schedule (continued)

Thursday

August 23, 2012

9:00 AM **River Session Introduction - George Pess (NOAA)**

9:15 AM **Chris Magirl** (USGS) - *Suspended-sediment load in the lower Elwha River during early stages of dam decommissioning*

9:30 AM **Jennifer Bountry** (Rec) - *River channel predictions and findings from the adaptive management sediment monitoring program*

9:45 AM **Amy Draut** (USGS) - *Sedimentary deposits and processes on the lower Elwha river during dam removal*

10:00 AM **Andy Ritchie** (ONP) - *Prelude to un-dammed: Elwha River reach-scale response to sediment and wood releases from dam removal through August 2012.*

10:15 AM **Break**

10:30 AM **John McMillian** (NOAA) - *Monitoring recolonization of salmon and steelhead in the Elwha River through photography and science*

10:45 AM **Keith Denton** (NOAA) - *SONAR in the Elwha: Seeing Through the Dirt*

11:00 AM **Pat Crain** (NPS) - *Update on fisheries investigations in the Elwha River*

11:15 AM **Sarah Morley** (NOAA) - *Benthic foodweb dynamics post dam removal - preliminary observations*

11:30 AM **River discussion**

12:00 PM **Lunch**

12:30 PM from bagged lunches made in AM

12:45 PM at NatureBridge

2:00 PM **Nearshore Session Introduction - Jeff Duda (USGS)**
2:15 PM **Matt Beirne** (LEKT) - *Elwha Estuary observations during dam removal*
2:30 PM **Anne Shaffer** (CWI) - *Long term fish use of the Elwha River nearshore*
2:45 PM **Jon Warrick** (USGS) - *The turbid coastal plume of the Elwha River during dam removal*
3:00 PM **Ian Miller** (WA SeaGrant) - *Rapid shoreline response to sediment discharge during Elwha River dam removal*
3:15 PM **Emily Eidam** (UW) - *Fine-grained sediment dispersal and deposition across the Elwha Delta: An update*
3:30 PM **S. Rubin and N. Elder** (USGS) - *Changes to the Shallow Subtidal Benthic Community near the Elwha River mouth in Year One of Dam Removal*
3:45 PM **Nearshore discussion**
4:15 PM **Poster Session - Intro**
5:00 PM Poster Session
6:00 PM **Dinner**
6:15 PM Salmon Bake
7:30 PM **Evening Program**
7:45 PM **Jaime Valadez** (award-winning Klallam language teacher & historian)
8:00 PM **River as Spirit: Rebirth of the Elwha**, 30-minute documentary by Leaping Frog Films

Appendix B: Press Release for Event

August 13, 2012
For Immediate Release

NPS Contact: Barb Maynes barb_maynes@nps.gov
360-565-3005
USGS Contact: Jonathan A. Warrick jwarrick@usgs.gov
831-566-7206
Reclamation Contact: Peter Soeth psoeth@usbr.gov
303-445-3615

Scientists to Share Effects of Elwha Dam Removal at Free Public Events, Streamed Live Online

Port Angeles, Washington - Restoration of the Elwha River, including the Nation's largest dam removal to date, is the backdrop for the second Elwha River Science Symposium, scheduled for August 20 through 24 at the campuses of Peninsula College and NatureBridge Olympic National Park. The symposium will feature presentations of recent scientific studies, as well as lectures from nationally-recognized scholars in the fields of fisheries biology, geomorphology, ecosystem health and dam removal and river policy.

Two free events will be offered for the public at Peninsula College's Little Theater, and live streamed live online. On Monday, August 20 at 6:30 p.m., the public is invited to an overview and update on the Elwha River Restoration Project. Dr. Luke Robins President of Peninsula College, Todd Suess, Acting Superintendent of Olympic National Park, and Frances Charles, Chairwoman of the Lower Elwha Klallam Tribe, will open the program. Featured speakers include Lynda Mapes, a Seattle Times reporter and John Gussman, a Sequim-based cinematographer. An informal poster session will follow the presentations, with scientists available to answer questions.

On Wednesday, August 22 at 9:00 a.m., the public is invited to join a panel of experts for two hours as they discuss what they've learned during the first year of the project. Panelists include Brian Krohmer, Project Manager for Barnard Construction, Tim Randle, Hydraulic Engineer for the Bureau of Reclamation, George Press, Fisheries Biologist for the National Oceanic and Atmospheric Administration (NOAA), Guy Gelfenbaum, Coastal Geologic and Oceanographic Researcher for U.S. Geological Survey (USGS), Mike McHenry, Fisheries Habitat Biologist for the Lower Elwha Klallam Tribe, and Joshua Chenoweth, Botanical Restorationist for Olympic National Park. The presentations will be followed by a question and answer session with both live and on-line audiences.

A live webcast of both events will be available for those who cannot attend in person. More information on the live webcasts can be found at:
<http://www.pencol.edu/events/elwha-science-symposium>.

The symposium is being planned and organized by members of the Elwha Research Consortium (ERC), a strategic partnership of government agencies, research and educational institutions, and community groups focused on understanding the social and ecological effects of dam removal and restoration activities in the Elwha River watershed. ERC member organizations include the U.S. Geological Survey, Olympic National Park, Reclamation, Elwha Nearshore Consortium, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration and Peninsula College.

More information on the Elwha River Science Symposium can be found at elwharesearchconsortium.wildapricot.org

Appendix C: Email Copy of Summary of Remote Broadcasting

On 8/23/2012 4:41 PM, Eric Waterkotte wrote:

Greetings All,

I wanted to take a minute to summarize and share a few notes about the online components of the Elwha Science Symposium events Monday night and Wednesday morning. First, I would like to share how impressed I am with how flexible, spirited, fun and cooperative the group was. In short, you are all great people to work with. Now, let's look at some highlights from Monday and Wednesday.

Monday Evening Public Event

According to the statistics I was able to pull from the streaming service, we had a total of 25 unique viewers who viewed the live webcast from remote locations on Monday night. The interesting thing for me to notice was that we had a total of 24 total viewing hours which means people out there tuned in, collectively for 24 total hours which means most people who watched the webcast watched the entire thing or at least 90% of it.

Wednesday Morning Presentations and Panel Discussion

As far as total online participants, we had a total of 34 online participants not including those of us connected to the online presentation from the Little theatre. While I don't have a complete list of full names and locations, I can report that we had folks who logged in from neighboring towns like Sequim as well as several folks from California, Colorado, Idaho and North Carolina. Internationally, we had one confirmed participant from a University in Sweden. Again, the participants didn't just log in, check it out and then leave, they logged in and stayed. In total, we had about 5 questions from the online audience which were presented and answered by the panel.

Recordings

Before I publish links to the recordings, I would like you all to take a moment to watch them. The recording from Monday night does not include John Gussman's portion by request from Mr. Gussman. I have edited that part out and published the video to a secure location on the College's Vimeo Channel. When you click on the following link, <https://vimeo.com/48041194> you will have to enter the password: **1MightyRiver!** I will be happy to share the video with the rest of the world once everyone feels comfortable with what is being shared. All I need to do is remove the password and add the video to the Symposium webpage on the Peninsula College website. Anyone else who wants to link to it or embed the video on their website will be free to do so after you all have reviewed the video.

Wednesday's recording was made using the Blackboard Collaborate recorder and I am sad to report that somehow it didn't record the first three presenters. I tried everything I could to recover the first portion of the presentation's recording to no avail. So, the recording we have starts with Guy Gelfenbaum and concludes after the end of the panel discussion. I am very sorry about this error, I am still investigating what caused the first portion of the recording to fail. Keep in mind that when playing the Wednesday recording, you will be using the Blackboard Collaborate web application. I have verified the audio and video so if you have any trouble hearing the recording, make sure your audio is configured properly on your computer. For help, visit

<http://support.blackboardcollaborate.com/ics/support/default.asp?deptID=8336&task=knowledge&questionID=1473>

Here is the link to Wednesday morning's recording: [View the Blackboard Collaborate recording](#)

Full URL: <https://sas.illuminate.com/site/external/jwsdetect/playback.jnlp?psid=2012-08-22.0901.M.DD3089AEBF13E61CD88084C0C05F6B.vcr&sid=2008170>

Final Thoughts

I am personally very pleased with how the webcasts turned out despite some little glitches. This was a first for the College in terms of the scale for this type of webcast. I cannot express enough, my gratitude for the planning and execution particularly with Wednesday morning's event. For all of you who jumped in and helped out, Jennifer, Pam, Jeff, the entire committee and to all of the presenters, thank you for being flexible and willing to try something new. While I will be ending my time at Peninsula College in my current role as Instructional Designer, I am pleased to share that I will be sticking around in a faculty capacity developing a new program for Cyber Security. I wish you all the best of luck with your research and efforts to restore the Elwha.

Sincerely,

Eric Waterkotte



Appendix D: Poster Abstract Summary

LOWER ELWHA RIVER SEDIMENTATION IMPACTS MODELING PROJECT

Mark Beggs, Marshall Kosaka, Anna Sigel, Renee Vandermause, J. Wesley Lauer

Seattle University, Department of Civil and Environmental Engineering (MB, MK, AS, RV, JL)

Prior to the start of dam removal, over 21 million cubic yards of sediment had accumulated in the reservoirs above the Elwha and Glines Canyon Dams. A portion of this sediment will erode and then be deposited on the downstream river bed and floodplain as dam removal progresses. To address uncertainty in downstream response to the project, the United States Bureau of Reclamation is implementing an adaptive management plan that relies upon continuous monitoring of water levels at a set of stream gages. To interpret the monitoring data and to rapidly assess the rate of downstream sedimentation, we developed rating curves at several key locations along the lower Elwha River. The curves consider a range of possible sedimentation scenarios, each involving different sedimentation levels and/or locations. One scenario considers sedimentation primarily in the river channel, another considers sedimentation primarily on the floodplain, and a third considers both possibilities together. Each scenario was represented in an existing U.S. Army Corps of Engineers HEC-RAS model from which rating curves were produced. Additionally, an independent 2-dimensional model was developed using the Bureau of Reclamation SRH-2D program. The 2-D model results were used to improve the representation of spatial variability in likely floodplain sedimentation. In general, results show that floodplain sedimentation is not as likely as in-channel sedimentation near riffle crests to appreciably alter flood hydraulics along the Lower Elwha River.

VALUING THE RETURN OF ECOSYSTEM SERVICES TO THE ELWHA RIVER

Richard Bishop, Jim Boyd, David Chapman, Anthony Dvarskas, Colleen Donovan, Peter Edwards, John Duffield, Megan Lawson, John Loomis

University of Wisconsin-Madison (RB, DC, CD, ML), Stratus Consulting (RB), Resources for the Future (JB), National Oceanic and Atmospheric Administration (AD PE), University of Montana (JD), Colorado State University (JL)

The National Oceanographic and Atmospheric Administration (NOAA) is investigating methods to determine economic benefits arising from habitat restoration. The Elwha River Floodplain Restoration Ecosystem Service Valuation Pilot Project will be NOAA's first effort to develop these metrics.

Removing the dams on the Elwha River marks the beginning of a long process towards ecosystem recovery. As the river returns to a free-flowing state, components of the ecosystem such as salmon and wildlife will eventually return to the watershed as well. While we know that salmon and wildlife are critical to the ecosystem, we do not know how people value them.

This project is designed to capitalize on Elwha River restoration efforts to allow NOAA to better understand how people think about ecosystem service measures and to value changes in ecosystem services associated with river habitat restoration. It will measure the combined use and nonuse value of alternative restoration activities. A person's use value may include fishing, birdwatching, or sightseeing on the Elwha River. Restoration actions may also be important to people throughout the Northwest, regardless of whether they visit the Elwha River. This type of value is called a *nonuse* value. Nonuse values associated with habitat restoration activities may be significant because these activities will restore the river to more natural conditions, restoring populations of salmon, other fish species, and wildlife.

We are in the final stages of survey development to determine how people in the Northwest feel about efforts to accelerate the return of ecosystem services to the Elwha River.

ELWHA RIVER RESTORATION: SEDIMENT MANAGEMENT

Jennifer A. Bountry, Timothy J. Randle, Andy Ritchie, Heidi Hugunin, Anna Torrance

U.S. Bureau of Reclamation, Denver, CO (JAB, TJR), National Park Service, Port Angeles, WA (AR, HH, AT)

The 1 to 2 year removal of Elwha and Glines Canyon Dams relies on controlled reservoir drawdown increments and natural river flows to erode and redistribute the reservoir sediment, estimated to be a total of 24 million yd³. To mitigate for the predicted sediment effects, facilities have been constructed for water quality and flood protection, including water treatment plants, new wells, a new surface water intake, raising the height of existing levees, and the construction of new levees. A sediment monitoring program is being implemented by an interdisciplinary team from Reclamation and National Park Service to integrate real-time measurements with continually updated numerical model predictions. The most recent numerical reservoir modeling and monitoring results indicate about 50 percent of the reservoir sediment will remain in the reservoir while another 50 percent is predicted to be released downstream during dam removal and a few high flood periods following the completion of dam removal. Early monitoring results confirm that lowering the reservoir pool in a controlled increment, and then holding the reservoir pool at constant elevation, is inducing sufficient vertical and lateral erosion of the exposed delta surface. Predam channel and floodplain surface has been exposed in numerous portions of Lake Aldwell. Dam removal is about halfway completed at Lake Mills and the first wave of coarse bedload sediment is expected to be released in late fall of 2012.

THE POLITICS AND CULTURE OF DAM REMOVAL IN THE NORTHWEST

Peter Brewitt

University of California, Santa Cruz

Politics is perhaps the biggest issue in dam removal. In this study I compare the stakeholder dynamics and political venues of three major northwestern dam removals: the Elwha dams (Elwha River, WA), Savage Rapids Dam (Rogue River, OR), and Marmot Dam (Sandy River,

OR). My findings will be applicable to many cases in the near future, as aging structures and depleted ecosystems make dams a vital issue across the region. While each dam and each river is unique, the political landscape presents similar challenges and possibilities for many of them.

Environmental politics in the United States offers many ways for advocates to access power. Preliminary data indicate that while it is important for dam removal proponents to build broad advocacy coalitions, removals can be delayed or derailed by opposition from even one politically adept individual. While the primary resistance to dam removal tends to come from local communities, the issue's movement to state or national venues may result in stronger opposition and greater challenges for removal advocates.

ELWHA RIVER RIPARIAN VEGETATION: BASELINE STUDIES PRIOR TO DAM REMOVAL

Rebecca L. Brown, Patrick B. Shafroth, Aaron J. Clausen

Eastern Washington University, Department of Biology (RLB, AJC), U.S. Geological Survey, Fort Collins Science Center (PBS)

Elwha River riparian vegetation communities are highly diverse and influence instream and terrestrial habitat of salmonid, aquatic invertebrate, and wildlife populations. Floodplain vegetation dynamics are largely driven by stream flow regime, and fluxes of sediment and large woody debris, all of which are being altered by dam removal on the Elwha. To characterize vegetation composition, structure, and diversity, we sampled 70-150 vegetation plots in 2004, 2005, and 2010 along five cross-valley transects in each of three river reaches: above both dams (reference), between the dams, and downstream of both dams. Plant community distribution on bottomland geomorphic surfaces is typical of other systems in the region. We identified 8 overstory and 26 understory communities using multivariate analyses. We found that overstory species composition was more stable from 2005 to 2010 than understory, that understory species composition was more influenced by reach than overstory, and that communities (particularly understory) on younger landforms were less stable. There were fewer young landforms/communities in the middle reach, suggesting they were stabilized by the dam. We found that native plant species richness was >25% lower downstream from both dams compared to the upstream reach in both 2005 and 2010; exotic species richness had the opposite pattern. Overall, our results suggest that the dams may significantly reduce native plant diversity in downstream reaches and that understory species composition is more greatly affected than overstory. Our data provide a baseline for monitoring long-term riparian vegetation responses to dam removal.

LOWER ELWHA RIVER SEDIMENTATION IMPACTS MODELING PROJECT

Kevin Cook, Justin Milne, Kristin Pesman, Katrina Schwab, Jim Shannon, J. Wesley Lauer

Seattle University, Department of Civil and Environmental Engineering

The U.S. Bureau of Reclamation's adaptive management plan for the Elwha River dam removal projects requires relatively frequent reassessment of the deconstruction approach. To support

this plan, we developed a computer model that routes flow through each reservoir, simulating discharge and reservoir drawdown rates at any point in the dam removal process. For Lake Mills, the model uses the level-pool routing method combined with the broad-crested weir equation to represent flow across the notches being used to remove Glines Canyon Dam. An iterative calibration method was developed to improve our representation of the stage-discharge function for the notches, allowing us to characterize the complicated notch geometry using two simple broad-crested weir equations. Level-pool routing was also used for Lake Aldwell, but a backwater equation was required to adequately model the diversion channel around Elwha Dam (prior to its removal). The program automatically downloads inflow predictions from NOAA's Advanced Hydrologic Prediction Service but also allows for a user specified inflow hydrograph.

The program allows the user to simulate the response to controlled blasting of notches in Glines Canyon Dam. It also has the ability to account for changes in reservoir stage-storage geometries as delta sediment is reworked. Early in the removal process, accounting for delta progradation using the time-variable reservoir geometry feature of the model yielded slightly different discharge and drawdown rates relative to a reservoir characterized by the pre-removal stage-storage curve. However, as dam removal progresses, we expect it will be important to account for temporal changes in reservoir geometry.

SEDIMENTARY DEPOSITS AND PROCESSES IN THE LOWER ELWHA RIVER, WASHINGTON, DURING DAM REMOVAL

Amy E. Draut, Joshua B. Logan, Mark C. Mastin, and Andrew C. Ritchie

USGS Pacific Coastal and Marine Science Center, Santa Cruz, CA (AED, JBL), USGS Washington Water Science Center, Tacoma, WA (MCM), National Park Service, Olympic National Park, Port Angeles, WA (ACR)

Ongoing removal of two dams on the Elwha River, Washington, is providing a valuable opportunity to evaluate a channel's response to the restoration of natural upstream sediment supply, on a scale not previously studied in any river setting. Topographic and grain-size data collected regularly over the 5 years before dam removal allow a detailed comparison with changes that have occurred since the start of dam removal in September 2011. High suspended-sediment concentrations and lack of large floods over winter 2011–2012 promoted widespread deposition in the Elwha River below the Elwha Dam site. New sediment deposits were evident throughout the lower river in spring 2012, and were composed of a much finer grain size (very fine sand, silt, and clay) than occurred on the riverbed before dam removal began. Although bed aggradation had been measured several times in previous years, 2012 marked the first instance of deposition of such fine bed material. No similar new deposition of fine sediment occurred in a reference reach upstream of the dam sites, indicating that the newly deposited sediment is derived entirely from former reservoir material. New sediment deposits in the lower river were typically 1–20 cm thick, with a maximum measured thickness of approximately 50 cm. Although this represents insufficient bed aggradation to raise the water surface (flood stage) appreciably, the common occurrence of new fine sediment and organic matter in interstitial spaces between gravel and cobble grains could potentially have substantial ecosystem effects.

ARCHEOLOGICAL INVESTIGATIONS IN THE FORMER LAKE MILLS RESERVOIR

Matt Dubeau and Davina Miller

Olympic National Park, Port Angeles, WA (MD, DM)

Site 45-CA-625 was recorded in 2009 during archeological reconnaissance conducted in preparation for the removal of Glines Canyon Dam. Subsequent lowering of Lake Mills reservoir revealed adjacent areas of the site which were formerly inundated. Archeologists from Olympic National Park identified a significant component of the site while monitoring dam removal activities in these newly exposed areas. Test excavations in these areas in August and September of 2011 yielded a high density of prehistoric stone artifacts and burnt animal bone fragments. Approximately 2,400 stone artifacts and 419 burned bone fragments were recovered from less than 4m³ of excavated material. Calibrated radiocarbon dates indicate site occupation as early as 8,340 years ago, establishing the site as one of the oldest known sites on the Olympic Peninsula. Also of interest is the presence of a single obsidian artifact. Obsidian is extremely rare on the Olympic Peninsula and is generally found to have been imported from sources in eastern and central Oregon. The obsidian recovered at 45-CA-625 was chemically traced to a source at Ilgachuz Mountain in central British Columbia. This site is believed to be the furthest south that obsidian from the Ilgachuz source has ever been found. This poster summarizes the results of the 2011 excavations at 45-CA-625 and offers new insights into the prehistory of the north Olympic Peninsula.

PRELIMINARY ECOSYSTEM SERVICE VALUATION: OPPORTUNITIES FOR INCREASED PROTECTION AND CONSERVATION IN CLALLAM COUNTY

Lola Flores and Jennifer Harrison-Cox

Earth Economics, Clallam County, Department of Ecology, Coastal Watershed Institute, Department of Natural Resources, Peninsula College and Friends of Dungeness Refuge.

Conserving our natural environment has become an interdisciplinary effort for many years. Economics a practice that is not only a part of conservation but also plays an essential role. As part of an economic analysis, ecosystem valuation can help minimize the gap created by the interaction of different disciplines. Working with Clallam County, Department of Ecology, Coastal Watershed Institute, Department of Natural Resources, Peninsula College and Friends of Dungeness Refuge this preliminary valuation was completed using Geographical information Systems (GIS) land acreage. The purpose of the preliminary report is to document and communicate initial countywide values. This partnership is currently conducting a detailed valuation of coastal and nearshore areas. Through benefit transfer methodology, preliminary values of Clallam County's ecosystem services are presented. Based on a total of 15 ecosystem services over 11 land cover types, Clallam County's ecosystem services contribute roughly \$1 to \$12 billion a year to the local and regional economy. The net present value for Clallam County analyzed over a 50-year period with a 0% discount rate is over 350 billion and at 4% 150 billion. These values will be used to inform the Shoreline Master Program update and

No Net Loss policy. This preliminary economic analysis enables further conservation of natural environments by giving a monetary value to services that currently have zero value in our markets. This approach helps communicate their environmental, economic and social importance.

MOVEMENT OF TRANSPLANTED ADULT SALMONIDS IN PREVIOUSLY INACCESSIBLE HABITAT IN THE ELWHA RIVER

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The removal of the Elwha and Glines Canyon Dams on the Elwha River will renew access for anadromous salmonids to 70 miles of high quality habitat located primarily within Olympic National Park. Concurrent dam removals began in 2011, with complete fish passage projected in 2014. While the long-term benefits to anadromous populations are undisputed, release of stored sediment behind the dams will temporarily elevate suspended solids and degrade existing spawning habitat downstream of the Elwha dam. To minimize deleterious effects in the lower river, give populations an early opportunity to spawn and imprint on upstream habitats, and examine the response of anadromous fish to the newly available areas, Chinook and coho salmon and steelhead were moved upstream of Elwha and Glines Canyon dams in 2011 and 2012. We radiotagged and tracked 20 adult Chinook salmon, 47 adult coho salmon, and 37 steelhead to determine spatial and temporal movements and spawning in tributaries and the main stem river. Fish movements were monitored using fixed sites and mobile tracking. We observed coho salmon and steelhead redds in Little River, Indian Creek, the mainstem Elwha River, and side channels of the river. Two Chinook redds were seen in the area upstream of Glines Canyon Dam. We also observed volitional fallback and subsequent spawning or migrational movement in the lower river by all species. The offspring from these relocated adults will have direct outmigration access to the ocean and the river will be open for upstream migration when they return as adults.

THE ELWHA NEARSHORE: AN OVERVIEW

Nicole Harris, Anne Shaffer, Justin Brown, Thomas Quinn, Chris Byrnes, Rebeca Hansen:

Western Washington University Huxley College of the Environment Peninsula (NH), Coastal Watershed Institute (AS), University of Washington (JB, TQ), Washington Department of Fish and Wildlife, Port Angeles, WA (CB), Peninsula College (RH)

Located on the north Olympic Peninsula of Washington State, the Elwha River nearshore includes approximately 12 linear miles of shoreline, from the western edge of Freshwater Bay, east to the tip of Ediz Hook, and is made up of five distinct geomorphic habitat landform types: lower river, estuary, embayed shoreline, feeder bluffs and spit. Extending from the area of tidal influence, including the riparian zone, out to 30 meters Mean Lower Low Water (MLLW) depth, the Elwha nearshore provides rearing and migration corridors for ESA listed species including

juvenile salmon and forage fish, Puget Sound and Columbia River Chinook, steelhead, bull trout, and eulachon, sand lance, and smelt. It also provides spawning areas for surf smelt. The Elwha nearshore is severely degraded due to significant sediment starvation from in river dams, shoreline armoring and diking. Dam removal, which began in September of 2011, will provide a partial restoration of sediment processes to the Elwha nearshore by delivering 7.5 million cubic yards of sediment within five years. Additional restoration and adaptive management actions (such as restoring the Elwha bluffs and restoring hydrologic connectivity to the estuary) are necessary for successful recovery of the Elwha nearshore and the Salish Sea ecosystem it supports

TRIBUTARY/MAINSTEM INTERACTION ON THE LAKE MILLS AND LAKE ALDWELL DELTAS

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Started on the Elwha River in 2011, the removal of two major dams has created a vast number of changes both downstream of the dam sites and in the reservoir areas behind each dam. Although changes in the mainstem Elwha have largely been predicted, little was known as to how the tributary/mainstem connectivity in the reservoir areas would be affected. As turbidity in the mainstem has increased from newly suspended fines, the areas have become largely inhospitable to the resident fish and other biota. Consequently, the tributaries have become important sites of clear water refugia. Five tributaries are monitored through biweekly observations that began in the winter of 2011, with the first observations made eight months prior to dam removal. Boulder Creek, Cat Creek, Hurricane Creek, and Wolf Creek all flow into what was the Lake Mills reservoir, and Indian Creek flows into what was Lake Aldwell. Significant changes have been observed in all five tributaries during the dam removal process, several of which have created barriers to fish passage or stranded fish and other biota in shallow pools after dewatering events. Currently, Boulder and Cat Creek are incising rapidly, eroding riparian vegetation, and creating steep gradients. Hurricane and Wolf have remained perched above the Elwha and, following a scouring event by the mainstem, are each cascading down a ~50% gradient. Indian Creek switched channels after a 10,000 cfs flood event and is now flowing along a pre-dam mainstem channel to meet the Elwha far upstream of its original confluence.

FIELD OBSERVATIONS ON THE EFFECTS OF IN-STREAM WOOD ON CHANNEL MORPHOLOGY AND LOCAL SEDIMENTATION IN LAKE MILLS AND LAKE ALDWELL DURING THE ELWHA AND GLINES CANYON DAM REMOVALS

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The interactions between woody debris, fluid flow and sediment transport in rivers are a first order control on river processes, affecting channel roughness, streambed morphology and sediment transport. In particular, woody debris increases the hydraulic and topographic

complexity in rivers, leading to a greater diversity of aquatic habitats and an increase in the number of large pools that are important fish habitat for feeding, hiding and spawning. In the past decade, engineered logjams have become an increasingly used tool in river management for protecting river infrastructure and improving aquatic habitat. We investigate the effects of in-stream wood on channel morphology and local sedimentation in Lake Mills and Lake Aldwell on the Elwha River, WA. These sites are currently undergoing accelerated channel processes due to dropping base levels from the Elwha and Glines Canyon dam removals. We track local channel migration and erosion patterns around wood using aerial photos and field surveys. On the Lake Mills delta we investigate how woody debris and logjams evolve and affect channel processes. On the Lake Aldwell lakebed we investigate how in-place tree stumps from the pre-dam valley floodplain affect mobile wood retention and local sedimentation. We present preliminary observations showing how woody debris, logjams and tree stumps affect local sediment retention, erosion and bank migration. A better understanding of how naturally occurring wood affects river processes can provide guidance and criteria for use in river restoration and engineering as well as scientific insights into a complex interdisciplinary problem.

AVIAN SEED DISPERSAL IN ELWHA RESTORATION

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Restoring native vegetation to the Elwha's drained reservoirs will be difficult but essential to restoration. Revegetation will be most effective if it is rapid and spatially extensive, to stabilize residual reservoir sediment, impede invasive plants, and restore other riparian functions. I evaluated the extent that birds could enhance Elwha restoration by dispersing native seeds to reservoir sediment deposits. Birds disperse seeds of most (59%) native woody plants likely to establish in the dewatered reservoirs. American robins (*Turdus migratorius*) accounted for most avian flights between seed source habitats and sediment deposits. Robins may be effective seed dispersers: they are abundant throughout the reservoir edge and native fruits form much of their seasonal diet. I assessed patterns of avian seed dispersal by evaluating eight causal hypotheses, using fresh avian scat as a seed surrogate. I recorded scat densities and habitat characteristics along randomly located transects in the Lake Mills reservoir delta and the Geyser Valley floodplain. I fit models for each hypothesis and compared model fits using Akaike's Information Criterion. Most avian scats occurred on logs, and scat density increased with log volume. Sapling density became more important in Geyser Valley where floodplain succession was advanced. These results suggest that birds can disperse native seeds throughout reservoir restoration sites. Revegetation programs associated with dam removals can leverage birds as restoration agents by retaining or placing large woody debris where fruit-bearing plants are desired. Next steps in this research include modeling avian seed dispersal and monitoring establishment of bird-dispersed plants.

RAPID SHORELINE RESPONSE TO THE REMOVAL OF ALDWELL DAM

Ian Miller, Jon Warrick, and Andy Ritchie

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Profiles and grain-size measurements from the intertidal beach of the Elwha River delta suggest a rapid shoreline response to the removal of the Aldwell Dam. Deconstruction of the Aldwell Dam, at river kilometer 7.9, started in September of 2011 and the reservoir behind the dam was completely drained by the last week of March 2012. Measurements were collected at four cross-shore oriented transects on the Elwha River delta, one to the west of the river mouth and three to the east, approximately bi-weekly since February 2011 and intermittently since 2008. Anomalous accretions of sand on the lower part of the beach profile (near or below Mean Lower Low Water) east of the river mouth were first observed in April 2012 and areas of sand grew in volume and extent over the subsequent months. At the measurement site immediately to the east of the river mouth patterns of profile accretion and a reduction in the mean grain size of the beach suggests that, by July 2012, sediment associated with the dam removal was recruiting to the foreshore and nourishing what has been a coarse eroding beach. At the other sites east of the river some changes have been observed low on the profile, but the foreshore response is, as of yet, unclear. No significant changes in profile shape, profile stability or grain size have been observed at the measurement site to the west of the river mouth.

ESTIMATING HISTORIC AND RECENT NEARSHORE SEDIMENT CONTRIBUTIONS FROM COASTAL BLUFFS IN THE ELWHA AND DUNGENESS DRIFT CELLS

David S. Parks

Washington Department of Natural Resources

The Elwha and adjacent Dungeness drift cell provide habitat for forage fish (*Hypomesus pretosis*, *Ammodytes hexapterus*) that utilize intertidal beaches for spawning and migration. These beaches are supplied with sediment from coastal bluffs through landsliding and surface erosion, and from coastal rivers and streams. Dams, coastal bulkheads, and upland development, have changed the rate of sediment delivery to intertidal beaches over the last century and have contributed to coastal erosion and coarsening of intertidal beaches in the Elwha drift cell, thus reducing the quality of habitat for forage fish. The Dungeness drift cell has experienced fewer anthropogenic changes to sediment supply processes than the Elwha, and provides an opportunity to compare these two adjacent coastal systems. Evaluating the intertidal beach response to the re-supply of sediment from removal of the two Elwha dams requires a similar evaluation of the supply of sediment from coastal bluff erosion. To measure the historic and recent coastal bluff sediment contributions to nearshore beaches we mapped the rate of bluff-edge retreat from National Geodetic Survey (NGS) observations (1892-2011) and from aerial photography (1939-2011), and estimated recent (2001-2012) bluff sediment yields by comparing terrestrial LiDAR data with observations collected with a laser rangefinder coupled with a survey-grade RTK-GPS. These measurements provide the basis for estimating along-shore sediment volumes contributed from coastal bluffs for both drift cells and provide a context for evaluating changes in sediment delivery from the removal of the dams on the Elwha River to nearshore intertidal beaches.

DISTRIBUTION AND FUNCTIONAL LINKAGES OF LARGE WOODY DEBRIS IN THE ELWHA NEARSHORE

Samantha Rich and Anne Shaffer

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Large Woody Debris (LWD) is an important part of the marine ecosystem as it's a base component of physical processes that form critical habitats for numerous fish species such as endangered salmon and their forage fish (smelt and sand lance). The Elwha drift cell has been starved for close to a century as the dams, dikes, and shoreline armoring along it have kept back not only sediment, but also the large wood that would have naturally made its way into the Strait of Juan de Fuca. Little is currently known about LWD in nearshore systems. With removal of the Elwha and Glines Canyon dams, begun in September 2011, there was a need to define baseline parameters of LWD to establish benchmarks and to use in comparison with other drift cells. These will help with predictions of the Elwha's future state as well as inform potential restoration actions in the Elwha nearshore.

This study aims to examine unmodified comparable landforms as well as accessing the historical information available about the Elwha's pre-dam state. Questions being addressed:

1. What is the current LWD of the Elwha nearshore? and;
2. What are some of the key relationships between nearshore habitat, including beach habitat areal extent and sediment composition, which Large Woody Debris provides?

Key sampling parameters include a qualitative description of LWD with an emphasis on location on the beach, general composition, configuration and size. Linkages between LWD's biological functions within the intertidal Elwha nearshore will also be illustrated.

DAM REMOVAL, SALMON RESTORATION, AND WILDLIFE IN THE ELWHA RIVER WATERSHED, OLYMPIC PENINSULA, WASHINGTON

Kim Sager-Fradkin, Kurt Jenkins, Patricia Happe, Nathan Chelgren, Chris Tonra, Peter Marra, Mike Adams

Lower Elwha Klallam Tribe, Port Angeles, WA (KS), USGS Forest and Rangeland Ecosystem Science Center, Port Angeles, WA and Corvallis, OR (KJ, NC, MA), Olympic National Park, Port Angeles, WA (PH), and Smithsonian Conservation Biology Institute, Migratory Bird Center, Washington, DC (CT, PM)

Removal of two hydroelectric dams and restoration of anadromous fishes in Washington's Elwha River provides a unique opportunity to improve understanding of habitat and trophic effects associated with dam removal on riparian faunal communities in the Pacific Northwest. Despite the known association of many wildlife species with salmon, and stable isotope studies showing the extent to which salmon-borne nutrients permeate terrestrial food webs, few studies have demonstrated the effect of salmon on species abundance, distribution patterns or the attendant effects on wildlife communities. We began a series of studies in 2002 to establish baseline conditions of several wildlife species in the Elwha valley with the intent to study long-

term changes in species distribution, community patterns and trophic relationships following river restoration. Specifically, we examined spatial use patterns of black bears, Roosevelt elk, and river otters; distribution and occurrence patterns of terrestrial mesocarnivores, small mammals, and amphibians; and contributions of marine-derived nutrients in diets of the American dipper. We hypothesize that (1) bears and river otters may shift in distribution or movement patterns to take advantage of energy- and protein-rich fish, (2) Roosevelt elk will benefit through improved floodplain and vegetative conditions (particularly in the restored reservoirs), (3) American dippers will see increases in marine-derived nutrients in their diets, with potentially commensurate improvements in fecundity, and (4) mesocarnivore and other species may also expand in distribution as salmon enter the upper river. Long-term continued study of wildlife in the Elwha Valley will help to tell the story of how changing habitats and salmon nutrients following dam removal affect wildlife populations that rely on riverine and floodplain habitats.

LONG TERM FISH USE OF THE ELWHA RIVER NEARSHORE

Anne Shaffer, Justin Brown, Chris Byrnes, Nicole Harris, Patrick Crain, and Thomas Quinn

Coastal Watershed Institute, Port Angeles, WA (AS), University of Washington, Seattle, WA (JB, TQ), Washington Department of Fish and Wildlife, Port Angeles, WA (CB), Western Washington University Port Angeles, WA (NH), Olympic National Park, Port Angeles, WA (PC). The nearshore is a complex and critical component of the Elwha River ecosystem. Extending from the area of tidal influence, including the riparian zone, and out to 30 m MLLW, the Elwha nearshore drift cell comprises approximately 17 linear km of shoreline. Variability and sediment processes, severely disrupted due to shoreline armoring, alterations in the lower river, and dams, are signature features of the Elwha nearshore. Fish use in this area varies with season, geomorphic landform, and species. Evidence suggests that the Elwha nearshore functioning is impaired relative to fish use in other comparable intact drift cells, and that habitat function differs across the estuary. Interannual variability in fish use of the Elwha estuary is critical to understanding current and future estuary function. In 2007 we initiated what has become a long term fish use monitoring study of the Elwha west estuary and a comparative “reference” site nearby. This presentation provides an overview of results to date, including seasonal trends in species richness, diversity, and densities of the Elwha west estuary, and how these results compare to observations in the reference site area. We also provide initial observations of estuary fish use after the initiation of dam removal, which commenced in September 2011, and a synopsis of other related and key monitoring projects in the Elwha nearshore.
