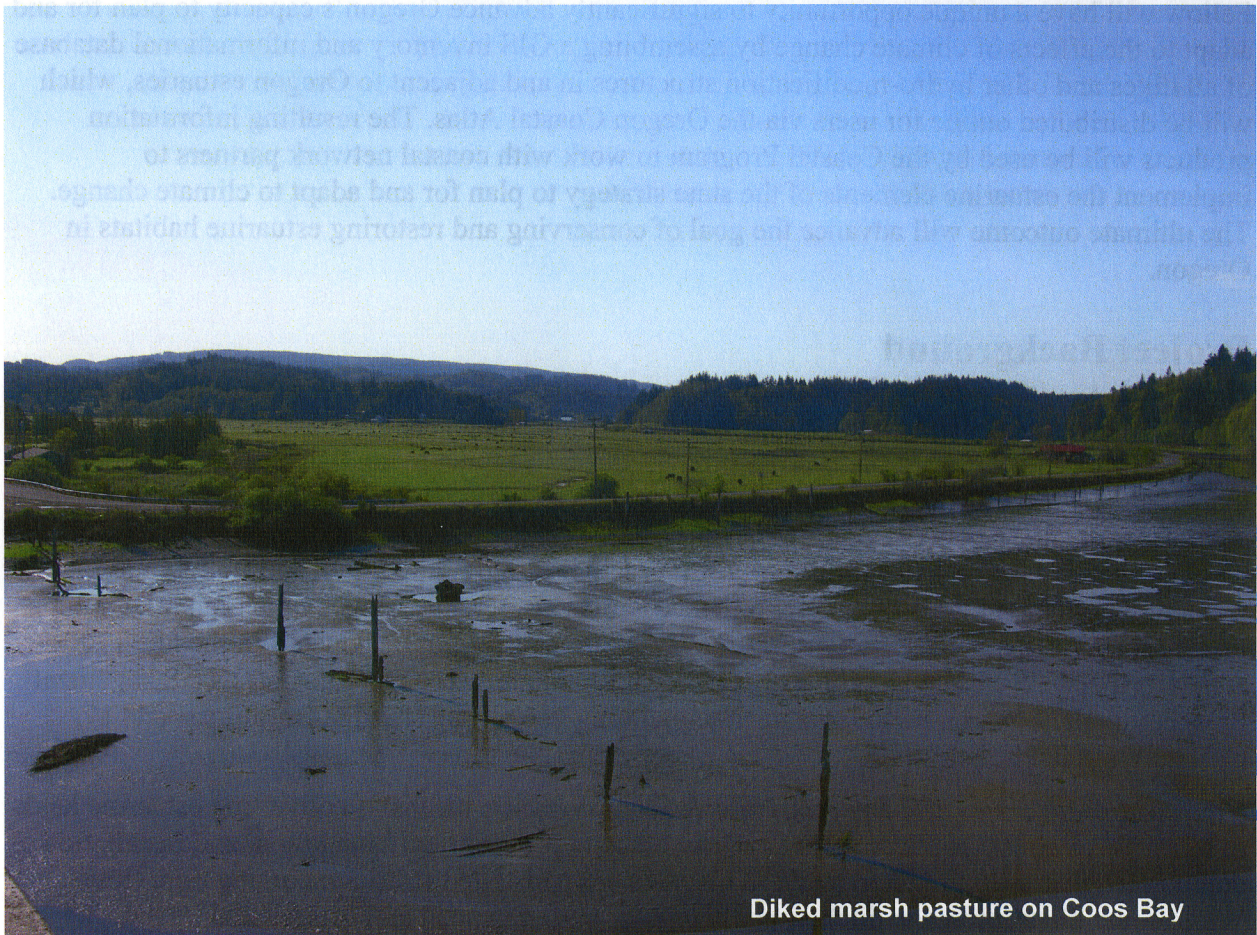


Constructing a Diked Lands Vulnerability Inventory to Support Strategic Planning for the Impacts of Sea Level Rise

A Proposal for a NOAA Coastal Management Fellow

The NOAA Coastal Services Center
2009 Coastal Management Fellowship Program



Diked marsh pasture on Coos Bay

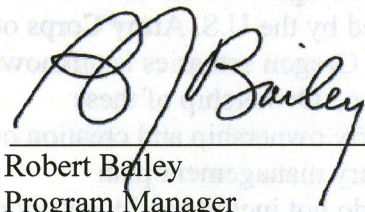
Oregon Coastal Management Program

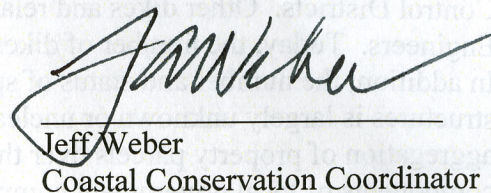
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Proposed 2009 Coastal Management Fellowship Oregon Coastal Management Program

Introduction

Oregon is experiencing a number of effects as a result of changes in Earth's climate. Among the likely effects is a rise in mean tidal elevations in estuaries driven by higher sea level. Higher tides in estuaries will in turn trigger a variety of effects on estuarine habitats, land uses, and public and private infrastructure. The Oregon Coastal Management Program is developing a strategy to plan for and adapt to these effects. The project described herein will provide the state with information products to implement the estuarine elements of this strategy. The NOAA Fellow will have a unique opportunity to significantly advance Oregon's capacity to plan for and adapt to the effects of climate change by assembling a GIS inventory and informational database of all dikes and other hydro-modification structures in and adjacent to Oregon estuaries, which will be distributed online for users via the Oregon Coastal Atlas. The resulting information products will be used by the Coastal Program to work with coastal network partners to implement the estuarine elements of the state strategy to plan for and adapt to climate change. The ultimate outcome will advance the goal of conserving and restoring estuarine habitats in Oregon.

Project Background

Historic Loss of Wetlands. Historically, Oregon estuaries have suffered significant loss of tidal wetlands. Beginning in the late 1800s, saltmarshes, tidelands, and other areas in many estuaries were converted to uses to support new communities developing along the Oregon coast. More than 50,000 acres, representing more than 68 percent of formerly productive estuarine habitats, have been lost due to diking, draining, filling, and other actions. A majority of these former wetlands were converted to agricultural use, principally cattle grazing. In addition to loss of wetland functions, the loss of tidally influenced areas also greatly reduced the total tidal volume of the estuaries. This loss of estuarine areas was the focus of public concern in the late 1960s and early 1970s. It became a principal reason for establishing the Oregon Coastal Management Program in 1977, which includes statewide planning goals 16, Estuarine Resources, and 17, Coastal Shorelands.

Construction of Dikes and Drainage Works. The common means of converting estuarine lands to other uses was the construction of earthen dikes to prevent tidal inundation, and installation of drainage ditches to drain diked lands. Tidegates were installed restrict incoming tidal flow. While some dikes, drainage ditches, and tidegates were financed and constructed by the landowner, most were constructed under the authority of special taxation districts that were created at the request of affected property owners and approved by the county. Such districts, which were formed as early as 1915, include Diking Districts, Drainage Districts and Flood Control Districts. Other dikes and related levees were constructed by the U.S. Army Corps of Engineers. Today, the number of dikes, ditches, and tidegates in Oregon estuaries is unknown. In addition, the number and status of special districts is not known. Ownership of these structures is largely unknown or unclear due to changes in property ownership and creation or aggregation of property parcels over the past 90 years. The estuary management plan components of local government comprehensive plans typically do not include an inventory of

dikes or other structures and do not identify ownership or the boundaries of these special districts. Many other scenarios are also possible.

Emerging Issues from Climate Change. Climate change is likely to affect estuaries in unique ways, principally from sea level rise and increased flooding during winter storm events. While some dikes and drainage structures have been well-maintained, an unknown number of others have not. All such structures, well-maintained or not, are vulnerable to these likely effects. Over the past thirty years, changes in the agricultural economy of the Oregon coast have affected the financial feasibility and necessity of maintaining, repairing, and reinforcing some dikes. These changed economic conditions, coupled with changing climate conditions, give rise to several possible scenarios in the face of increased tidal elevations and flooding. Under one scenario, some land owners will simply let these structures deteriorate over time. Under another scenario, the residents within some diking districts may be unable to agree on a management strategy with the result that dikes protecting key infrastructure or economically viable operations will deteriorate, jeopardizing both public and private assets. Finally, public infrastructure currently protected by dikes and drainage ditches, such as schools or roads, might be jeopardized by dike failures elsewhere.

Improving Planning and Management. The scenarios above create an opportunity for the State of Oregon to work with local governments, landowners, state and federal agencies, and non-governmental organizations to visualize the effects of increased tidal elevations and flooding in estuaries, develop vulnerability assessments, assess economic and conservation factors affecting estuarine lands, and prepare an adaptation strategy for each estuary. Such an adaptation strategy would provide for the identification of lands and infrastructure to be protected, and lands that may appropriately be reconnected to tidal influence to accommodate flooding and the landward migration of habitats. A number of pilot or demonstration projects in Oregon estuaries have demonstrated the success of reestablishing estuarine functions in formerly diked and drained lands.

Project Value The Oregon Coastal Management Program has drafted a Climate Change Adaptation Strategy that details various elements needed to assist coastal climate change adaptation planning. One of the elements is a need for tidal land information products, like a dike inventory, and related assessment tools to assist coastal planners in planning for sea level rise and other effects of climate. This fellowship project will develop some of those products. Thus, the results of this fellowship will directly fulfill an identified coast wide information priority for the OCMP. The resulting data, information products and tools will enable the state, land owners, local governments, and others to identify and understand the degree of vulnerability and risk for farms, communities, and infrastructure that occupy extensive areas of what used to be wetlands and tide flats.

Available Resources Oregon has a substantial amount of the raw data needed to create the information products and assessment tools to support estuarine adaptation planning. Part of the challenge of the fellowship will be to work with users to assemble the available data and information in an integrated environment that supports seamless analysis, planning, and decision-making. A significant resource available to the fellowship project is the Oregon Coastal Atlas (OCA), <http://www.coastalatlantlas.net>, developed by the OCMP in cooperation with Oregon State University, Ecotrust and other partners. The OCA is an online interactive map, data, and metadata portal designed to be used by a diverse range of users, including coastal managers,

scientists, and the general public. It was developed as a tool to deliver data and information to users via the internet, and to improve information access and interpretation for decisions that affect coastal resources. The products developed by this fellowship project will be shared with coastal program partners via the Coastal Atlas, and the fellow will have the full support of the Coastal Atlas project team for reaching the fellowship outreach goals.

Available data include:

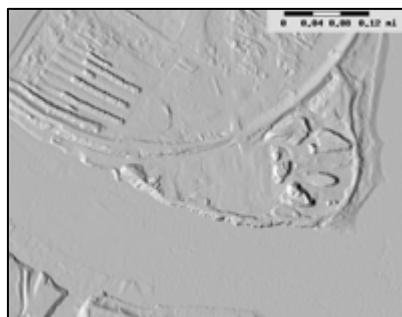
- detailed LiDAR elevation data acquired in 2007, 2008 and 2009 by the Oregon Department of Geology and Mineral Industries that is being converted to digital elevation models for all estuaries;
- digital county assessor property maps and other data related to local districts;
- aerial orthophotos, both true color and infrared, flown in 2004 and 2005;
- digital estuarine habitat and estuarine management maps from Oregon Estuary Plans ;
- digital and paper county and city land use maps of estuarine and shoreland areas;
- digital public utility infrastructure information from counties and utilities;
- updated FEMA flood maps in digital format;
- detailed wetland assessment data created by watershed councils for specific areas;
- digital inventories of tidegate locations for some estuaries;
- digital inventories of potential wetland restoration sites for some estuaries.

These and other data constitute the raw materials for assembling the information products envisioned in this fellowship proposal. Some of these building blocks, such as the cadastral and LiDAR data, are new, and this project would not be possible without them. The challenge and opportunity for the fellow is to work with coastal program partners to use these new and other data to create information products that support analyses and strategic planning related to the impacts of climate change. This project will provide a foundation for planning for the long term disposition of dikes, drainage ditches, and tidegates in Oregon estuaries.

Examples of data and data products to be used in the Oregon Fellowship Project



Color orthophoto



Bare-earth image derived from LiDAR



USGS topographic map

Goals and Objectives

The overall goal of this project is to improve access to data and provide the State of Oregon with information products centered on climate change adaptation planning to aid infrastructure investment decisions in Oregon estuaries.

The major objectives of the project are to:

- 1) Develop a geo-spatial database of existing information to support an inventory of dikes and other hydromodification features in Oregon estuaries, with supporting information on property ownership and boundaries of related special districts.
- 2) Research GIS decision-support tools to support physical, economic, and conservation assessments and strategic planning decisions about lands affected by hydromodification features.
- 3) Create estuary vulnerability information products to support planning for infrastructure and habitat on lands subject to tidal inundation or flooding from increased tidal elevations.
- 4) Construct an assessment tool that uses the information products described above to improve awareness of sea level rise issues in tidal areas.
- 5) Establish partnerships with other agencies and organizations, including watershed councils and special districts, with an interest in the future management of diked lands and hydro-modification structures in Oregon estuaries.

Project Description and Thematic Areas

The OCMP seeks a creative Coastal Services Center coastal management fellow with an interest in estuarine management issues and a familiarity with GIS to develop an inventory of hydro-modification structures and vulnerable tidal lands in Oregon estuaries. This inventory will meet Oregon's increasing needs for integrated information products targeted at climate change adaptation planning in estuarine areas. The fellow will not be alone in this effort: the coastal program is a distributed network of planners and involves significant partnership contributions from other agencies and institutions, and this fellowship project will entail working within that framework and those relationships to achieve the project goals and objectives.

This project presents an opportunity for a two-year fellowship at the Oregon Coastal Management Program to improve access to estuarine data and the use of information products related to the management of dikes and diked lands. The project will compile dike-related data into detailed planning specific information. The project addresses several of the thematic areas specified by NOAA in the project selection criteria, primarily those relating to climate change adaptation, alternative land use planning, and strategic conservation planning.

The project directly relates to the OCMP authority to oversee implementation of Statewide Planning Goal 16, Estuarine Resources, Statewide Planning Goal 17, Coastal Shorelands, and the Oregon Estuary Management Program. Ultimately, the Fellowship project will set the stage for long term strategic planning for conserving and restoring estuarine habitats, protecting key shorelands, accounting for landward migration of estuarine habitats, and maintaining public infrastructure. More important, the databases, information products, and decision-support tools resulting from this project will enable the OCMP to engage landowners, non-profit

organizations, and local governments and state and federal agencies in collaborative decision-making about the future of Oregon estuaries.

Thematic Areas: The Fellowship project squarely supports a number of Thematic Areas in the 2009 Fellowship Project Selection Criteria. In particular, the Fellowship will result in

- development of a multidisciplinary vulnerability assessment tool for estuaries;
- development of local decision-support or scenario tools to assess sea level rise impacts;
- increased information and visualization products related to coastal inundation;
- spatial data and tools that will support strategic and tactical planning to adapt to climate change.

Milestones and Timeline

Task 1 – (August - October 2009) Orientation and Project Development: The first stage of the project will orient the Fellow to Oregon, the OCMP and other agency staff, Oregon's estuary management framework and potential partners who have responsibilities or programs related to estuaries. The Fellow, with assistance from OCMP mentors and Program Manager, will identify a priority list of estuaries and will develop a detailed work program and timeline for accomplishing various tasks.

Task 2 – (November 2009 - March 2010) Data Acquisition and Preparation: The Fellow will acquire existing data sets for each estuary, including LiDAR, aerial photos, and county assessor data, that will be needed develop the information products for each estuary. The Fellow will also meet with agency partners and visit local communities to meet with planning staff and others to acquire and verify data sets, discuss the status of estuarine dikes, and become familiar with the landscapes represented in the data sets.

Summer 2010 Milestone: Poster Presentation at the 22nd Coastal Society (TCS) Conference.

Task 3 – (April 2010 – February 2011) GIS Analysis and Inventory: Utilizing data assembled in Task 2, the fellow will develop a systematic method for inventorying tidal lands and hydro modification structures in Oregon estuaries, in priority order. As inundation areas, ownership and infrastructure details are identified and assembled, a GIS database will be populated to house the information. The fellow will work closely with agency GIS staff to design the parameters of the database and ensure conformance to state and federal data standards.

Task 4 – (March 2011 – May 2011) Assessment and Visualization: The Fellow will assemble a functional GIS module for each estuary comprised of key data layers and secondary or ancillary data. The Fellow will develop a GIS-based inventory tool that will contain assessment results and decisions about dikes and other structures, property ownership, and conservation values, and level of potential risk.

Summer 2011 Milestone: Presentation at 22nd Coastal Zone '09 (CZ09) Conference.

Task 5 – (June 2011 – August 2011) Outreach and Distribution: The Fellow will develop an estuary assessment and visualization tool based on the results of Task 4. The Fellow will collaborate with the Coastal Atlas Developer to develop a web-based application of this tool. All data and metadata in the GIS database will be published to the Coastal Atlas.

Fellow Mentoring

Where: The Fellowship project will be housed in the Portland office of the Oregon Coastal Management Program (OCMP), a division of the Oregon Department of Land Conservation and Development.

Who: The Fellow will be mentored by Jeff Weber, Coastal Conservation Coordinator, who is lead staff for the state's Coastal Climate Change Adaptation Strategy, and Tanya Haddad, lead Coastal Atlas developer. Both work in the Portland office of the Department. In addition, the Fellow will work closely with Coastal GIS Specialist Randy Dana, also in the Portland office. Jeff will provide guidance on estuarine policy and climate change planning needs and provide initial direction and on-going supervision, while Tanya and Randy will help with development of a technical work plan, project schedule, and product development. The Fellow will also be counseled regularly by Bob Bailey the OCMP Program Manager who has overall program oversight.

The Fellow will be a member of the core OCMP staff and will participate in regular staff meetings, which are typically held in Salem, the main DLCD office. In addition, the Fellow will also participate in semi-annual coastal network meetings with local planners on the coast, which will provide insight into coastal management issues from a local perspective.

Project Partners

Estuaries are important to Oregon. Because Oregon's Coastal Management Program is a networked program, a number of potential partners will be involved in this fellowship. In addition to coastal program staff, the Fellow will have an opportunity to work with experts at South Slough National Estuarine Research Reserve, the Tillamook Bay Estuary Partnership, the Columbia River Estuary Study Team, Pacific Coast Joint Ventures, Ducks Unlimited and the US Fish and Wildlife Service. The Fellow will be expected to travel to coastal estuaries and county seats as necessary to gather or verify various data sets and to meet with landowners, local planners, and various state and federal agency staff as required.

Other key partners include:

[Oregon Department of State Lands](#) has jurisdiction over submerged and submersible lands, including estuaries, and as such has a keen interest in the infrastructure that has modified these lands, in the restoration of estuarine wetland functions, and on the risks and vulnerability of estuarine lands to effects of sea level rise.

[Oregon Department of Geology and Mineral Industries](#) is responsible for acquiring LiDAR data for Oregon's estuaries (and coastal zone) and translating that data into GIS-compatible products. During the time period of this fellowship, the DOGAMI work program includes a task to revise the FEMA floodplain datasets for Oregon estuaries, a project that will be of great value to the fellowship information products. DOGAMI is housed in the same Portland state office building as the OCMP field office, which will facilitate working with both the LiDAR and FEMA data.

[South Slough National Estuarine Research Reserve](#) is a division within the DSL, above, and conducts research programs aimed at understanding and improving restoration and protection of estuarine habitats. SSNER also has a strong interest in the impacts of climate change and

increases in mean tidal elevation in estuaries along the Oregon coast and often provides technical assistance and training for local officials.

Oregon Watershed Enhancement Board (OWEB): OWEB provides support and funding for local watershed councils and watershed restoration projects, including in estuarine areas.

US Fish and Wildlife Service: The USFWS Oregon Coastal Refuges Office manages a National Wildlife Refuge in three Oregon estuaries, Nestucca Bay, Siletz Bay, and Coquille River, and has a strong programmatic interest in restoring estuarine habitats and ecosystem functions.

Pacific Coast Joint Venture is a non-profit organization, one of 14 nationally that was created under the North American Waterfowl Management Plan. The Pacific Coast JV has a strong interest and expertise in the conservation and restoration of estuarine wetlands and habitats.

Ducks Unlimited (DU) is a non-profit organization that conserves, restores and manages wetlands and other habitats to benefit waterfowl, and will be working with NGOs and state and local governments to identify areas subject to inundation from sea level rise in Oregon.

Tillamook Estuaries Partnership is one of 28 designated National Estuary Projects. The TEP supports conservation activities within five estuaries, their shorelands and watersheds: Nehalem Bay, Netarts Bay, Tillamook Bay, Sand Lake, and Nestucca Bay. The TEP will provide a strong liaison to local governments, land owners, and watershed councils in Tillamook County.

Coos Watershed Association involves a variety of landowners, public agencies, and local governments in the restoration and conservation of habitats within the Coos River watershed, including Coos Bay estuary.

Cost Share Description

The State of Oregon will contribute both in-kind services and a \$15,000 non-federal cash match from the Department of Land Conservation and Development's general fund. The Department will provide in-kind match in the form of work space, equipment, materials and supplies, and support services, at the Portland State Office Building location. A furnished computer work station and appropriate software will be provided, along with all necessary office supplies and materials for performing the work.

Standard software employed by the OCMP includes Microsoft Office (Word, Excel, Access, and Powerpoint), ESRI products (both ArcGIS 9.x and ArcView 3.x), and ER Mapper. The agency is PC-based with each staff member having a desktop computer, as well as access to an equipment pool that includes laptops, printers, scanners, a projector, a digital camera, and a handheld GPS unit. Travel costs to in-state destinations in performance of the work program will be reimbursed by the Department in accordance with the state travel rules. The work space, supplies and services, and travel support will be provided for the entire two-year period of the Fellowship. Because the CSC Fellow will be part of the DLCD staff he or she will have equal access to all training offered to permanent staff as well as special training identified as needed.