



Oregon

Kate Brown, Governor

Department of State Lands

775 Summer Street NE, Suite 100

Salem, OR 97301-1279

(503) 986-5200

FAX (503) 378-4844

www.oregon.gov/dsl

State Land Board

Kate Brown

Governor

Dennis Richardson

Secretary of State

Tobias Read

State Treasurer

MEMORANDUM

Date: February 5, 2019

To: Governor Kate Brown
Secretary of State Dennis Richardson
State Treasurer Tobias Read

From: Vicki L. Walker
Director

Subject: Summary of the South Slough Reserve's Work Related to Climate Change

Climate change presents a significant threat to the Oregon coast. Developed shorelines, coastal roads, and natural ecosystems are vulnerable to sea level rise and extreme weather events that can negatively impact infrastructure, coastal economies, coastal accessibility, and human safety. Ocean acidification has serious implications for water quality, shellfish industries, and ecosystem services, and it has already noticeably impaired shellfish production in Oregon.

The South Slough Reserve identifies Climate Change as a management priority in its 2017-2022 Management Plan. As such, reserve staff are engaged in several research and education efforts to increase understanding and communication of climate change. This memo summarizes the Reserve's research related sea level rise, climate change, ocean acidification, and carbon storage in coastal wetlands; education and training related to these topics; and actions the Reserve is taking to reduce greenhouse gas emissions.

Sea Level Rise and Climate Change

The South Slough Reserve participates in the National Estuarine Research Reserve System's Sentinel Sites program, which is a national initiative centered on monitoring

the response of tidal wetlands to changes in sea level and tidal inundation patterns. Essentially, this program is designed to answer the question: *What will happen to tidal wetlands as sea level changes?*

Reserve staff maintain the necessary infrastructure in South Slough to: 1) measure changes in sea level and tidal inundation patterns, 2) quantify changes in wetland elevation, both from geologic processes and the rate at which sediment accumulates in or erodes from wetlands, 3) measure changes in plant diversity and species richness within wetland study sites, and 4) measure changes in weather and water quality. The Reserve's Sentinel Site Plan that describes this work has been highly regarded by the National Oceanic and Atmospheric Administration (NOAA) and disseminated amongst the reserve system as a gold standard.

The value of the Reserve as a Sentinel Site extends beyond understanding local impacts of sea level rise. The Reserve is part of a national study to assess the resilience of marshes across the country. The resulting peer-reviewed publication¹ includes a calculation tool to help coastal managers evaluate the resilience of marshes and inform their decisions for the most appropriate coastal management strategy. In addition, the Reserve's monitoring infrastructure and data attract visiting researchers to the Reserve and facilitates a broader range of climate and biological research.

The Reserve is mapping density and distribution of tidal marshes, eelgrass beds, and other habitats in the South Slough watershed. Habitat maps provide essential baseline data for assessing habitat changes over time, and the Reserve's work is being used to inform mapping protocols for use across the State of Oregon. The Reserve has also partnered with University of Oregon to incorporate sea level rise into land use and infrastructure planning to increase resilience of waterfront areas in the Coos Estuary.

The Reserve participates in the U.S. Climate Reference Network, a partnership with NOAA's National Climatic Data Center, by maintaining a climate observing station in the Reserve at Fredrickson Marsh that measures changes in precipitation, air temperature, and a suite of other meteorological parameters. At the time of its installation, the Reserve's station was the first marsh station in the Climate Reference Network that now includes over 130 climate observing stations across multiple habitat types.

Ocean Acidification

The Reserve maintains equipment in South Slough for continuous measurements of pH and dissolved carbon dioxide (pCO₂) in the estuary and is partnering with other researchers to assess impacts of changing pH on submerged aquatic vegetation. Combined with data from a recently installed NOAA networked ocean buoy near the mouth of Coos Bay, the Reserve's data will help characterize pH and pCO₂ patterns at the interface of nearshore and estuarine waters.

Reserve staff sit on the West Coast Ocean Acidification and Hypoxia Science Panel and participate in the Oregon Ocean Acidification and Hypoxia Monitoring Workgroup. Additional partners for this work include the Confederated Tribes of the Coos, Lower

Umpqua and Siuslaw Indians; the Northwest Association of Networked Ocean Observing Systems; and NOAA.

Carbon Storage in Tidal Wetlands

Blue Carbon refers to carbon that is stored and sequestered in coastal ecosystems that would otherwise be released and contribute to increasing CO₂ levels in the atmosphere.

The Reserve helped create and continues to be part of the Pacific Northwest Blue Carbon Working Group, which is a group of research scientists, restoration practitioners, conservation leaders, land managers, and policy experts who are working to organize the region's approach to coastal blue carbon research and policy.

With this group, Reserve staff are working to: 1) quantify the carbon storage potential of tidal wetlands throughout the Pacific Northwest, 2) characterize environmental drivers that influence carbon storage in wetlands, and 3) understand how carbon storage potential changes when wetlands are converted to alternate uses, such as pastures or developed sites. This work was highlighted in an invitational presentation to the legislative Joint Interim Carbon Reduction Committee on July 24, 2018, where it was well received.

Reserve staff are also contributing to efforts to develop coastal climate adaptation and mitigation strategies for Oregon. This includes partnering on a Blue Carbon Market Feasibility Assessment and surveying the needs of natural resource managers, restoration professionals, and decision makers for blue carbon information.

Education Related to Climate Change

The Education Program at the South Slough Reserve incorporates climate change themes into its school programs, volunteer trainings, community education, public outreach, and teacher trainings. Recently, the Reserve partnered with the Oregon Department of Land Conservation and Development to deliver a presentation on the effects of sea level rise in Coos Bay, as well as a "King Tides Tour" and photo sharing event to help the community visualize what increasing sea levels will look like.

Upcoming teacher training workshops will focus on ocean acidification and sea level rise to provide teachers with resources and training in using scientific data to investigate climate issues in the classroom with their students. Teachers and students also benefit from hands-on learning at the Reserve's demonstration Sentinel Site where they can collect their own data and learn how the Reserve is studying climate change.

The Coastal Training Program at the South Slough Reserve provides training for coastal managers and decision makers in Oregon. Recent workshops addressed climate adaptation for coastal communities and mapping of estuarine wetlands and sea level rise inundation in coastal areas.

The Reserve also provides applied work experience opportunities for recent high school and college graduates by partnering with external programs. For example, much of the

work described in this memo involved interns funded through NOAA, the National Science Foundation, Oregon Sea Grant, and Friends of the South Slough Reserve, Inc.

Facilities and Operations

The Reserve is in the process of completing facility upgrades to increase its energy efficiency and water conservation practices. With grant funding from NOAA, the Reserve recently replaced outdated HVAC systems at the Reserve's Visitors Center and housing facility with high efficiency heat pumps that greatly reduce energy use and associated costs. The Visitor Center also has an array of solar panels that offset a portion of the facility's energy use. A recent remodel at the Reserve's science lab also included several energy savings measures, including the installation of high efficiency LED lights and energy efficient windows and doors.

¹ Raposa, K.B., K. Wasson, E. Smith, J.A. Crooks, P. Delgado, S.H. Fernald, M.C. Ferner, A. Helms, L.A. Hice, J.W. Mora, B. Puckett, D. Sanger, S. Shull, L. Spurrier, R. Stevens, and S. Lerberg. 2016. Assessing tidal marsh resilience to sea-level rise at broad geographic scales with multi-metric indices. *Biological Conservation*, 204(B): 263-275.
<https://www.sciencedirect.com/science/article/pii/S0006320716305742>

Summary of Geographic Range of Students and Teachers Served by South Slough Reserve Education Programs

Reporting: 2017-2019 Biennium

* Schools are still scheduling for the Spring 2019

K-12	# Students Attended since 7/1/17	Scheduled for Spring 2019*	Projected total for 2017-2019 Biennium*	Universities	# Students Attended since 7/1/17	Scheduled for Spring 2019*	Projected total for 2017- 2019 Biennium*
	Ashland	163	183	346	Southern Oregon University	36	35
Bandon	259	60	319	Stonehill College, MA	9	10	19
Bend	73		73	Treasure Valley Community	34		
Camas Valley	28	28	56	University of Oregon	38		38
Central Point	165	70	235	Oregon State University	24	68	92
Coos Bay	812	270	1082	TOTALS	141	113	254
Coquille	143	30	173				
Corvallis		125	125				
Eugene				# Teachers Attended since 7/1/17			
	122		122	Teachers			
Florence	126		126	Bandon	1		
Gold Beach	18	33	51	Coos Bay	1		
Lebanon	26		26	Coquille	2		
Mapleton	42	23	65	Corvallis	1		
Myrtle Point	63	60	123	Florence	2		
North Bend	377	321	698	North Bend	5		
Port Orford	21	20	41	Portland	2		
Reedsport	51	60	111	Roseburg	1		
Riddle	10		10	Salem	2		
Roseburg	123	85	208	Federal Way, WA	1		
Talent	48	50	98	TOTALS	18		
Wolf Creek	13	12	25				
Grenada, CA	23	28	51				
Mt. Shasta, CA	48		48				
Yreka, CA	29		29				
TOTALS	2783	1458	4241				