Ooze News

Society of Wetland Scientists Pacific Northwest Chapter Volume 28, No. 2: Summer/Fall 2018

http://www.sws.org/pacific-northwest-chapter

President's Corner

By Lizbeth Seebacher, PNW Chapter President

The SWS PNW Chapter board and SWS conference committee members have been working with the Society for Ecological Restoration (SER) board and committee members on our upcoming joint conference! The *Restoring Resilient Communities in Changing Landscapes* Conference will take place in October from the 15th through the 18th at the Davenport Grand Hotel in Spokane, Washington. Check out the most recent information on the conference at https://restoration2018.org/. If you are a student and would like to volunteer, please contact our Vice President and volunteer coordinator, Josh Wozniak. His contact info can be found to the left of this article.

If you submitted an abstract to present at the conference, you should have been notified of acceptance by August 31st. If you have any questions about the conference that the website doesn't answer, feel free to contact me and I will try to direct you to the right person. It's going to be an awesome conference, so don't miss it!

The National SWS meeting for 2018 took place in Denver from May 29th through June 1st. Symposia covered a variety of subject matter ranging from: Stemming the deterioration of wetlands, Coastal hydrologic restoration, Integrating Traditional Ecological Knowledge (TEK), to Floating Wetlands: From Natural to Novel Ecologies (a personal favorite). Unfortunately, SWS board members were not able to attend the conference, but I have heard from about a dozen people who did go, that they thought it was an excellent conference! Check out additional upcoming conferences under the Calendar section of this newsletter.

We hope you have had a superb summer. I imagine that it may feel as if the restoration and conservation work that we do is being undermined on an everyday basis. I know that when I look at my social media and see the constant attack on environmental regulations, I feel incredibly frustrated and helpless. So much that I want to drop everything and move to some island in the south Pacific. But I won't! Well, mostly because of student loans, but

additionally, we have to stick together and continue to oppose this onslaught of destruction to our wetlands, water quality and wildlife habitat. We will see you at the conference in a month, until then, stay strong!

Upcoming SWS-SER Conference in Spokane

By Katrina Poppe, Co-Secretary

JOINT REGIONAL
CONFERENCE
Spokane Oct 15–18, 2018

RESTORING RESILIENT COMMUNITIES
IN CHANGING LANDSCAPES

https://restoration2018.org/

Join us for an engaging forum that includes regional and national members of the **Society for Ecological Restoration** and **Society of Wetland Scientists** coming together to address North American issues of ecological restoration and wetland science.

Please visit the conference website for registration, and information about the program and venue. The conference will include one day of field trips and workshops, and three days of plenary and concurrent sessions.

Carpool: Visit our Ride Share site to sign up for transportation to and from the conference as either a driver or a passenger. Help us reduce our carbon footprint while squeezing in some extra networking time!

Volunteer: We are still looking for student volunteers to help with conference organization during the event. Volunteers receive free registration!

Lodging at the Conference Venue: We have reserved a room block with a reduced conference price at the Davenport Hotel. We may add options elsewhere if this block fills and update the website accordingly. If you have trouble reserving a block room in the meantime, contact Allison Warner.

Restoration and Climate Change in the Stillaguamish Delta: Lessons Learned

By Roger Fuller, Padilla Bay National Estuarine Research Reserve, and Western Washington University

The Stillaguamish estuary in Port Susan Bay supports extensive brackish tidal marsh habitats that are critical to an array of wildlife species, including salmon, crustaceans, shorebirds, waterfowl, and raptors. Over the past 150 years, humans have altered the estuary, substantially reducing the amount of habitat and number of channels. In addition to the direct loss of habitat, the constructed levee system also constrains the remaining channels between levees until they reach the brackish tidal marsh. This constraining of the channels substantially affects key processes like the pattern of distribution of freshwater and suspended sediment across the estuary.

After most of the original tidal marshes were diked and converted to agriculture in the 1800's, rapid accretion and new tidal marsh expansion occurred outside the dike system. Marsh area expanded, peaking in 1990 with about 1,064 acres at the north end of the bay. However, since 1990 there has been a sharp 26% decline in total marsh area as changes in ecological processes drive marsh retreat.

To reverse this habitat decline, The Nature Conservancy (TNC) restored 150 acres of marsh at the mouth of the Stillaguamish River in 2012. The project removed a dike surrounding the site and carved two channel connections to a small river side-channel. With the site located right at the mouth of the Stillaguamish River, pre-project modeling indicated that direct river flow across the restoration site would occur at high tide.

The habitat objectives of this project were to:

- restore tidal marsh and channel habitat within the 150-acre restoration site
- improve the distribution of freshwater and sediment from the river across the estuary ecosystem to increase system resilience and reduce the rate of marsh loss.

Several independent research groups contracted with TNC to monitor the outcomes of restoration, including Western Washington University, U.S. Geological Survey-Pacific Coastal and Marine Science Center, U.S. Geological Survey-Western Ecological Research Center, and the Skagit River System Cooperative.

Overview of the Stillaguamish estuary. (Credit: The Nature Conservancy)

OVERALL MONITORING FINDINGS

Site-scale Habitat

Marsh Area: Tidal marsh plants underpin the ecosystem services we seek from estuaries by generating the biomass that fuels the food web for fish and birds, and protects human communities from coastal flooding. Tidal marsh on the site initially proliferated rapidly as seacoast bulrush (*Bolboschoenus maritimus*) and river bulrush (*B. fluviatilis*) expanded from the smaller non-tidal wetland that existed prior to dike removal. Marsh covered most of the site within two years. As the marsh rapidly expanded upslope, it retreated slowly at first from the lowest elevations, as expected. But in 2015 the marsh almost completely died on the lower 2/3 of the site. Record low river levels had caused very high soil salinity, a stress that we think may have combined with other stresses, leaving the plants vulnerable to insect attack. The stem-boring larvae of a moth wiped out the marsh. 2015 river levels correspond to those projected to be the norm by 2050 due to climate change. As such, dynamics in 2015 provide us with insights into how climate change affects both the restoration site and the broader estuary. In 2017, with higher than average flows, some marsh areas recovered but others did not.

Accretion: Sediment deposition is critical for the development of productive tidal marsh and to help marshes keep up with sea level rise (SLR). By the time of restoration, the site had subsided 0.5 to 1 m below adjacent marshes. Deposition since then has led to an annual elevation change rate of 3.1 cm/year. This is a substantial rate, about 3 times higher than the average rate in adjacent reference marshes. Accretion is expected to slow over time however as the subsided site approaches the elevation of neighboring marshes. If we assume local sea level rise of 82cm by 2100, and assume that the SLR rate changes non-linearly and also that the rates of elevation change remain the same, then the restoration site is expected to keep up with SLR beyond 2100. However, all four of the natural reference marsh areas would begin to lose ground to SLR well before then. The assumption that the rates of elevation change will stay the same is, of course, not realistic. There are a number of factors that could cause those rates to increase or decrease over time.

Tidal channels: Tidal channels are critical to key ecological processes such as delivery of water and sediment, exchange of organic matter that fuels the food web, fish access, and drainage of the site. Channel development has exceeded model predictions in terms of total length. Total channel length increased 10 fold after the 2012 restoration, reaching 23,266 meters in 2015, while only 4,458 m was predicted. However, an underlying hardpan layer may be limiting channel depth and site drainage rates. In addition, the linear pathways created by construction truck traffic have become channels, with unknown effects on the developing channel system.

Estuary-scale habitat

An important objective of the project was to improve connectivity between the river mouth and the rest of the estuary, allowing the river's freshwater and sediment to reach a larger part of the system. Marshes north of the current mainstem have been declining in productivity and resilience, and gradually disappearing. Pre-project modeling suggested that restoration at the mouth of the river would allow freshwater to be pushed by the high tide across the restoration site, more directly towards these northern marshes. This has not occurred, with river water only flowing directly onto the restoration site during high winter flood levels. During spring and summer, when soil salinity limits marsh productivity, there is no extra river flow towards the north during high tides. As a result, marsh decline continues north of the restoration area and there is no indication of improved connectivity at the broader system scale.

LESSONS LEARNED

Lessons learned are summarized here in four categories. Some of the main lessons include:

1. Restoration Design Elements

Pre-restoration conditions that affect post-restoration habitat development

Agricultural legacies affect site topography and soils in a way that will strongly influence post-project conditions including tidal drainage and soil physical and chemical conditions. Significant topographic or soil work may be necessary, including channel excavations, re-contouring, sediment addition, or sub-soiling, to achieve desired habitat results. Post-project monitoring should include soil saturation and chemical conditions.

Number and size of breaches

The number and size of breaches was insufficient to support tidal flooding and ebbing at velocities and rates similar to reference marshes. New blind tidal channel connections were expected to form across the old dike footprint but have not, due to the highly compacted dike footprint that resists erosion. For the same reason, expansion of the two breach sites and channel downcutting is less than would be expected.

2. Design and Construction Process

Documentation of design assumptions and impact pathways

Be explicit about the impact pathways that are expected to deliver the project objectives. Objectives are usually desired habitat functions such as new habitat and improved ecological processes. However, restoration actions alter the physical structure of a site, under the assumption that this will result in the desired functional outcome. It is important to describe in detail the assumptions about the impact pathway between altered structure and new functions. If these assumptions aren't explicitly documented and included as design constraints, the design process may miss key project elements. For this project, the objective of improved estuary-scale hydrological connectivity has not been achieved because daily flood tides are not sufficient to overtop the Hatt Slough bank along the restoration site as was expected. Key design assumptions made at the beginning of the project did not translate into final construction drawings, resulting in as-built conditions that didn't match conceptual design model outputs.

3. Monitoring

Tidal wetland hydrology

Marsh plain drainage at low tide was assumed to be complete because a hydro logger in the main site drainage channel registered water levels at least 1m lower than the marsh plain. However, much of the marsh surface appears to have retained shallow standing water and saturated soils at low tide for at least three years, likely causing stressful soil conditions for plants. Channel loggers are an insufficient and indirect method of monitoring marsh surface hydrology. Soil saturation may have been a source of stress that contributed to a large marsh dieback event in 2015.

Soil physical and chemical conditions

Soil physical and chemical conditions were not part of the monitoring plan, and we thus have no way of testing our hypothesis that overly saturated soils led to soil conditions that were detrimental to plant health and contributed to the marsh dieback event. Specifically we had no direct indicators of saturated soils, oxygen exchange, redox potential, sulfide levels, nutrient processes, or heavy metal species.

Importance of system-scale perspective and multiple reference sites

A system-scale perspective and multiple, ecologically varied reference sites are important to understanding restoration responses and possible effects of climate change at site and system scales. Due to the legacy of drainage, farming, or other land-use impacts, most estuary restoration projects will not look similar to reference sites in the near future. However a range of reference sites allow a much improved ability to project likely outcomes at the restoration site. Without multiple reference sites, we would still be befuddled by plant and habitat dynamics at both the restoration site and estuary scale.

Importance of seasonal data on vegetation structure

The physical structure of plant communities, in both summer and winter, may be more important to ecological processes and ecosystem functions than metrics like species richness and cover.

Importance of long term reference data sets

Long-term reference site data is key, and the Salish Sea needs a network of reference sites that can collectively inform estuary restoration projects throughout the region.

Non-native invasives monitoring and response plan

Consider whether invasive non-native plant species such as *Typha angustifolia* (narrow-leaved cattail) are likely to invade, and even if you don't expect them, include them in your monitoring plan, and decide beforehand how you would respond if they appear and expand.

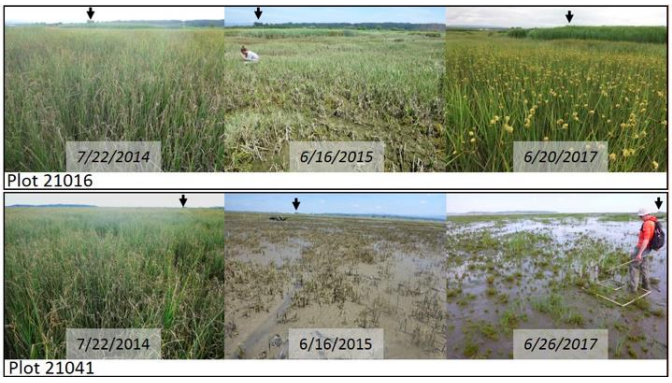

Photo time series within the restoration site, with a higher elevation site shown at top, and lower elevation at bottom. (Credit: R. Fuller)

4. Species, Habitat, and Ecosystem Responses

Some vegetation responses were a surprise.

Tidal marsh retreated farther than expected, the bulrush *S. pungens* has not colonized the site substantially, and both cattail species (*Typha)* are playing larger roles than projected.

Bolboschoenus fluviatilis, river bulrush, is a common and important estuarine species.

The presumed *Bolboschoenus maritimus* (seacoast bulrush) meadows in the Stillaguamish estuary turn out to be co-dominated by *B. maritimus* and *B. fluviatilis* (river bulrush). The latter species appear to be common in local estuaries, though it has not been documented in Washington or Oregon estuaries previously. This is likely because the two species are nearly identical. It holds potential as an agent of tidal marsh resilience, with high biomass production, very robust above-ground biomass during the dormant but geomorphically important winter storm season, and with potential resistance to summer salinity stress. Its ecological preferences, such as elevation and soil structure, could be considered in developing restoration project design targets in places where *B. maritimus* or *S. pungens* are common.

The most important, direct, individual effect of climate change is likely to be declining summer river flows.

Declining flows will affect soil salinity, marsh productivity, and resilience during the tidal marsh growing season. Actions that enhance freshwater residence time in the estuary should be priorities.

Interaction of stresses is important, and may be key to understanding climate change impacts.

The greatest impacts from climate change will come as a result of the multiple ways that climate change interacts with existing sources of stress and disturbance. Surprising and rapid change can happen from a previously un-recognized source of stress, when the additive effects of multiple sources of stress push a system over a tolerance threshold. These ideas were illustrated by the 2015 dieback of 50 acres of marsh, which involved a previously unknown moth herbivore, extremely high soil salinity levels, and an assumed (but undocumented) legacy of plant stress resulting from over-saturated soils.

Article adapted from the Port Susan Bay Estuary Restoration Project Final Monitoring Report by R. Fuller to The Nature Conservancy and the WA Estuary and Salmon Restoration Program, June 2018. Report available online in October.

Consultant List Updates

By Maki Dalzell, Co-Secretary

The PNW Chapter hosts a quarterly updated consultant list on the website: http://www.sws.org/Pacific-Northwest-Chapter/pacific-northwest-resources.html. The only requirement to be on this list is current SWS PNW membership. ***Please note that updates to your SWS member profile through SWS business office do not automatically carryover to the consultant list.*** The PNW Chapter does not get member profile information from the SWS business office, and we need you to keep us informed for updates on the consultant list. If you would like to be added to the list or have your information updated, contact Maki Dalzell at maki.dalzell@hdrinc.com.

Calendar of Wetland Classes and Workshops

By Maki Dalzell/Katrina Poppe, Co-Secretaries

To better serve our members we have included a list of wetland related classes and workshops occurring in the Pacific Northwest. If you know of other organizations that offer classes please forward the web link to katrina@nwecological.com.

Coastal Training Program:
http://www.coastaltraining-wa.org/

- Using the Revised WA State Wetland Rating System (2014) in Western Washington: Oct 10-11, 2018. Lacey, WA.
- Selecting Wetland Mitigation Sites Using a Watershed Approach: Nov 8, 2018. Lacey, WA.

Northwest Environmental Training Center:
https://nwetc.org/
No wetland related courses at this time.

Portland State University Environmental Professional Program: https://www.pdx.edu/environmental-professional-program/

- River Restoration Project Design: Oct 29 – Nov 2, 2018. Portland, OR.
- River Restoration Project Management: Dec 4-6, 2018. Portland, OR

Richard Chinn Environmental Training, Inc.:
http://www.richardchinn.com/
No wetland related courses at this time in our region.

The Seminar Group:
http://www.theseminargroup.net/
No wetland related courses at this time.

University of Washington – Professional Development Program:
http://www.pce.uw.edu/

- Wetland Science and Management 9-month Certificate Program. Starts Oct 2018. Seattle, WA.

Western Washington University:
https://ee.wwu.edu/
No wetland related courses at this time.

Wetland Training Institute:
http://wetlandtraining.com/
No wetland related courses at this time.

WHPacific, Inc.:
Course Information PDF

- Wetland Delineation and Regional Supplement Training: Nov 12-16, 2018. Portland, OR.

Ooze News Deadlines for Articles

Articles and announcements are welcomed and appreciated for the winter edition of the Chapter newsletter, Volume 28 Number 3, no later than December 15, 2018. Please send associated documentation to co-secretaries Katrina Poppe at katrina@nwecological.com or Maki Dalzell at maki.dalzell@hdrinc.com. We will review your information for submission to the Ooze News.

SWS Funds Available for Wetlands Workshops

By Maki Dalzell/Katrina Poppe, Co-Secretaries

The PNW Chapter Board is encouraging applications for SWS support to conduct workshops on relevant topics. The application can be found on the chapter website: http://www.sws.org/Pacific-Northwest-Chapter/pacific-northwest-chapter-events.html

Chapter Board Meetings

By Lizbeth Seebacher, Chapter President

The PNW Chapter Board conducts quarterly board meetings via conference call. These meetings are open to the general membership and you are encouraged to attend. If you have questions, concerns, want to get involved or are just curious please feel free to attend the meetings. Our last meeting was held on June 12, 2018 at 1:00 pm, and our next meeting date is TBD. If you are interested, please contact Lizbeth at lsee461@ecy.wa.gov to receive conference call information.

SWS PNW Member List Serve

By Maki Dalzell/Katrina Poppe, Co-Secretaries

Of the many benefits of becoming a SWS-PNW member, members enjoy being on an exclusive list serve which provides up to date information regarding events, workshops, news, etc. If you're not a member already, please consider becoming one or encourage your colleagues, employees, or the like to join. Thank you!