

Summary of Climate Adaptation Work

*Agencies and Organizations
working in
Clatsop and Tillamook Counties*

Compiled July 2014

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Natural Resources Conservation Service (NRCS)
U.S. Fish and Wildlife Service (USFWS)
United States Geological Survey
 Oregon Water Science Center (USGS/OWRSC)

Local Governments

Clatsop County Department of Public Health
Tillamook County Community Development
City of Astoria
City of Cannon Beach

State Agencies

Department of Agriculture (ODA)
Department of Fish and Wildlife (ODFW)
Health Authority, Public Health Division (OHA/PHD)
Department of Land Conservation and Development (ODLCD)
Parks and Recreation Department (OPRD)
Department of Transportation (ODOT)
Water Resources Department (OWRD)

Non-Governmental Organizations

Columbia Land Trust
Lower Columbia Estuary Partnership
Oregon State University, Civil Engineering

Summary of Agency Adaptation Work

Agency Name: Bureau of Land Management

Lead Preparer: Louisa Evers (levers@blm.gov, 503-808-6377)

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

No specific programs are in place. Resources are limited to the Climate Change Library, which is a collection of scientific papers posted into the Oregon-Washington BLM State Office's SharePoint site, which is not accessible to anyone outside of BLM. OR-WA BLM in conjunction with Region 6 of the Forest Service is slowly building a long-term monitoring network using Research Natural Areas and a selected number of Areas of Critical Environmental Concern with the intent of detecting shifts in vegetation species composition that may be an impact of climate change. However, I am not sure if any of these monitoring sites would be located in Clatsop or Tillamook counties.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Nothing specific to Clatsop and Tillamook Counties.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

BLM is supporting several climate-change research projects across Oregon and Washington although few have much relevance to Clatsop and Tillamook counties.

BLM in partnership with EPA, the Institute for Natural Resources (a consortium between OSU, UO and PSU), Weyerhaeuser Corporation, Oregon Department of Forestry, and several other partners is supporting a climate change research project investigating climate change mitigation and adaptation opportunities in the Oregon Coast Range.

BLM currently provides support to a program investigating the problems and opportunities concerning assisted migration of Douglas-fir ecotypes that may be better adapted to future climates in western Oregon.

In the recent past, BLM provided support to develop monitoring protocols for overwintering coho salmon in the Wilson-Trask-Nestucca basin

Salem and Eugene BLM have partnered with the Mt. Hood, Willamette, and Suislaw National Forests and Columbia River Gorge National Scenic Area and with the Conservation Biology Institute to conduct a climate change vulnerability assessment for northwest Oregon with the intent of developing adaptation recommendations.

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

- a) IPCC climate reports, the National Climate Assessment, the Oregon Climate Change Research Institute (OSU) and Climate Impacts Group (UW), Forest Service climate change-related publications, and a host of peer-reviewed scientific journals publishing papers on climate change and potential climate change impacts.
 - b) None specifically
5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.
- No

Summary of Agency Adaptation Work

Environmental Protection Agency

Lead Preparer: Steven L. Klein, EPA, 200 SW 35th Street, Corvallis, Oregon 97333 (541) 754-4858
klein.steve@epa.gov

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Federal and EPA Adaptation Plans

<http://www.epa.gov/climatechange/impacts-adaptation/fed-programs.html>

Climate Impacts on Water Resources

<http://www.epa.gov/climatechange/impacts-adaptation/water.html>

EPA National Water Program 2012 Strategy Response to Climate Change

<http://water.epa.gov/scitech/climatechange/2012-National-Water-Program-Strategy.cfm>

Climate Change indicators

<http://www.epa.gov/climatechange/science/indicators/>

EPA Air Climate And Energy Research (ACE) Program

<http://www.epa.gov/climatechange/science/>

EPA Climate Ready Estuaries

<http://water.epa.gov/type/oceb/cre/index.cfm>

<http://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=241556>

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

No

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

EPA Climate Change Impacts and Adaptation

<http://www.epa.gov/climatechange/impacts-adaptation/>

EPA Region 10 Climate Change and TMDL Pilot

<http://www.epa.gov/wed/pages/whatsnew.htm>

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

National Climate Assessment (NCA)

<http://nca2014.globalchange.gov/>

NCA Northwest Regional Chapter

<http://nca2014.globalchange.gov/report/regions/northwest>

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

Adaptation Tools for Public Officials

<http://www.epa.gov/climatechange/impacts-adaptation/adapt-tools.html>

EPA Region 10 Climate Change and TMDL Pilot Project South Fork Nooksack River, Washington

Climate Change Pilot Project

Place: South Fork Nooksack River, Washington

Problem: Climate Change Risks to Salmonids

Decision Framework: Clean Water Act (CWA) 303(d) Total Maximum Daily Load (TMDL) Beneficial Uses and Endangered Species Act (ESA) Salmon Recovery Planning (see *Key Terms on page 2*)

Key Stakeholders and Collaborations:

- Nooksack Indian Tribe
- Lummi Nation
- Washington Department of Ecology
- Water Resource Inventory Area 1 Salmon Recovery Team
- University of Washington Climate Impacts Group
- Tetra Tech (EPA Contractor)
- U.S. Forest Service
- National Oceanic and Atmospheric Administration (NOAA) Fisheries
- U.S. Geological Survey

Project Background

Global climate change has the potential for significant impacts on the nation’s freshwater ecosystems. Stream temperature is projected to increase in most rivers under climate change scenarios due in part to increases in air temperature, while changing precipitation and snowmelt patterns could influence water levels and water flow. Increases in stream temperature and changes in stream hydrology could have substantial effects on cold water fish species such as salmon.

To help better understand the potential impact of climate change on achieving water quality and salmon recovery goals, the U.S. Environmental Protection Agency’s (EPA) Region 10, Office of Research and Development, and Office of Water launched a collaborative pilot research project in the South Fork Nooksack River in Washington State. The project uses a temperature TMDL for the South Fork Nooksack River as a pilot for integrating climate change into a

watershed-specific plan for improving water quality. An overarching goal is to ensure that relevant findings and methodologies related to climate change inform the South Fork Nooksack River TMDL.

Project Objectives

The following specific objectives have been identified for the pilot research project:

- Assess the potential impacts of climate change on stream temperature and stream flow for a temperature TMDL.
- Prioritize stream restoration actions under climate change for ESA Salmon Recovery Planning.
- Guide implementation of EPA’s [National Water Program 2012 Strategy: Response to Climate Change](#).
- Support EPA’s National Tribal Science Priorities for Climate Change and Integration of Traditional Ecological Knowledge.



Juvenile Chinook (*Oncorhynchus tshawytscha*)

Roger Tabor (USFWS)

Project Methods

The pilot research project methods involve developing a quantitative and qualitative assessment to support the project goals. This project is structured as a stakeholder-centric process, with numerous opportunities for stakeholder engagement and capacity building.

Quantitative Assessment

- Compare modeled stream temperature, including riparian shading, with and without climate change for the 2020s, 2040s, and 2080s.
- Compare to the CWA Coldwater Temperature Water Quality Standard for protecting salmonids.
- Use a risk assessment approach to provide risk managers with an understanding of potential climate change impacts on stream temperature and stream flow.

Qualitative Assessment

- Comprehensively analyze freshwater salmon habitat for ESA salmon restoration in the South Fork Nooksack River under climate change.
- Create a prioritized list of strategies that support salmon restoration in the South Fork Nooksack River under climate change.
- Base the approach and method on [Restoring Salmon Habitat For A Changing Climate \(Beechie et al. 2012\)](#).

Key Terms

The pilot project represents the integration of three key management programs.

Total Maximum Daily Load (TMDL)

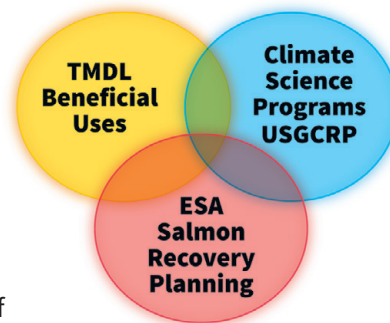
Under the CWA, if a waterbody does not meet the definition of clean water (as set by the state) because of one or more pollutants, the state must then determine the maximum amount of the pollutant(s) that the water body is allowed to receive and still meet state water quality goals. This maximum amount is called a TMDL.

ESA Salmon Recovery Planning

The ESA requires states to develop and implement recovery plans for salmon species listed under the Act. Recovery plans identify actions needed to restore threatened and endangered species to the point that they are again self-sustaining elements of their ecosystems and no longer need protection.

USGCRP Climate Science Programs

The U.S. Global Change Research Program (USGCRP) is a federal program that coordinates and integrates global change research across 13 government agencies to ensure that it most effectively and efficiently serves the nation and the world.



Helpful Links

The Project Research Plan is published (electronically) and available on EPA's Web Site (NSCEP):

EPA Region 10 Climate Change and TMDL Pilot – Project Research Plan; February 12, 2013, EPA Publication EPA/600/R/13/028
www.epa.gov/nscep/

Two project workshop agendas and presentations are available on EPA's Web site (ORD/NHEERL/WED)
www.epa.gov/wed/pages/whatsnew.htm

For More Information

For more information contact:

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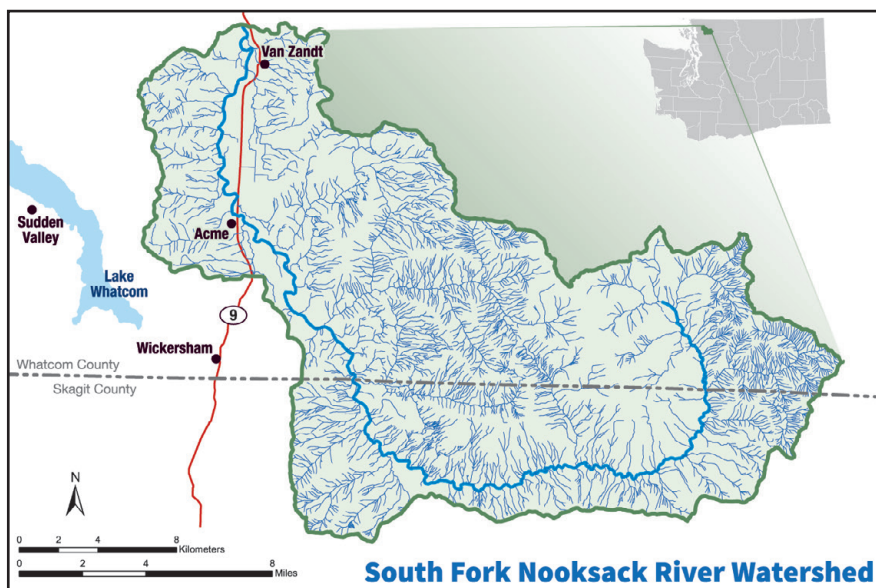
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This fact sheet is the first in a series of three fact sheets on this project. EPA anticipates that additional fact sheets will be released with project updates in summer 2014 and spring 2015.



Summary of Agency Adaptation Work

FEMA – Federal Emergency Management Agency

Lead Preparer : Steven Randolph, FEMA Region 10, Seattle; July 9, 2014

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

FEMA has a variety of grant programs and/or resources that can be used to address climate change or may be utilized for adaptation techniques.

National Preparedness and Emergency Management – Threat Hazard Identification and Risk Assessment (THIRA) process, together with development of Emergency Response and Operations Plans.

Hazard Mitigation Planning – on the local, Tribal, and State level, addressing the built environment.

Hazard Mitigation Assistance grant programs (HMA) for retrofitting vulnerable public infrastructure to be more disaster resistant, buyout of floodprone buildings and conversion of the land to Open Space uses,

Disaster recovery grants for Public Infrastructure. When a Presidential Disaster Declaration is made, damaged public (and Private-non-Profit) infrastructure and buildings can be built back stronger and smarter, including addressing project impacts of climate change. Including climate change impacts was piloted after Hurricane Sandy.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Not directly. However, FEMA has funded hazard mitigation planning efforts for both Counties (and constituent municipalities) as well as a number of hazard mitigation (HMA) projects that reduce the vulnerability of communities in Clatsop and Tillamook Counties to the potential impacts of climate change, in particular more extreme rainfall events, including:

Floodplain buyouts and commercial structure elevations on US 101 North in Tillamook, including the Safeway store.

Water system inter-connection between Tillamook and Bay City

City of Wheeler Hemlock Street stormwater management project

Relocation of Astoria Bond Street water line due to ongoing land slippage, and Garibaldi main water line due to river erosion

In addition, FEMA is considering contribution of funds to the Tillamook Southern Flow Corridor Project. An Environmental Impact Statement process has recently begun. For more information: <http://southernfloweis.org/>

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

FEMA actively supports ***hazard mitigation planning*** to address the full range of natural hazards impacting a community, a Tribe, or a State. Funding is provided for developing and updating hazard mitigation plans, and tools are provided via the fema.gov website (see 5. Below). Hazard Mitigation Plans are intended to guide development decisions and to influence comprehensive land use plans, capital improvement programs, education and outreach initiatives, and budgeting to retrofit vulnerable public infrastructure. Also, through our National Preparedness System, we provide guidance and funding for comprehensive Threat Hazard Identification and Risk Assessments (THIRAs) for purposes of emergency preparedness planning. Both of these planning functions encourage addressing future impacts due to climate change.

4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

A) *National Climate Assessment*; NOAA, USGS, US Army Corps of Engineers, and EPA climate science research and reports.

B) Oregon Climate Research Group; regional chapter of *National Climate Assessment*

5. **Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

Sea Level Rise Tool for New York and New Jersey (collaboration between NOAA, US Army Corps of Engineers, and FEMA)

<http://www.globalchange.gov/browse/sea-level-rise-tool-sandy-recovery>

Mitigation Ideas, FEMA Publication 508:

www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf

Coastal Mapping tools – for New York and New Jersey

<http://www.region2coastal.com/>

Climate Change and Emergency Management Forum

<https://www.llis.dhs.gov/topics/climate-change-adaptation-and-emergency-management>

Local Hazard Mitigation Planning website and Handbook

<http://www.fema.gov/multi-hazard-mitigation-planning>

<http://www.fema.gov/media-library/assets/documents/31598?id=7209>

Threat Hazard Identification and Risk Assessment (THIRA) website & guidance

<http://www.fema.gov/threat-and-hazard-identification-and-risk-assessment>

<http://www.fema.gov/media-library/assets/documents/26335>

Summary of Agency Adaptation Work

Agency Name: NOAA Fisheries, Oregon Washington Coastal Area Office

Lead Preparer: Rob Walton, robwalton@noaa.gov 503 231-2285

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Research and guidance documents:

- Beechie et al 2012;
- National Fish and Wildlife Adaption Strategy
- NOAA Coastal Planning and Adaption Guidance
- <http://collaborate.csc.noaa.gov/climateadaptation/default.aspx>
- <http://www.climate.gov/>

Actions:

- NOAA Restoration Center-funded projects
- Pacific Coast Salmon Recovery Fund
- ESA consultations on Federal actions

2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

- Developing an ESA Recovery Plan for Oregon Coast Coho Salmon

3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

- NOAA is engaged in research and monitoring of ocean conditions, and is working closely with ODFW on freshwater habitat conditions on the Oregon Coast.

4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

In-house climate scientists

5. **Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

See <http://www.climate.gov/>

Summary of North Pacific Landscape Conservation Cooperative Adaptation Work

Agency Name: North Pacific Landscape Conservation Cooperative

Contacts: John Mankowski, Director, John_Mankowski@fws.gov 360 534-9330

Mary Mahaffy, Science Coordinator, Mary_Mahaffy@fws.gov 360 753-7763

For the Conservation Planning Atlas, contact: Tom Miewald, Landscape Ecologist & Conservation Data Coordinator, Thomas_Miewald@fws.gov 503 231-6840

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**
2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**
3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

Answer to Questions 1-3:

The North Pacific Landscape Conservation Cooperatives (NPLCC) is one of 22 LCCs established by the Department of Interior. The North Pacific Landscape Conservation Cooperative is a self-directed partnership between federal agencies, states, Tribes/First Nations, non-governmental organizations, universities, and other entities to collaboratively define science needs and jointly address broad-scale conservation issues, such as climate change. The geographic scope of the NPLCC extends from the Kenai Peninsula in south-central Alaska to Bodega Bay in northern California (including British Columbia). It includes landscapes within the Kenai, Chugach, St. Elias, and Coast Mountains of Alaska and Canada; and portions of the Cascade, Klamath, and Coast Mountains in Washington, Oregon, and California and into adjacent coastal zones.

The NPLCC combines the collective science capacity, infrastructure, creativity, perspectives, and sometimes, financial resources of existing partnerships and programs to address decision support needs on a comprehensive scale. It is a forum for developing a common understanding of change driven by climate and related stressors and its success depends on active engagement of partners throughout the region.

Priority Topics Include:

- Effects of hydrologic regime shifts on rivers, streams, and riparian corridors
- Effects of change in air temperature and precipitation on Forests
- Effects of changes in sea levels and storms on marine shorelines, the nearshore and estuaries
- Effects of the changes in the hydrologic regime on anadromous fish
- Invasive species, diseases, pests and their effects on biological communities

Each year the NPLCC convenes or funds a variety of projects addressing its partners' science and information needs. We partner with other organizations to support high-priority projects, often leveraging funding in creative ways and accomplishing work that would otherwise not be

possible. Project outcomes are intended to spark interest and action and develop tools and models to facilitate successful conservation, management and climate adaptation planning.

Project Highlights

The NPLCC's new, dynamic [Conservation Planning Atlas](#) can help discover, visualize and analyze landscape-scale. Stakeholders are invited to visit the Atlas, search for spatial data sets, visualize results of NPLCC-funded projects, and learn about landscape-scale conservation science and design. The CPA is constantly being expanded through user contributions and completion of new projects. We encourage you to explore the CPA, contribute to the vast array of content, and join the NPLCC in cultivating a one-stop-shop for landscape data in the North Pacific Region. Information includes:

- Coastal and Marine Resources
- Freshwater Resources
- Climate Change
- Anadromous Resources
- Terrestrial Resources

Contact Tom Miewald with questions, comments, and suggestions for the Atlas:

Thomas_Miewald@fws.gov 503 231-6840

<http://nplcc.s3.amazonaws.com/Executive+Summaries+of+all+three+NPLCC+reports.pdf>

Other project and product information can be found at:

<http://www.northpacificlcc.org/Resources/Projects>

Sample products and projects include:

- *Executive Summaries for Marine & Coastal, Freshwater, and Terrestrial Ecosystems. Climate Change Effects & Adaptation Approaches in Ecosystems, Habitats, and Species: A Compilation of Scientific Literature for the North Pacific Landscape Conservation Cooperative Region.* 2013. Online at: <http://nplcc.s3.amazonaws.com/Executive+Summaries+of+all+three+NPLCC+reports.pdf> (for copies of the full reports, go to <http://www.northpacificlcc.org/Resources/Projects> select “NPLCC Wide Projects” and select the two publications by Patricia Tillman, National Wildlife Federation)
- Current and Future Distribution and Abundance of North Pacific Birds in the Context of Climate Change (<http://www.northpacificlcc.org/Resources/View/2>)
- Predicting the vulnerability of nearshore species and habitats to climate change effects (<http://www.northpacificlcc.org/Resources/View/3>)
- North Pacific Forest Landscape Corridor and Connectivity Project: Assessing Landscape and Species Vulnerability (<http://www.northpacificlcc.org/Resources/View/9>)
- Climate Change Vulnerability Assessment of Pacific Lamprey (<http://www.northpacificlcc.org/Resources/View/41>)

4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

For the Pacific Northwest, with implications for Clatsop and Tillamook Counties, the following are key recommended resources:

National Climate Assessment

Dalton, M.M., P.W. Mote, and A.K. Snover [Eds.]. 2013. *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Washington, DC: Island Press.

See also sector “our changing climate” reports (e.g., sea level rise) at:

<http://nca2014.globalchange.gov/report#submenu-report-our-changing-climate> and “sector” reports (e.g., ecosystems) at: <http://nca2014.globalchange.gov/report#section-1947> and the

technical input reports (e.g., “Coastal Impacts, Adaptation and Vulnerability: A Technical Input to the 2013 National Climate Assessment”) at:

<http://www.globalchange.gov/engage/activities-products/NCA3/technical-inputs>

Climate Trends and Projections

- 1) The University of Idaho has ‘statistically downscaled’ global climate models from the 5th Climate Model Intercomparison Program (CMIP5) provided for the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). Find maps and charts, download data and see references (etc.) at:

<http://nimbus.cos.uidaho.edu/MACA/>

The MACA method is a statistical method for downscaling Global Climate Models (GCMs) from their native coarse resolution to a higher spatial resolution that captures both the scales relevant for impact modelling while preserving time-scales and patterns of meteorology as simulated by GCMs (see short lecture videos on statistical downscaling and MACA). This method has been shown to be slightly preferable to direct daily interpolated bias correction in regions of complex terrain due to its use of a historical library of observations and multivariate approach (Abatzoglou and Brown, 2011). Variables that are downscaled include *2-m maximum/minimum temperature, 2-m maximum/minimum relative humidity, 10-m zonal and meridional wind, downward shortwave radiation at the surface, 2-m specific humidity, and precipitation accumulation* all at the daily timestep.

- 2) The [USGS National Climate Change Viewer](#) allows users to visualize historic climate trends and *projected changes in climate* (maximum and minimum air temperature and precipitation) and *projected changes in water balance* (snow water equivalent, runoff, soil water storage and evaporative deficit) for *any state, county and USGS Hydrologic Units (HUC)*. The Viewer includes the historical and future climate projections from 30 of the downscaled models for two of the RCP emission scenarios, RCP4.5 and RCP8.5. RCP4.5 is one of the possible emissions scenarios in which atmospheric GHG concentrations are stabilized so as not to exceed a radiative equivalent of 4.5 Wm^{-2} after 2100, about 650 ppm CO_2 equivalent. RCP8.5 is the most aggressive emissions scenario in which GHGs continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 Wm^{-2} , about 1370 ppm CO_2 equivalent. To create a manageable number of permutations for the viewer, the climate and water balance data is averaged into four climatology periods: 1950-2005, 2025-2049, 2050-2074, and 2075-2099. See: http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp

For sea-level rise, the generalized projections from NRC 2013 need to be adjusted for localized vertical land movement, as per for example, Komar 2012.

Komar, P. D., Allan, J. C., Ruggiero, P. 2011. [Sea Level Variations along the U.S. Pacific Northwest Coast: Tectonic and Climate Controls](#), *Journal of Coastal Research* 27 (5), 808-823, (2011), doi:10.2112/JCOASTRES-D-10-00116.1

National Research Council. 2012. Committee on Sea Level Rise in California, Oregon, and Washington, [Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future](#)

Shoreline Change

National Assessment of Shoreline Change: Historical Shoreline Change Along the Pacific Northwest Coast, Ruggiero et al., 2013. The attached pdf provides the section on the Bandon Littoral Cell. Full document available at: <http://pubs.usgs.gov/of/2012/1007/pdf/ofr2012-1007.pdf>

Higher Waves Could Mean More Flooding and Erosion: Wang, Xiaolan L., Yang Feng, Val R. Swail (2014). Changes in global ocean wave heights as projected using multimodel CMIP5 simulations, Geophysical Research Letters, 41 (3), 1026–1034, doi: 10.1002/2013GL058650, <http://onlinelibrary.wiley.com/doi/10.1002/2013GL058650/abstract>

Ocean Acidification

Doney, S.C., Fabry, V.J., Feely, R.A. 2009. Ocean Acidification: [The Other CO₂ Problem](#). Annu. Rev. Marine. Sci. 2009.1:169-192

Feely, R. A., C. L. Sabine, R. H. Byrne, F. J. Millero, A. G. Dickson, R. Wanninkhof, A. Murata, L. A. Miller, and D. Greeley. 2012. [Decadal changes in the aragonite and calcite saturation state of the Pacific Ocean](#), Global Biogeochem. Cycles, 26, GB3001, doi:10.1029/2011GB004157

Feely, R.A., Sabine, C.L., Hernandez-Ayon, M., Ianson, D., Hales, B. 2008. [Evidence for Upwelling of Corrosive “Acidified” Water onto the Continental Shelf](#). Science 320, 1490 (2008); DOI: 10.1126/science.1155676

Gruber et al., 2012. [Rapid Progression of Ocean Acidification in the California Current System](#). Science 337, 220 (2012); DOI: 10.1126/science.1216773

Wittmann, Astrid C., Portner, Hans-O. 2013. [Sensitivities of extant animal taxa to ocean acidification](#). Nature Clim. Change, Vol 3, 11, pp 995-1001, Nature Publishing Group, <http://dx.doi.org/10.1038/nclimate1982>

5. **Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

Yes, see the Conservation Planning Atlas and the projects described above. These are all intended as decision support resources and/or tools.

Summary of Agency Adaptation Work

Agency Name: Natural Resources Conservation Service (NRCS)

Lead Preparer: Mitch Cummings, USDA-NRCS. 503 842-2848 Ext 107

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Environmental Quality Incentives Program-

Reducing the impacts;

Energy initiative- reduce energy foot print

Tree/Shrub establishment, Forest health activities

Adapting to climate change;

Soil health to allow a more robust soil ecosystem that helps plants get through drought.

Promoting cover crops to moderate soil temperature.

Promoting no-till planting to maintain organic matter and moisture in soil.

2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Not specifically

3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

Not at the local level.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?
5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

http://www.usda.gov/oce/climate_change/

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/air/quality/>

Summary of Agency Adaptation Work

US Fish and Wildlife Service

Lead Preparer: David Patte, Climate Change Coordinator, david_patte@fws.gov 503 231-6210

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**
2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**
3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

Answers to Questions 1-3:

#1: FWS has co-authored a strategy on adaptation for fish, wildlife and plants that can assist in framing issues and key adaptation strategies. The [National Fish, Wildlife and Plants Climate Adaptation Strategy](#) provides a unified approach—reflecting shared principles and science-based practices—for reducing the negative impacts of climate change on fish, wildlife, plants, and the natural systems upon which they depend.

<http://www.wildlifeadaptationstrategy.gov/strategy.php>

#1 and #2: A specific example of both a potential resource and an example of how we are addressing climate-related issues in Tillamook and Clatsop Counties can be found in the Nestucca Bay NWR (Tillamook County) Comprehensive Conservation Plan.

http://www.fws.gov/oregoncoast/CCP_NES_SLZ_BDM.htm

The Comprehensive Conservation Plan, completed April 2013, contains a summary of climate change related risks (among other risks to fish, wildlife and their habitats) and management priorities and actions to address these, and other risks. The purpose for developing a CCP is to provide refuge managers with a 15-year plan for achieving [refuge purposes](#) and contributing toward the [mission of the National Wildlife Refuge System](#), consistent with sound principles of fish and wildlife management, conservation, [legal mandates](#), [our policies](#), and the [National Environmental Policy Act](#). The goals, objectives, and strategies under the preferred alternative emphasize expanded habitat management, restoration, and monitoring along with increased public use opportunities. Now that the plans have been completed, the Service will begin implementing proposed projects and partnerships as funding becomes available.

In the Nestucca Bay NWR CCP, see chapter 3, pp 3-1 to 3-13 for a summary of air temperature and precipitation trends and projected change and climate cycles; 3-15 for hydrology; 3-16 for tides and salinity; 3-16 to 3-19 for sea level rise (including a summary of [SLAMM](#) results) and ocean chemistry; and Chapter 2 for management direction (pp. 2-5 to 2-6) and management priorities and actions to resolve a broad range of issues (not solely climate change) to help bring a refuge closer to its vision.

#2 Locally, the FWS's National Wildlife Refuge System, habitat conservation and restoration programs, endangered species program, fisheries program, and migratory bird conservation programs consider climate change information during decision making and planning processes.

FWS also funds and convenes Landscape Conservation Cooperatives (LCC's) and the North Pacific LCC is the partnership for this geographic area. (See separate agency form for information on projects that can help inform adaptation, and the new conservation planning atlas.)

4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

For the Pacific Northwest, with implications for Clatsop and Tillamook Counties, the following are key recommended resources:

National Climate Assessment

Mote, P., A. K. Snover, S. Capalbo, S. D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder, 2014: Ch. 21: Northwest. *Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 487-513. doi:10.7930/J04Q7RWX. On the Web:

<http://nca2014.globalchange.gov/report/regions/northwest>

and

Dalton, M.M., P.W. Mote, and A.K. Snover [Eds.]. 2013. *Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities*. Washington, DC: Island Press.

See also sector “our changing climate” reports (e.g., sea level rise) at:

<http://nca2014.globalchange.gov/report#submenu-report-our-changing-climate> and “sector”

reports (e.g., ecosystems) at: <http://nca2014.globalchange.gov/report#section-1947> and the technical input reports (e.g., “Coastal Impacts, Adaptation and Vulnerability: A Technical Input to the 2013 National Climate Assessment”) at:

<http://www.globalchange.gov/engage/activities-products/NCA3/technical-inputs>

Climate Trends and Projections

- 1) The University of Idaho has ‘statistically downscaled’ global climate models from the 5th Climate Model Intercomparison Program (CMIP5) provided for the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC). See the maps and charts, download data download and view references (etc):

<http://nimbus.cos.uidaho.edu/MACA/>

The MACA method is a statistical method for downscaling Global Climate Models (GCMs) from their native coarse resolution to a higher spatial resolution that captures both the scales relevant for impact modelling while preserving time-scales and patterns of meteorology as simulated by GCMs (see short lecture videos on statistical downscaling and MACA). This method has been shown to be slightly preferable to direct daily interpolated bias correction in regions of complex terrain due to its use of a historical library of observations and multivariate approach (Abatzoglou and Brown, 2011). Variables that are downscaled include *2-m maximum/minimum temperature, 2-m maximum/minimum relative humidity, 10-m zonal and meridional wind, downward shortwave radiation at the surface, 2-m specific humidity, and precipitation accumulation* all at the daily timestep.

- 2) The [USGS National Climate Change Viewer](#) allows users to visualize historic climate trends and *projected changes in climate* (maximum and minimum air temperature and precipitation) and *projected changes in water balance* (snow water equivalent, runoff, soil water storage and evaporative deficit) for *any state, county and USGS Hydrologic Units (HUC)*.

The Viewer includes the historical and future climate projections from 30 of the downscaled models for two of the RCP emission scenarios, RCP4.5 and RCP8.5. RCP4.5 is one of the possible emissions scenarios in which atmospheric GHG concentrations are stabilized so as not to exceed a radiative equivalent of 4.5 Wm⁻² after 2100, about 650 ppm CO₂ equivalent. RCP8.5 is the most aggressive emissions scenario in which GHGs continue to rise unchecked through the end of the century leading to an equivalent radiative forcing of 8.5 Wm⁻², about 1370 ppm CO₂ equivalent. To create a manageable number of permutations for the viewer, the climate and water balance data is averaged into four climatology periods: 1950-2005, 2025-2049, 2050-2074, and 2075-2099. See: http://www.usgs.gov/climate_landuse/clu_rd/nccv.asp

Sea Level Rise

For sea-level rise, the generalized projections from NRC 2013 need to be adjusted for localized vertical land movement, as per for example, Komar 2012.

Komar, P. D., Allan, J. C., Ruggiero, P. 2011. [Sea Level Variations along the U.S. Pacific Northwest Coast: Tectonic and Climate Controls](#), Journal of Coastal Research 27 (5), 808-823, (2011), doi:10.2112/JCOASTRES-D-10-00116.1

National Research Council. 2012. Committee on Sea Level Rise in California, Oregon, and Washington, [Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future](#)

Shoreline Change

National Assessment of Shoreline Change: Historical Shoreline Change Along the Pacific Northwest Coast, Ruggiero et al., 2013. The attached pdf provides the section on the Bandon Littoral Cell. Full document available at:

<http://pubs.usgs.gov/of/2012/1007/pdf/ofr2012-1007.pdf>

Higher Waves Could Mean More Flooding and Erosion: Wang, Xiaolan L., Yang Feng, Val R. Swail (2014). Changes in global ocean wave heights as projected using multimodel CMIP5 simulations, Geophysical Research Letters, 41 (3), 1026–1034, doi: 10.1002/2013GL058650,

<http://onlinelibrary.wiley.com/doi/10.1002/2013GL058650/abstract>

Ocean Acidification

Doney, S.C., Fabry, V.J., Feely, R.A. 2009. Ocean Acidification: [The Other CO₂ Problem](#). Annu. Rev. Marine. Sci. 2009.1:169-192

Feely, R. A., C. L. Sabine, R. H. Byrne, F. J. Millero, A. G. Dickson, R. Wanninkhof, A. Murata, L. A. Miller, and D. Greeley. 2012. [Decadal changes in the aragonite and calcite saturation state of the Pacific Ocean](#), Global Biogeochem. Cycles, 26, GB3001, doi:10.1029/2011GB004157

Feely, R.A., Sabine, C.L., Hernandez-Ayon, M., Ianson, D., Hales, B. 2008. [Evidence for Upwelling of Corrosive "Acidified" Water onto the Continental Shelf](#). Science 320, 1490 (2008); DOI: 10.1126/science.1155676

Gruber et al., 2012. [Rapid Progression of Ocean Acidification in the California Current System](#). Science 337, 220 (2012); DOI: 10.1126/science.1216773

Wittmann, Astrid C., Portner, Hans-O. 2013. [Sensitivities of extant animal taxa to ocean acidification](#). Nature Clim. Change, Vol 3, 11, pp 995-1001, Nature Publishing Group, <http://dx.doi.org/10.1038/nclimate1982>

Other

Coquille Estuary Vulnerability Assessment (final product, April 2014): This project is a science-based assessment of the Coquille Estuary's vulnerabilities to the effects of climate variability and climate change. Many climate-related observed and projected changes for coastal communities, habitats, and aquatic and terrestrial resources of estuaries were summarized in the projects for the vulnerability assessment (see project website), and the assessment itself. <http://ecoadapt.org/programs/awareness-to-action/Lower-Coquille-Vulnerability-Project>

Tillmann, P., D. Siemann, & P. Glick. *Executive Summaries for Marine & Coastal, Freshwater, and Terrestrial Ecosystems. Climate Change Effects & Adaptation Approaches in Ecosystems, Habitats, and Species: A Compilation of Scientific Literature for the North Pacific Landscape Conservation Cooperative Region.* 2013.

<http://nplcc.s3.amazonaws.com/Executive+Summaries+of+all+three+NPLCC+reports.pdf> (for copies of the full reports, go to <http://www.northpacificlcc.org/Resources/Projects> select "NPLCC Wide Projects" and select the two publications by Patricia Tillman, National Wildlife Federation

[Oregon Climate Assessment Report](#) (OCCRI, 2010)

5. **Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

FWS co-sponsored the following resources:

Glick, P., B.A. Stein, and N.A. Edelson, editors. 2011. *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment.* National Wildlife Federation, Washington, D.C.

http://www.habitat.noaa.gov/pdf/scanning_the_conservation_horizon.pdf

Stein, B.A., P. Glick, N. Edelson, and A. Staudt (eds.). 2014. *Climate-Smart Conservation: Putting Adaptation Principles into Practice.* National Wildlife Federation, Washington, D.C. http://www.nwf.org/pdf/Climate-Smart-Conservation/NWF-Climate-Smart-Conservation_5-08-14.pdf

Summary of Agency Adaptation Work

USGS Oregon Water Science Center, Portland, Oregon

Lead Preparer: Greg Fuhrer (gjfuhrrer@usgs.gov), John Risley (jrisley@usgs.gov), Elena Nilsen (enilsen@usgs.gov), main tel. (503)-251-3200

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

The USGS Oregon Water Science Center (ORWSC) is not currently involved with adaptation issues in Clatsop or Tillamook Counties. However, ORWSC and other USGS centers have the resources in personal and equipment to conduct a wide range hydrologic and ecosystem data collection and research studies related to adaptation issues if requested by other agencies.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

As with adaptation issues, the USGS has the resources to conduct data collection and research studies related to climate-related issues if requested.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

The USGS has used modeling to evaluate the hydrologic response to changes in precipitation and air temperature under future climate change (Markstrom et. al, 2012; Risley et. al, 2011). The USGS Precipitation-Runoff Modeling System (PRMS) model is being developed and calibrated for the entire state of Oregon. After completion the model will be capable of simulating energy and hydrologic processes at the HUC10 sub-watershed scale, or smaller, on a daily time step. Input to PRMS includes precipitation and air temperature data.

Information about the PRMS model can be found at:

http://wwwbrr.cr.usgs.gov/projects/SW_MoWS/PRMS.html

References:

Markstrom, S.L., Hay, L.E., Ward-Garrison, C.D., Risley, J.C., Battaglin, W.A., Bjerklie, D.M., Chase, K.J., Christiansen, D.E., Dudley, R.W., Hunt, R.J., Koczot, K.M., Mastin, M.C., Regan, R.S., Viger, R.J., Vining, K.C., and Walker, J.F., 2012, Integrated watershed-scale response to climate change for selected basins across the United States: U.S. Geological Survey Scientific Investigations Report 2011–5077, 143 p. Report available for download at: <http://pubs.usgs.gov/sir/2011/5077/>

Risley, John, Hamid Moradkhani, Lauren Hay, Steve Markstrom, 2011: Statistical Comparisons of Watershed-Scale Response to Climate Change in Selected Basins across the United States. *Earth Interact.*, 15, 1–26. Paper available for down load at: <http://journals.ametsoc.org/doi/abs/10.1175/2010EI364.1>

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

None currently

- 5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

USGS researchers, Steve Hostetler and Jay Alder, both in Corvallis, Oregon, created an online climate change viewer tool which shows at a state/county scale projected changes air temperature, precipitation, snow, soil moisture, runoff using various General Circulation Models (GCMs):

http://www.usgs.gov/climate_landuse/clud/nex-dcp30.asp

Summary of Agency Adaptation Work

Agency Name: Clatsop County Department of Public Health

Lead Preparer: Brian Mahoney, bmahoney@co.clatsop.or.us, 503-325-8500

Please provide URLs where appropriate to refer to *supporting* material that is available online.

1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.
 - Public Health Department with emergency preparedness capabilities, abilities to form a response, communicate with the public, and integrate with the county emergency management structure.
 - Able to provide information to the community when it needs to know health information and what to do in crisis situations.
 - Ability to collaborate with health care providers, agencies, and other sectors to collect, analyze, share, and make decisions with data.

2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.
 - The Health Department does not have any funding or program directive specific to climate-related issues.
 - The Director has had previous engagement with climate-related planning activities that were funded by the state, run by the state, but required his participation as a stakeholder representing public health emergency preparedness and response.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?
 - Not outside of this meeting.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?
 - The Oregon Public Health Division, websites, and news agencies.
 - County HVA and Public Health HVA

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

- No

Summary of Agency Adaptation Work

Tillamook County Community Development

Lead Preparer: Bryan Pohl (503)842-3408 x-3123

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

On July 10th, the Tillamook County Planning Commission will begin hearing a proposed ordinance and Comprehensive Plan amendment, known as the Neskowin Coastal Hazards Adaptation Plan

(<http://www.co.tillamook.or.us/gov/ComDev/documents/planning/Website%20Forms/Neskowin%20Adaptation%20Plan1.pdf>). While not adopted yet, this plan would provide amendments to the Tillamook County Land Use Ordinance and Comprehensive Plan that would address issues related to sea level rise and coastal erosion.

The Tillamook County Board of Commissioners met with the Neskowin Citizen Advisory Committee (known then as the Community Planning Advisory Committee-CPAC) to discuss beach hazard issues at the request of the Neskowin residents in October of 2009. This meeting led to the formation of the Neskowin Coastal Hazards Committee in December 2009, comprised of Neskowin residents, County Staff (County Commissioner Mark Labhart as Chair of the committee), and state agencies. Numerous opportunities for public outreach and public coordination occurred between 2009 and 2014, including two formal letters in request of support and assistance, six public meetings, and seven Neskowin Citizen Advisory Committee meetings, resulting in strong community/county coordination with extensive public involvement that created a slow deliberate process.

The ultimate goal of this plan is to incorporate the Neskowin Coastal Hazards Overlay (Nesk-CH) Zone and establish specific development standards to address coastal erosion issues for those properties located within this proposed overlay zone. The existing uses permitted outright and conditionally in the underlying zoning districts for those properties located within this proposed overlay zone remain the same.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

In 2010, Tillamook County was awarded a federal grant from the Oregon Coastal Management Program (OCMP) of the Department of Land Conservation and Development to assist the Neskowin Community in the development of a plan for identifying areas subject to coastal erosion and adapting to it, an adaptation plan, using information and ideas from several sources, including the State's Department of Geology and Mineral Industries (DOGAMI), Oregon Parks and Recreation (OPRD), Oregon State University and OSU Sea Grant, and US Geological Survey (USGS). The Department of Community Development helped manage the project, working closely with the agencies and the consultant. The resulting document, "The Neskowin Coastal Erosion Adaption Plan" dated June 2013, was initially drafted by the NCHC and outlines the findings, conclusions and recommendations for amending the Tillamook Comprehensive Plan, the creation of the proposed overlay zone and implementing ordinances.

The boundary of the Neskowin Coastal Hazard Overlay (Nesk-CH) Zone was determined using the Oregon Department of Geology and Mineral Industries maps for Neskowin identifying the areas of coastal-hazard risks. These areas were delineated as active, high, medium, and low risk, with the areas west of the top of the rip rap in Neskowin identified as areas of active risk, immediately subject to ocean processes. Areas of high risk are subject to coastal hazards in the event of a fifty-year storm event, which Neskowin experienced as recently as the late 1990's. Medium risk areas are defined as areas subject to coastal hazards in the event of a hundred-year storm. Low risk areas are subject to coastal hazards in the event of a hundred-year storm occurring after a subduction zone earthquake has lowered the shoreline.

It was concluded by the Neskowin Citizen Advisory Committee (known formerly as the Community Planning Advisory Committee- CPAC) that combining the active, high, and medium risk areas into one "regulatory trigger" coastal erosion hazard zone was appropriate. The decision served three purposes:

- Properly delineating the area most at risk to coastal hazards over the long run.
- Simplifying administration of the zone by the County with a simple "in or out" distinction.
- Decoupling the hazard zone from the DOGAMI maps as the DOGAMI maps are subject to revision which could trigger redrawing of the hazard zone and ordinance amendments.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?

Tillamook County Department of Community Development has also participated in the Envision – Coastal Futures Project and the Coastal Processes and Hazard Working Group.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

In the case of the Neskowin Plan, the principal source of information was the data collected by the Neskowin Coastal Hazards Committee, using information and ideas from several sources, including the State's Department of Geology and Mineral Industries (DOGAMI), Oregon Parks and Recreation (OPRD), Oregon State University and OSU Sea Grant, and US Geological Survey (USGS).

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

At this point, we have not created decision support tools related to climate change. However, our next iteration of Tillamook County's Hazard Mitigation Plan will include a mapping initiative that will map all building footprints, cross-reference with market value and year built from Assessor's records, then integrate flood, tsunami, and erosion hazards to obtain risk information. The intent will be to publish this in an online GIS database.

Summary of Agency Adaptation Work

City of Astoria

Lead Preparer: Rosemary Johnson, City Planner, 503-338-5183, rjohnson@astoria.or.us, 1095 Duane Street, Astoria OR 97103

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Astoria does not have a program addressing climate change issues.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Astoria is not actively addressing climate-related issues but have been following some of the news on this issue.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

Both the Planner and the GIS / CAD Tech have been working with a professor from Portland State University who is conducting an independent study of water level changes on the Columbia River. We have assisted him in locating original tidal markers and working toward an archaeological investigation of "Tidal Rock" that marked the tide levels in the early 1800's. This is not a City project but City staff have assisted with local historical research.

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

DLCD, King County "Preparing for Climate Change" handbook, news

- 5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

Astoria has not developed any resources specifically related to climate change. We do have a Pre-Disaster Hazard Mitigation Plan (October 2008, Addendum to the Clatsop County Plan) that is updated on a regular basis. We also have a Flood Hazard Overlay Zone (http://www.astoria.or.us/Assets/dept_1/pm/pdf/article.2.pdf)

**CITY OF ASTORIA OREGON CLIMATE CHANGE
IMPACT ASSESSMENT SCREENING FOR INFRASTRUCTURE**

City Public Works Department – July 2014

SUMMARY OF APPLICABLE PROJECTED CLIMATE CHANGES FOR THE PACIFIC NORTHWEST*					
Climate Variable	General Change Expected	Is Impact on Infrastructure Expected?	Sector Impacted	Anticipated Impact	Mitigation Measure
Temperature	Increase	Yes	Water Resources	Possible decreased surface drinking water	Improved storage capacity
Precipitation	Very small increase	No	N/A	N/A	N/A
Sea Level	Increase	Possibly	Wastewater & stormwater river outfalls Shoreline erosion	Unknown Increased erosion	Unknown
Heavy Rainfall Events	Unknown**	Yes	Stormwater and Sanitary Sewer Infrastructure	PMF at reservoirs Capacity of storm water systems	Consider increase runoff in PMF calculations Current CSO program improvements will leave us with excess capacity in existing system
Windstorms	Unknown**	Yes	City Watershed/Forest (3,700 Acres) City Property	Increase blow down events	Modify forest practices to strengthen forest Remove dangerous trees

* Source: PREPARING FOR CLIMATE CHANGE, A Guidebook for Local, Regional and State Governments, King County

**Assume negative impact for planning purposes

INITIAL SCOPING – SECTORS AND POTENTIAL CLIMATE CHANGE IMPACTS

Sector	Possible Impacts	Comments
Water Resources	<ol style="list-style-type: none"> 1) Decreased surface drinking water due to decrease in summer precipitation 2) Increase water turbidity due to increase in winter precipitation 	<ol style="list-style-type: none"> 1) Will need to build resiliency into water supply system with new storage facilities and improved source water infrastructure. Possible need for groundwater supply. 2) May impact future costs of sand filter resanding
Transportation	<ol style="list-style-type: none"> 1) Reduced maintenance cost for snow & ice 2) More traffic disruptions and maintenance costs associated with landslides & road washouts 3) Increased road surface damage from higher temperatures 	<ol style="list-style-type: none"> 1) Will need more funding for already stressed road system maintenance program
Sanitary Sewer	<ol style="list-style-type: none"> 1) Temperature increase impacts on sewage treatment lagoons and processing 2) Increased combined sewer overflows due to changes in rainfall events 	<ol style="list-style-type: none"> 1) May require additional treatment improvements beyond those already planned. 2) Need to consider impacts on overall CSO reductions.
Stormwater	<ol style="list-style-type: none"> 1) Capacity issues due to increased heavy rainfall events 2) Increase in erosion potential 	
Shoreline	<ol style="list-style-type: none"> 1) Increased shoreline erosion 	<ol style="list-style-type: none"> 1) Shoreline erosion is random and a function of wind, tide and river levels. Should monitor over time to determine patterns in increased erosion that is not evident at this time.
Emergency Response	<ol style="list-style-type: none"> 1) Increased demands on emergency response services related to extreme weather events 	<ol style="list-style-type: none"> 1) Plan for increased resources and staff time during storm season
Watershed/Forest/City Property	<ol style="list-style-type: none"> 1) Increased blow down events 	<ol style="list-style-type: none"> 1) Modify forest practices to strengthen forest

Summary of Agency Adaptation Work

City of Cannon Beach

Lead Preparer: **Mark Barnes; 503-436-8040; barnes@ci.cannon-beach.or.us**

1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.

City sustainability program : <http://ci.cannon-beach.or.us/docs/Planning/City%20Sustainability%20Outline.pdf>

2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.

Only indirectly through our sustainability program.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?

No.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

(a) generally, professional literature, university studies.

(b) in Clatsop County specifically: risk/vulnerability mapping.

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

No

Summary of Agency Adaptation Work

Oregon Department of Agriculture (ODA)

Lead Preparer: Margaret Matter; 503-986-4561; mmatter@oda.state.or.us

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Status Since 2011: In 2011, ODA defunded their energy and climate change programs due to budget shortfalls.

2014 Status: ODA is re-establishing focus on preparedness and adaptation to climate variability and change, including issues in water resources quantity and quality; energy; and forecasting (water supply and climate). The process includes evaluating how ODA's current programs may address adaptation issues.

ODA programs that address and/or are related to water quality include:

- Agricultural Water Quality
 - Provides funding to Soil and Water Conservation Districts to work with the agricultural community to identify and address practices, activities and conditions that adversely affect or pose a threat to water quality.
- Confined Animal Feeding Operations (CAFO) Program
 - Work with confined animal feeding operations (e.g., dairies, mink farms, non-dairy cattle operations) to contain and manage animal waste to prevent non-point source discharges of animal waste to surface waterways and ground water. A permitted operation has waste containment and management facilities as well as operations and maintenance plans, and the operations are periodically inspected for compliance.
- Fertilizer Program
 - Regulates licensing of manufacturers and bulk distributors; registration and labeling of fertilizers (soil enhancers).
- Pesticides Program
 - Regulates pesticide user licensing and recertification; pesticide registration; bulk distribution; compliance monitoring and use reporting.

Marginal water quality conditions stemming from particular agriculturally-related practices, activities and conditions may be exacerbated by increasing temperatures associated with climate variability/change. Resultant poor water quality conditions may in turn negatively impact aquatic ecosystems in general, but in particular shellfish, fishing industry, T&E fish species; and pose risks to municipal/domestic water supplies.

- Water Resources Program
 - The Water Resources Specialists assists agriculture in Oregon with issues including:
 - Acquiring access to water resources

- Relevant regulations and related permits
- Forecasting: Water supply and climate

The Water Resources Program assists agriculture secure access to water resources; identify water storage, use and management options; and educates about water resource/climate variability and change interactions in order to enhance economic opportunity for and resilience and flexibility in agriculture in Oregon.

- Policy Program
 - The Policy Program:
 - Interprets existing and analyzes proposed policies that influences agriculture in Oregon
 - Develops new policy that promotes and supports agriculture, and
 - Informs ODA and the agricultural community about policy relevant to agriculture in Oregon.

2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.

No, ODA is not currently addressing climate-related issues in Clatsop and/or Tillamook counties.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?

The Natural Resources Program at ODA is currently engaged in activities focused on re-establishing department resources for climate adaptation, for example: (a) planning research to improve accuracy and increase lead time of water supply and forecast methods; (b) identifying water resources use and management options and strategies that:

- Involve efficient and effective use of water for agriculture;
- Are flexible to adjust to variable and changes in climate;
- Preserve or enhance water quality; and
- Promote or enhance instream conditions.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

Newspapers (online and hardcopy), professional journals, radio, webinars, newsletters and listserves and other internet resources.

5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

No, ODA has not yet developed decision support or other online tools for adaptation planning or management related to climate change.

Summary of Agency Adaptation Work

Oregon Department of Fish and Wildlife

Lead Preparer: David Jepsen, ODFW Fish Division

1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.

- Native Fish Conservation and Recovery Program: (<http://www.dfw.state.or.us/fish/CRP/>) with guidance from Native Fish Conservation Policy and other policies/strategies. Program develops conservation and recovery plans for ESA-listed fish species, with a climate change component for risk assessment. Plans describe general actions but agency has several implementation coordinators (ICs) to facilitate priority actions, including those addressing climate changes. Outcome is to restore native fish populations to levels of viability. ODFW has adopted two state fish conservation plans and one federal/state ESA plan that involve salmonid species in Clatsop and Tillamook counties. These plans have an adaptive management component that can be used to modify actions and strategies under a climate change adaptation framework. The ODFW Fish Division is also undertaking a climate change vulnerability analysis for several fish species that will inform an adaptation strategy and is developing a set of policy concepts that can guide adaptation strategies and management decisions.
- Oregon Conservation Strategy (OCS): ODFW added a 7th Key Conservation Issue to the OCS in 2012 on climate change. It is currently being updated and expanded as part of the overall Strategy update. ODFW co-convened a workshop in 2013 on climate change impacts to estuaries, held in Newport. Over 40 people attended from organizations and agencies working on climate adaptive management and research. The results are applicable for the entire Oregon coast.

2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.

- For aquatic species we are implementing conservation and restoration actions through conservation plans. We are assuming the threats from climate change will be mostly manifested in hydrologic regime changes and warmer water. Given there are multiple pathways to biological vulnerability, ODFW is using guidance from the recent adaptation/restoration literature to formulate comprehensive habitat actions. In Tillamook Clatsop counties the ODFW ICs facilitate funding partnerships and formulation of shared outcomes. In general, habitat objectives are scaled to HU-12 watersheds. Conservation plans have several conservation targets that include consideration of climate change.
- The ODFW OC Coho Conservation Plan is currently working with its stakeholders to create long term strategic habitat restoration and protection plans at the OC Coho population scale. While we are early in the process, we are emphasizing that implementing protection and restoration of ecosystem functions with an awareness that climate change will likely alter weather patterns and that on-the-ground actions need to be selected and implemented with the likely environmental changes (stream power,

hydrograph compression, sea level rise and ocean wave energy increases) as key decision elements in the development process.

- Ongoing activities include the local ODFW Tillamook office participation in the development of the Southern Flow Corridor, a community led effort to reconnect floodplains to help managing existing winter flood events effecting parts of Tillamook County.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?

- The above bullets describe active conservation planning efforts, and the plans have significant RME components. ODFW applies state-of-the-science monitoring of fish populations for status and trend but has yet to invest in monitoring strategies specific to adaptation and the appropriate temporal scales. The agency is promoting the use of intensively monitored watersheds to inform future actions. ODFW is also involved with OWEB, NOAA, WSC and NFWF in developing 3 different pilot business plan models in three populations here on the coast. These efforts will work with local stake holders to develop long term strategic actions plans and one of the models is referred to as “community resiliency” (there others are “working lands” and “all lands”) and directly addresses climate change and how watershed restoration will need to move forward under these conditions.
- ODFW is also a member of the Pacific Marine and Estuarine Fish Habitat Partnership (PMEP) which is a three state (Oregon, Washington, and California) effort to address juvenile fish nursery functions within the estuaries and nearshore environment. The PMEP vision is to provide for healthy native fish populations in functional, resilient estuarine and nearshore marine ecosystems. Current work includes conducting a coast wide Nursery Habitat Assessment with a focus on nursery functions for juvenile fish in west coast estuaries. Understanding these habitat / biological relationships will allow better identification and management of threats, including the physical landscape changes that will occur as a result of climate change.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

- General: Active review of the rapidly expanding adaptation literature, with focus on Northwest US. Use of climate change list-serve sites. Using products from OCCRI, CIG, and other regional federal science centers. ODFW can provide a list of citations.
- Clatsop/Tillamook Counties: There is a need for better downscaled climate models for the counties. There are some resources we have been reviewing. ODFW is working with watershed councils and other entities to better define habitat limiting factors for salmonids (existing vulnerabilities).

5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

- Not yet

Summary of Agency Adaptation Work

Agency Name: Oregon Health Authority - Public Health Division

Lead Preparer: Emily York Emily.A.York@state.or.us & Brendon Haggerty
Brendon.Haggerty@state.or.us

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Oregon's Public Health Division has partnered with 5 different local health jurisdictions to pilot local 'climate and health adaptation plans'. Tools and examples from this program can be used in other counties. Summaries of the plans can be found on our [Local Adaptation Planning](#) webpage, including additional resources for planning for the health effects of climate change.

One of our partners, Benton County, developed a 'Health Risk Assessment tool' that can be found on our [Publications and Training Materials](#) webpage. The tool is based on an emergency preparedness approach and can be used by a group of local experts to identify and prioritize risks in their region.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Our current effort to document climate and health impacts and create a climate and health adaptation plan encompasses Clatsop and Tillamook counties, as it is statewide. We do not have a specific project within Clatsop or Tillamook Counties, although we're interested in building partnerships and providing technical assistance. In the coming years, we hope to make small grants available to support climate and health adaptation planning on the coast.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

This summer, Oregon's Public Health Division will publish a new statewide report, the [Climate and Health Profile Report](#). This document will help to raise awareness about the connections between climate change and health and can be used as a resource to help identify health priorities and vulnerable communities in Oregon. The report will lay the groundwork for a future statewide Climate and Health Adaptation Plan that will provide a set of recommended policies and practices for building resilience and protecting our communities.

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

Our principal source of information on climate drivers comes from the Oregon Climate Research Institute and NW climate assessments. We also draw on data sets from NOAA and the National Climatic Data Center. Regarding sea-level rise, we rely on *Sea-level Rise for the Coasts of California, Oregon, and Washington* from the National Research Council. We are in the beginning stages of conducting more in-depth social vulnerability assessments that will compile a number of different social indicators. Principal sources for this assessment include the American Community Survey and the Oregon Behavioral Risk Factor Surveillance System. Our sources are the same for Clatsop and Tillamook counties, although local expertise and traditional ecological knowledge are important sources to include at the local level.

5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

In the Fall of 2014, a new local planning toolbox will be made available online for public health planners in Oregon. The toolbox will include examples and resources for implementing CDC’s [BRACE \(Building Resilience Against Climate Effects\) Framework](#) at the local level.

We’re also in the process of expanding our [Climate and Health Equity](#) resource page to include more guidance on addressing environmental justice issues, engaging diverse stakeholders, and building local capacity.

Our [Environmental Public Health Tracking Portal](#) provides data on climate-related health issues such as heat-related illness and asthma. In coming years, we expect to have data on social vulnerability available through this portal.

Summary of Agency Adaptation Work

Department of Land Conservation and Development

Lead Preparer Laren Woolley and Jeff Weber (971.673.0964 jeff.weber@state.or.us), with assistance from Marian Lahav and Steve Lucker.

1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.

A. Oregon's statewide comprehensive planning program provides a foundation for cities and counties to address several adaptation issues and climate risks, in particular those that can be approached through comprehensive land use planning. Elements of Oregon's planning program that may support adaptation efforts or be used to address adaptation issues include several Statewide Planning Goals, especially Goal 7 – Areas Subject to Natural Hazards; Goal 5 – Natural Resources, Scenic and Historic Areas, and Open Spaces; Goal 16 – Estuarine Resources; Goal 17 – Coastal Shorelands; and Goal 18 – Beaches and Dunes.

- Goal 7 – Areas Subject to Natural Hazards. Goal 7 is the foundation for addressing natural hazards through comprehensive land use planning. The purpose of Goal 7 is to protect people and property from all natural hazards, including hazards with climate drivers like floods, landslides, wildfire, and coastal erosion. As credible information about hazards becomes available, local governments can—and should—develop strategies and regulations to protect people and property from harm or loss due to such hazards.

Note that Goal 7 only *requires* mitigation of "...floods (coastal and riverine), landslides, earthquakes and related hazards, tsunamis, coastal erosion, and wildfires." It goes on to say "Local governments MAY [emphasis added] identify and plan for other natural hazards." Additional climate-related natural hazards that are addressed in Oregon's NHMP (see below) that local governments could address in part using Goal 7 are drought, dust storms, windstorms, and winter storms.

- Goal 16 – Estuarine Resources. Goal 16 is designed to provide for legitimate in-water development in Oregon's estuaries under certain specific conditions and otherwise to conserve and protect important estuarine functions and habitats. Goal 16 provides the foundation in state law to protect estuarine functions, resources, and areas that mitigate the effects of climate change from sea level rise, flooding and ocean acidification. Most importantly, Goal 16 is the foundation for protecting tidal wetlands, which are potentially of immense importance in mitigating the effects of sea level rise.
- Goal 17 – Coastal Shorelands. Like Goal 16, Goal 17 provides policies, regulations and a foundation for local governments to adopt measures to protect water quality and fish and wildlife habitat (including riparian areas), among other things like public access, water-dependent uses, economic resources and recreational and aesthetic resources.
- Goal 18 – Beaches and Dunes. Goal 18 provides several tools to address risks along the ocean shoreline:

- Goal 18 prohibits development on Oregon’s beaches, primary foredunes, and other foredunes and deflation plains that are subject to ocean undercutting and wave overtopping.
 - Goal 18 generally prohibits the placement of beachfront protective structures (BPS) for development which did not exist as of January 1, 1977. This important state policy should be a primary factor in addressing future climate conditions, especially sea level rise. Note that LCDC allowed Tillamook County to take exceptions to Goal 18 in a number of areas, generally in and around rural communities and other developed areas. BPS to protect newer development is permitted in these exception areas, if needed.
 - Goal 18 prohibits grading of foredunes unless a foredune grading plan is developed, adopted by local government, and acknowledged by LCDC. If foredune grading is authorized it must be done in a way that will encourage the development of a more robust foredune (to assist in mitigating erosion cycles) and must not lower a dune more than the FEMA base flood elevation plus 4 feet.
- B. DLCD has used federal coastal zone management resources to contract with DOGAMI to develop coastal erosion risk zone maps and analyses for Tillamook County. These maps and analyses support local efforts to develop and adopt hazard mitigation and climate adaptation strategies. DLCD and DOGAMI are currently assisting Tillamook County in a project that will result in revised hazard risk zone maps and analyses to address sea level rise for dune-backed shorelines, using the 2012 NRC sea-level rise study for the west coast¹.
- C. DLCD implements FEMA’s **National Flood Insurance Program (NFIP)**, which is a longstanding federal program to support community efforts to implement measures to reduce risks to development in flood-prone areas. The NFIP is the common foundation for regulating development in areas subject to the so-called “100-year flood.” FEMA is currently supporting the revision of floodplain maps in several Oregon communities.
- D. DLCD is managing the 2015 **update of Oregon’s Natural Hazard Mitigation Plan** due to FEMA in 2015. The draft NHMP update (under development) contains a summary of statewide climate changes and a first-cut assessment of the climate-related risks for each of eight regions in the state. The next update of the NHMP, due in 2020, is expected to further integrate climate change.
- E. DLCD is in **active discussions with FEMA** on ways that climate change can be integrated into Oregon’s natural hazards mitigation planning efforts using FEMA’s RiskMAP program. RiskMAP begins with identifying risk, then assessing risk, then communicating risk, and finally encouraging communities to use non-regulatory means to support improved local natural hazards mitigation planning, including planning for future climate conditions.
- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

¹ National Research Council. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Washington, DC: The National Academies Press, 2012. Available online at http://www.nap.edu/catalog.php?record_id=13389

- A. Neskowin Coastal Erosion Adaptation Plan. The OCMP has been working with Neskowin and Tillamook County to address coastal erosion in the unincorporated community of Neskowin. The county is in the process of adopting a coastal hazard overlay zone for Neskowin, which provides more robust development regulations and use limitations. The overlay zone includes such things as erosion control and drainage and runoff provisions, requires a geologic report for new or substantial improvements, more robust geologic report standards, safest site requirements (must develop on the safest portion of the lot), limitations on land partitioning within hazard areas, and limitations on increasing residential density.
 - B. The other effort in NW Oregon DLCD is involved in that is specifically devoted to climate adaptation is the regional-scale adaptation alignment and prioritization effort (this project). DLCD is the originator, organizer, and facilitator of this effort.
 - C. The OCMP is a partner in a ‘community resilience’ pilot planning project in southwest Clatsop County, which in practice has focused mostly on earthquake and tsunami hazards.
- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**
- A. Because of its role in managing, facilitating, and producing the Oregon Climate Change Adaptation Framework, DLCD is the **de facto lead and the primary agency of contact with the Office of the Governor for statewide adaptation planning**. However, at this point there is no active organized state-level adaptation planning effort.
 - B. The OCMP has been **fostering, leading and supporting efforts to develop ‘decision support’ resources appropriate and accurate enough to assist in climate adaptation planning at the community level**. (Beginning with CAPIS—Climate Adaptation Planning Information System; see #5 below.)
 - C. OCMP is actively **engaged on climate change adaptation work groups at the west coast and national levels**. The West Coast Governors’ Alliance Climate Change Work Group is currently developing a work plan for a project to develop a west coast-wide decision support system for sea level hazards based on a system called CoSMoS implemented in select California locations. See http://walrus.wr.usgs.gov/coastal_processes/cosmos/
 - D. DLCD and OCCRI jointly hosted a Post-Doctoral Fellow who developed a **website to provide data and maps showing projected future climate conditions**. Go to http://oregonpace.net/pace/climatology_explorer.htm for access.
 - E. As part of the PACE project, in 2011 OCCRI and DLCD completed a first-cut **assessment of state agency needs for information products using downscaled climate data**. (Contact jeff.weber@state.or.us to get a copy of the summary report (April 2011) “Management Issues for Downscaling Climate Model Outputs.”)
 - F. DLCD/OCMP is working with DOGAMI and ODOT to **clarify a consistent approach to mapping areas subject to sea level hazards**, including storm surge, sea level rise, and El Niño events.
 - G. The OCMP participates in the annual **King Tide events**, which are primarily designed as a vehicle for public outreach about climate change, specifically sea level rise. This

effort involves both a website (www.coastalatlantlas.net/kingtides) and a Flickr Group (www.flickr.com/groups/oregonkingtides/).

- H. DLCD and OPRD are jointly hosting a NOAA Coastal Fellow who is updating **inventories related to beachfront protective structures** (OCMP beachfront protective structure eligibility inventory, and the OPRD shoreline protective structure inventory). The project also involves an analysis of existing state policies on BPS, and will provide options for future consideration. These updated tools and information will assist local and state decisions related to beachfront protective structures, considering increases in sea level rise and potential coastal erosion.
4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**
- A. The Oregon Climate Assessment Report; Oregon Climate Change Adaptation Framework; and the Pacific Northwest chapter of the National Climate Assessment. IPCC reports provide a good global-scale context, and the National Climate Assessment provides good national-scale context.²
- B. A report on climate change in Tillamook Bay watersheds developed for the Tillamook Estuaries Partnership by the Oregon Climate Change Research Institute.
5. **Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**
- A. DLCD and OCCRI jointly hosted a Post-Doctoral Fellow who developed a **website to provide data and maps showing projected future climate conditions**. Go to http://oregonpace.net/pace/climatology_explorer.htm for access.
- B. The OCMP attempted in 2009 to foster an intergovernmental and interdisciplinary effort to develop what it named the Climate Adaptation Planning Information System, or CAPIS. The project conducted an initial assessment of information needs for local decision-making that would be affected by the effects of climate change. CAPIS is not currently active, although the initial discussions, partnership and assessment remain sound basic elements for developing decision support tools for use at the local level. See <http://www.climateadaptationplanning.net/index.php>.

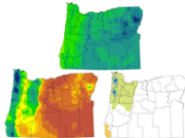
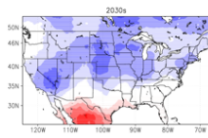
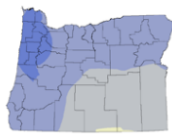
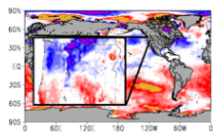
² Note that while DLCD staff knows where to get information on climate drivers, risks, and vulnerabilities, staff generally do not have enough time under current workloads to review these reports.

PACE data explorer web interface

The screenshot shows a web browser window with the URL http://oregonpace.net/pace/climatology_explorer.htm. The browser's address bar and menu bar are visible. The page content includes the OregonPACE logo and navigation links: [Pace Blog Home](#), [PACE Data Explorer Home](#), and [Explore Projected Climatologies](#).

Explore Projected Climatologies

Select the **climate variable**, the **future era** and **time period** you are interested in exploring, then select a **model** and **click Go!**

- 1** Select a climate variable

About Climate Variables
Explore various climate variables to see how they may change.
- 2** Select a future era

About Future Eras
Choose a future era for which climatologies have been modeled.
- 3** Select a time period

About Time Periods
Choose to explore seasons or individual months.
- 4** Select a climate model

About Climate Models
Choose to explore the outputs of different climate models.

More Information

- Climate Projections:** A climate projection is usually a statement about the likelihood that something will happen several decades to centuries in the future if certain influential conditions develop. In contrast to a prediction, a projection specifically allows for significant changes in the set of boundary conditions, such as an increase in greenhouse gases, which might influence the future climate. As a result, what emerge are conditional expectations (if this happens, then that is what is expected). For projections extending well out into the future, scenarios are developed of what could happen given various assumptions and judgments. The International Panel on Climate Change (IPCC) published its 4th Assessment report in 2007. The report summarized information on climate projections based on the IPCC emission scenarios. Source: IPCC
- Climate Variables - Temperature:** Average daily temperature for the selected month or season, in degrees Fahrenheit.
- Climate Variables - Precipitation:** Average daily precipitation for the selected month or season, in inches.
- Climate Variables - Runoff:** Total runoff, including base flow and surface runoff, for the selected month or season, in inches.
- Future Eras:** The 2030s and 2040s were chosen as the temporal range of projections shown here because 2030 has been suggested by many in the scientific community as the point at

The browser's taskbar at the bottom shows several open windows: "PACE Project Data Ex...", "Agency_summaries", "Inbox - jweber@dlcd...", "DLCD_OCMP_LW.do...", and "DLCD_OCMP.docx - ...". The system tray on the right indicates the time is 3:59 PM on Monday, 7/7/2014, with a volume icon and a 95% zoom level.

Summary of Agency Adaptation Work

Agency Name: Oregon Parks and Recreation Department

Lead Preparer: Jim Morgan & Laurel Hillmann, OPRD

1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.
2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.
 - a. OPRD is in the process of acquiring a coastal property in Tillamook County known as “Beltz Farm”, located between Cape Lookout and Cape Kiwanda. The property includes some of Oregon’s least developed estuaries, including approximately 357 acres of open water, tidal flats, dunes, emergent marsh and forested wetlands. Wetland ecosystems provide a potential buffer against the impacts of climate change. The state’s documented interest in acquiring this property dates back to the 1960’s. Acquisition of properties with wetlands is on the list of recommended action items in OPRD’s Climate Change Response and Preparedness Action Plan (OPRD, 2010). In June 2014, the Oregon State Parks and Recreation Commission voted to offer to purchase the Beltz property from the nonprofit that currently owns it. Information is available [online](#).
 - b. OPRD completed a Comprehensive Plan for a major state park in Tillamook County, Cape Lookout State Park. The plan incorporates scenarios for potential future erosion at the park based on DOGAMI modeling efforts. The section of shoreline fronting the campground and day-use area has been retreating 3-6 feet on average per year. The plan acknowledges future potential shoreline change and sites proposed development outside of highly risky areas. Incorporating climate change into planning efforts (and avoiding erosion hot spots) are both on the list of recommended action items in OPRD’s Climate Change Response and Preparedness Action Plan (OPRD, 2010). Information about the Cape Lookout State Park plan is available [online](#).
3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?
 - a. OPRD, along with DLCDC, is hosting a two-year NOAA Coastal Management Fellow whose project will help to create an improved data repository and framework for Oregon's ocean shore permitting process that can be used to plan for erosion impacts, improve storm response, protect the public interest, and other purposes. The fellow, Meg Gardner, is also helping to coordinate the [King Tides](#) initiative for Oregon.

- b. In 2010, OPRD produced a Climate Change Response and Preparedness Action Plan which is available online.
 - c. OPRD coordinates with DOGAMI on their ongoing shoreline monitoring projects along the coast, including in Clatsop and Tillamook County.
 - d. OPRD is currently participating in the Tillamook County Coastal Futures Project, to review policy scenario narratives and climate change scenarios using the Coastal Tillamook County “Envision” Model.
 - e. OPRD participated in the Neskowin Coastal Hazards Committee to look at ways to maintain the beach and protect the community through short term and long term strategies; make recommendations to state/county/local agencies, and explore ways to plan for and adapt to the potential future changes in the Neskowin coastal area.
4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?
- a. Oregon Climate Change Research Institute (OCCRI) and state produced information, such as CCIG reports as well as federal and international reports such as the US National Climate Assessment and IPCC reports.
 - b. Regarding vulnerabilities, the local research results from DOGAMI’s shoreline research project are relevant; some are listed on DOGAMI’s website. Also, research is published in DOGAMI Open-File Reports and various Oregon State University (OSU) coastal research project publications
5. Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.
- a. In 2010, OPRD produced a Climate Change Response and Preparedness Action Plan which is available online.

Summary of Agency Adaptation Work

Oregon Department of Transportation

Lead Preparer: Geoff Crook, Sustainability Program Manager - (503) 986-3425

ODOT Adaptation home page-

http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/Pages/cc_adaptation.aspx

ODOT Adaptation Strategy Report-

http://www.oregon.gov/ODOT/TD/CLIMATECHANGE/docs/odot_adaptation_strategy_final.pdf

1. What programs or resources does your agency have in place that might be used to address known adaptation issues/needs in Clatsop and/or Tillamook?

ODOT has a Sustainability Program Manager dedicated to adaptation planning. ODOT has a technical Adaptation Work Group available to guide adaptation work. The agency is conducting a climate change vulnerability assessment and adaptation options study in the north coast (two-county) area. Results from this work will inform where vulnerabilities are located throughout the State highway network in this area (~300 miles of roadway) and strategies for how to address them in the future.

2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties?

ODOT is conducting a climate change vulnerability assessment and adaptation options study in the two-county area. The project is FHWA funded. We are focusing on state highways with the principal climate drivers of extreme precipitation, higher sea levels and intense storms. Primary hazards include flooding, high water/ scour, landslides/ rock fall, coastal erosion and storm surge. The purpose is to identify system vulnerabilities and risks along area highways. Adaptation sites were selected within a Study Corridor. We are in process of developing conceptual design solutions to address failures at the sites along with long-term maintenance and construction costs for a range of options (Benefit-Cost Analysis). Partners include OCCRI, state agencies, input from local agencies and region groups where feasible.

3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring

ODOT has been engaged in adaptation planning and research since 2008. We partnered on the Adaptation Framework Plan in 2010. We developed an Adaptation Strategy (high level assessment of risks/ opportunities) in 2012. ODOT plans to conduct a Statewide Vulnerability Assessment in the 2015-16 timeframe and develop specific ways to engage internal partners and mainstream adaptation.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

- a) OCCRI; OSU; UW; University of Idaho (downscaled GCM data/ CMIP5); NOAA/ NWS; West Coast SLR report (NRC 2012);
- b) DOGAMI extreme value analysis; ODOT Maintenance Dispatch Records; maintenance information regarding frequency and magnitude of past events.

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

N/A

ODOT Vulnerability Assessment and Adaptation Pilot

ODOT maintenance staff already know what others are just beginning to notice. Extreme weather events are becoming more common in the Pacific Northwest, and they are having an impact on our facilities and our maintenance budgets. Culverts flood more often. Landslides have become larger and more frequent. Washouts, sinkholes and standing water problems have increased.

Extreme weather events are projected to increase through this century. ODOT wants to be ready. To better understand and respond to climate-related impacts on our transportation system, ODOT is conducting an Adaptation Pilot on the north coast of Oregon. This project will assess the vulnerability of highway infrastructure to extreme weather events, inventory and prioritize hazard areas, and develop a corridor-specific implementation plan. Lessons learned from the pilot will be used to inform ODOT's broader statewide vulnerability assessment.

Adaptation Planning in Oregon

"Adaptation" refers to policies, projects or strategies that seek to reduce the vulnerability and risks posed by extreme weather and climate related impacts. ODOT's adaptation measures will help improve our ability to get ahead of problems, and to address problems that do occur more quickly and efficiently.

Goals and Objectives of the ODOT Pilot

ODOT received a grant from the Federal Highway Administration (FHWA) to carry out the 18-month pilot project. The goal of the pilot is to conduct a regional vulnerability assessment and prepare options for adaptation actions and priorities. Through the project ODOT will:

- Collect and map vulnerability and risk data for the north coast region based on climate science, asset conditions, and known and anticipated natural hazards information.
- Conduct a workshop with ODOT maintenance and technical staff to collect information and identify priorities.
- Rank highway segments and Lifeline Routes for vulnerability.
- Prioritize a study corridor with a high vulnerability rating for more detailed analysis.
- Identify areas to build resiliency in the study corridor based on engineering and technical review by ODOT staff and input from stakeholders.
- Develop a set of specific adaptation measures addressing infrastructure vulnerable to landslides, coastal erosion or other hazards.
- Prepare a comprehensive Coastal Hazards Adaptation Implementation Plan.
- Collaborate with other agencies and coastal communities planning for resilience to natural hazards on the north coast.

The Adaptation Pilot will be led from ODOT's Active Transportation Section. Work will be guided by ODOT's Adaptation Work Group in cooperation with the Oregon Climate Change Research Institute and other state agencies. The Work Group, formed in 2012, is made up of staff from asset management, Geographic Information Systems (GIS) mapping, planning, geology, environmental, and maintenance and operations divisions. In the years ahead, results from the study will allow ODOT to test and monitor specific adaptation measures for applicability in other areas of the State. Work on the pilot is scheduled for completion by September 2014. For more background or to share information, please contact Geoff Crook, 503-986-3425.



Summary of Agency Adaptation Work

Oregon Water Resources Department

Lead Preparer: Alyssa Mucken, Program Coordinator for Oregon's Integrated Water Resources Strategy (alyssa.m.mucken@state.or.us; 503-986-0911)

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

The Department has field staff based in Tillamook that may be able to help with understanding current issues or challenges facing water management and supply constraints. The Department is currently in the recruitment phase to fill a vacated Watermaster position in Tillamook County.

The Department also has trained hydrogeologists and hydrologists, based mostly in Salem that can assist with technical questions or research requests.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

No.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

The Oregon Water Resources Department (OWRD) led development of the state's first "Integrated Water Resources Strategy," adopted in August 2012. This Strategy includes two recommended actions aimed as supporting continued basin-scale climate changes research efforts, and helping assist water users with climate change adaptation and resiliency strategies.

The Strategy can be accessed here:

http://www.oregon.gov/OWRD/pages/law/integrated_water_supply_strategy.aspx

As part of implementation of the Strategy, OWRD will be expanding the density and spatial distribution of its surface water gaging network and state observation well network, which hopefully could be used by the Department and other partners to monitor and project changes in streamflow and groundwater resources.

The Department has a newly created water resources development account, which provides \$10 million in grants to local communities to support instream or out-of-stream projects. Funds should be available, on a competitive basis, in mid-2015. Increasing ecosystem resiliency to climate change impacts is one of several elements to be evaluated when scoring and ranking the environmental benefits of a particular project.

Since 2008, the Department has provided grant funds to conduct planning studies, which can include studies proposing hydrological analyses of a proposed water conservation, reuse or storage project, including the anticipated effects of climate change on hydrological refill capacity. This program is the "Water Conservation, Storage, and Reuse Grant Program (often referred to as SB1069 Grants).

OWRD has also provided funds, groundwater data, and technical assistance to support Reclamation's WaterSMART Basin Study Program efforts occurring here in Oregon. The

Hood River Basin Study is nearly complete, and water users and other interested partners in the Deschutes Basin are in the early stages of initiating a two-year basin study. Basin Studies analyze supplies and demands, incorporating climate change into the analysis and identifying possible solutions and trade-offs to address growing pressures on water resources in a particular basin.

The Department has also participated in the Willamette Water 2100 project, as part of the Learning Action Network, providing data or clarifying information for researchers working on this project. Researchers within the Oregon university system are looking at how climate change, population growth, and economic growth could change the availability and the use of water in the Willamette River Basin on a decadal to centennial timescale. The Willamette Water 2100 Project website: <http://water.oregonstate.edu/wv2100/>

OWRD also participated in development of the state's 2010 Climate Change Adaptation Framework.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?

In general, OWRD relies on reports and information from the Oregon Climate Change Research Institute and has utilized information from the University of Washington's Climate Impacts Group.

5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL. .

No

Summary of Agency Adaptation Work

Agency Name: Columbia Land Trust

Lead Preparer: Nadia Gardner, Conservation Manager. ngardner@columbialandtrust.org, (503)338-5263

- 1. What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Columbia Land Trust works with willing sellers/donors to conserve their land for wildlife habitat in perpetuity. In Clatsop County, we are actively purchasing floodplain/wetland land along the Columbia River and its tributaries for conservation and wildlife habitat restoration. We are especially interested in building on other conserved lands and creating wildlife corridors. This is a tool that will allow for species migration and could help mitigate human impacts of sea level rise and increased storm events.

- 2. Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

See above. Geographic scope – watersheds that drain to the Columbia. Purpose – wildlife habitat. Partners & Funding: Bonneville Power Administration, USFWS, NRCS, OWEB, National Fish & Wildlife Foundation, Watershed Councils, Counties, Cities, landowners. Outcomes: Conserved and restored intertidal and floodplain wetlands, side channels, and streams. Healthy and abundant fish stocks and other wildlife.

- 3. Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

We are currently undertaking comprehensive conservation planning, which is integrating climate change models, such as SLAMM data.

- 4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

Point Blue: Produced current distribution and density models for 26 bird species that were chosen to represent coniferous, grassland, oak, and riparian habitats. The models were produced using climate and vegetation data in conjunction with one million new additions to the Avian Knowledge Network, in addition to millions of existing records. The models were projected to future conditions (2070) using five regional climate models. The resolution of the data is approximately 1 km. www.pointblue.org

Washington Wildlife Habitat Connectivity Working Group, which is co-led by the Washington Department of Fish and Wildlife (WDFW) and the Washington Department of Transportation (WSDOT). Habitat core areas and wildlife migration corridors - The core areas are vector based, and the resolution of the raster corridors is 1 km². The data were developed by Tristan A. Nunez as part of his University of Washington Master's thesis, *Connectivity Planning to Facilitate Species Movements in Response to Climate Change*. <http://waconnected.org/>

SLAMM: Sea Level Affecting Marshes Models

NOAA Sea Level Rise and Coastal Flooding Viewer: <http://csc.noaa.gov/slr/viewer/>

5. **Has your agency developed ‘decision support resources’ or ‘online tools’ intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

Yes, internal tools only. See above sources of data for our conservation planning.

Summary of Agency Adaptation Work

Agency Name: Lower Columbia Estuary Partnership

Lead Preparer: Catherine Corbett, Tel: 503-226-1565; email: ccorbett@estuarypartnership.org

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

Habitat Restoration, Ecosystem Monitoring and Action Effectiveness Monitoring Programs that includes funding for on-the-ground restoration and monitoring within the historic tidally influenced areas of the lower Columbia River.

2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Actively seeking funding for vulnerability assessments of same geographic area, including mapping downscaled sea level rise scenarios; identifying habitats and species vulnerable to changing precipitation and temperature; and mapping cold water refugia locations. The sea level rise maps would include scenarios with more intense and frequent storms (resulting in more erosion); and would assess impacts on local infrastructure. Results would be provided online and would be available to local, state, tribal and federal agencies.

3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

See above

4. **What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?**

5. **Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.**

See above

Summary of Agency Adaptation Work

Agency Name: Oregon State University, Civil Engineering

Lead Preparer: David Hill (david.hill@oregonstate.edu)

1. **What programs or resources does your agency have in place that might be used to address known adaptation issues or needs in Clatsop and/or Tillamook Counties? Please provide a brief summary of the scope, purpose, and desired outcomes for each.**

We have several efforts underway to investigate climate-change impacts on estuarine waters in the Pacific Northwest. We are trying to establish the likely range of changes to 'boundary conditions' such as offshore wave climate and streamflow and sea level rise. We are next trying to connect those changes to changes in water elevations inside the estuaries.

2. **Is your agency actively addressing climate-related issues in Clatsop and/or Tillamook Counties? Please provide a brief summary of the issue, geographic scope, purpose, partners, funding, and expected outcomes.**

Yes, the effort described above is taking place initially in Tillamook Bay and in Coos Bay.

3. **Is your agency engaged in any other activities related to adaptation, like planning, research, outreach, or monitoring?**

As part of the SeaGrant project, we are working with DOGAMI to try and produce useful mapping products related to future water levels. Also, we will be consulting with stakeholders at our two study sites.

4. What is your principal source of information on climate drivers, risks, and vulnerabilities, a) in general; and b) in Clatsop and Tillamook Counties?
5. Has your agency developed 'decision support resources' or 'online tools' intended to be used for either adaptation planning or management issues related to climate change? If so, please provide a URL.

