



# Coastal Ecosystem Response to Climate Change



USGS

## Helping coastal managers keep pace with sea-level rise

Coastal resource managers are faced with many challenges and uncertainties in planning adaptive strategies for conserving estuarine habitats with climate change. To plan and manage for future scenarios, managers need access to data, models, and training on the best-available science.

To address this need, the **USGS Western Ecological Research Center** has worked with federal, Tribal, state, and local partners to establish a network of study sites in 17 estuaries along the Pacific Coast, examining climate change effects on tidal wetlands with high-quality local data, downscaled models, and projected storm effects. Study sites include ten **USFWS National Wildlife Refuges** and four **NOAA National Estuarine Research Reserves**. New models are created from these site surveys. Using the data to establish detailed baseline conditions, USGS is developing site-specific sea-level rise models for tidal wetlands at each study site. These models can then be used to assess impacts on wildlife, fish and their habitats.

The effort continues with collaborative workshops for resource managers and their partners. With regional and local collaborators, the USGS team is facilitating outreach events to share these sea-level rise tidal wetland modeling results. These participatory workshops will convene managers, scientists, and other decision makers at eight Pacific Coast estuaries between September 2014 and January 2015. These outreach visits are supported by the California and North Pacific Landscape Conservation Cooperative.

Our work complements and is partnered with USGS Patuxent Wildlife Research Center efforts on Atlantic Coast sea-level rise. As managers and policymakers on both coasts develop adaptation plans, USGS can work with coastal partnerships to guide the future of their nearshore habitats—to sustain ecosystem functions and ensure the future of fish and wildlife habitat, recreation, and flood protection for these communities.

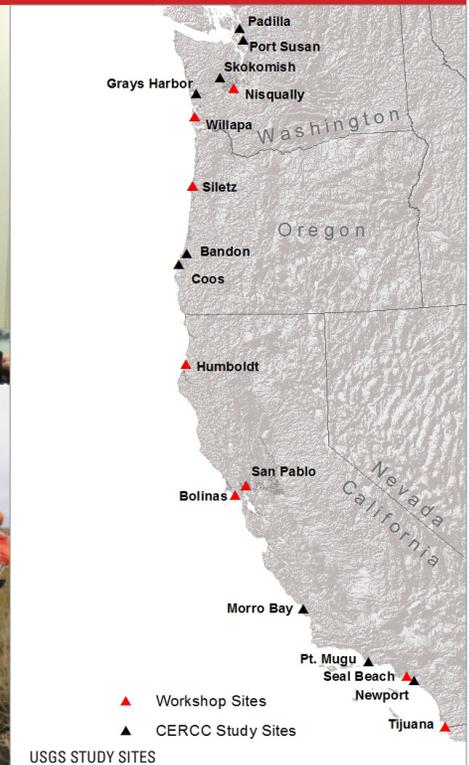
## RESEARCH CONTACTS

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**San Francisco Bay Case Study**  
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# WERC Estuary and Climate Change Research



## MODELING WETLAND RESPONSE TO SEA-LEVEL RISE

To gather reliable estimates of climate change impacts at regional scales, USGS and university partners have collected information from coastal wetland sites in Washington, Oregon, and California. Our study is focused on collecting high-quality data at local site scales, and then using that data to provide information that may be interpreted across the entire latitudinal gradient of the Pacific Coast.

In addition to our extensive network of sites, three estuaries in California have been intensely surveyed and metered to represent Mediterranean and northern Oceanic climate regimes (San Diego, San Francisco Bay, and Humboldt Bay).

At all sites, we examine potential climate change effects and vulnerability of nearshore habitats and their dependent wildlife. Using local habitat information, we develop approaches for investigating the complexity of climate-induced changes—physical and biological—to wetland ecosystems, both at scales relevant to land managers as well as a broader Pacific Coast perspective.

## STUDY SITE OBJECTIVES

**Downscale physical processes and climate projections to local scales:** Using ecosystem response modeling (WARMER) with climate models, we can assess impacts to tidal marsh and nearshore ecosystems with sea-level rise and storm scenarios. Modeling results are developed for each decade to 2110 and are translated into habitat types to assist management decisions.

**Measure morphological and ecological characteristics across the continuum of tidal marsh, intertidal mud flat, and subtidal shoals, including:**

- Fine-scale marsh elevation using a Real Time Kinematic (RTK) GPS
- Plant composition and diversity
- Bird abundance and habitat use
- Bathymetric surveys to map mud flats and shallow subtidal zones
- Bed sediment flux (suspended sediment concentrations)
- Water level, salinity, and temperature
- Weather characteristics
- Marsh sediment cores to measure accretion rates and stability
- Surface Elevation Tables (SETs) to measure marsh elevation changes

## STAKEHOLDER WORKSHOPS

Workshop participants will: **(1)** Learn about local baseline data and modeling results, coast-wide trends, and data gaps; **(2)** Help identify how local results may be incorporated into conservation, planning, and adaptation case studies; and **(3)** Provide feedback on a coast-wide science needs assessment. Information learned from participants will be shared with North Pacific and California LCCs.

**2014-2015 Workshop Sites:** Tijuana Slough; Seal Beach; San Pablo Bay; Humboldt Bay; Siletz Bay; Willapa Bay; Nisqually River

WERC partners in sea-level rise research include: Skokomish Tribe • Nisqually Tribe • USGS National Climate Change and Wildlife Science Center • USGS Climate Science Centers • U.S. Fish and Wildlife Service • NOAA National Estuary Research Reserve System • U.S. Navy • California LCC • North Pacific LCC • California Department of Fish and Wildlife • California State Parks • University of California-Davis • UCLA • Oregon State University • Marin County • East Bay Regional Parks • The Nature Conservancy

The USGS Western Ecological Research Center (WERC) is an Ecosystems mission science center of the U.S. Geological Survey serving California, Nevada and the greater Pacific West. Online at [www.werc.usgs.gov](http://www.werc.usgs.gov)