USGS Western Ecological Research Center

Research Profile

Helping Managers Build Resilience: Seal Beach National Wildlife Refuge

Helping coastal managers plan and build resilience to keep pace with sea-level rise

Coastal resource managers face many challenges and uncertainties in planning adaptive strategies to conserve estuarine habitats and wildlife from the effects of climate change. To plan for and manage future climate change scenarios, managers need access to information, models, and training on the best available science.

To address this need, the **USGS Western Ecological Research Center (WERC)** has worked with Federal, Tribal, State, and local partners to establish a network of study sites in 17 estuaries along the Pacific Coast, including **Seal Beach National Wildlife Refuge (SBNWR)**. The USGS and partners examined climate change's effects on tidal wetlands with high-quality local data, downscaled models, and projected storm effects.

Climate change effects on coastal ecosystems include projected changes in average and extreme ambient temperatures, precipitation patterns, ocean temperature and acidity, extreme storm events, and sea-level rise (SLR). The SBNWR salt marshes are one of the largest parcels of contiguous salt marsh in southern California and an important home to many protected species, like the federally endangered light-footed Ridgway's rail. Fewer than 1,000 of these birds remain worldwide. Sea-level rise is a critical threat to the survival and persistence of these rails and other threatened species at SBNWR if the marshes cannot 'keep pace' with sea-level rise.

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.** Our objectives include: (1) improve our understanding of wetland response to sea-level rise to inform management actions, (2) assess impacts to protected wildlife species, and (3) develop climate change adaptation strategies that can be implemented by the Department of the Interior and the Department of Defense to build salt marsh resilience to sea-level rise.

RESEARCH CONTACTS

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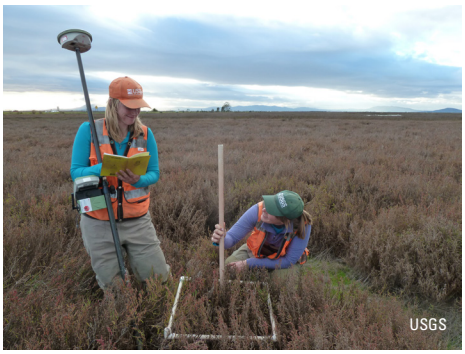
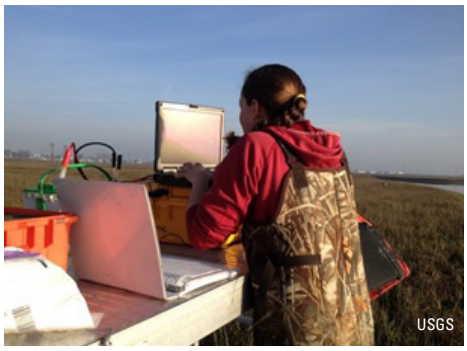
Main Research Page
http://www.werc.usgs.gov/cercc

San Francisco Bay Case Study
www.werc.usgs.gov/SFBaySLR

WERC Estuary and Climate Change Research





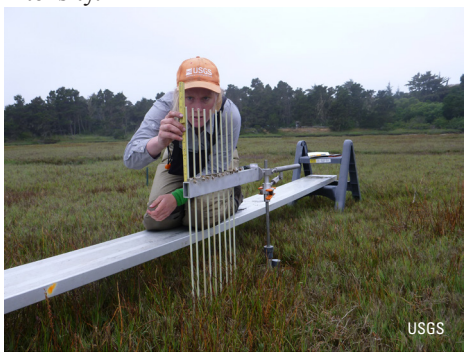
MODELING TO INFORM MANAGEMENT

Wetland Current Conditions
WERC researchers measured elevation across SBNWR and collected data on local plants to define the marsh's state before impacts from sea-level rise occur. WERC surveys have shown that plants at SBNWR differ in their tolerance to flooding. Sea-level rise could mean the loss of all low, mid and high plant species that provide wetland habitats for endangered and migratory bird species. This information will also be used to model how sea-level rise changes the marsh habitats over the next 100 years.

Monitoring Regional Subsidence

Our goal was to assess if regional subsidence (sinking elevation) was still occurring within and around SBNWR. Subsidence can increase wetlands' vulnerability to sea-level rise. We resurveyed benchmarks, tools that mark elevation at their location, left by the National Geodetic Survey to determine current subsidence or rebound rates. With local subsidence, SBNWR is experiencing a relative sea-level rise rate three times greater than that of similar southern California sites.

Monitoring Tidal and Storm Flooding
To provide the most up-to-date data, WERC is monitoring water and salinity levels to better understand current flooding patterns, including flooding during storms. We use these data to examine the flooding patterns of wildlife habitats and investigate how that will change with sea-level rise and changes in storm frequency and intensity.



Marsh Elevation - Sediment Build-Up
We measured how the marsh builds or increases elevation (accretion) relative to sea-level rise and subsidence to prevent drowning. We found that SBNWR had relatively low rates of sediment accretion compared to other sites along the California coast, making it more vulnerable.

Wetland Modeling for Decision Making
We used the data collected on elevation, plants, subsidence rates, water levels during different tides and storms, and sediment build-up at SBNWR to model wetland response with sea-level rise over the next 100 years. Sea-level rise is projected to be up to +5.4 ft by 2100 for southern California (NRC 2012). Using an ecosystem response model called WARMER, we found that by the end of the century all wetland habitats will be lost and most of SBNWR will convert to subtidal open water.

CLIMATE CHANGE ADAPTATION PLANNING

Scenario planning provides a systemic method for thinking about a large array of complex and uncertain futures with climate change. A team that includes the USGS, U.S. Fish and Wildlife Service, and the U.S. Navy has been working to outline conservation targets and develop a comprehensive list of adaptation strategies and actions to prevent wetland and wildlife loss in light of sea-level rise.

TESTING ADAPTATION STRATEGIES TO BUILD RESILIENCE

The USFWS will apply a thin layer of sediment over 10 acres of existing low salt marsh habitat on the SBNWR. We hope to document this strategy's effectiveness in combating sea-level rise, while also improving the quality of salt marsh habitat for the endangered light-footed Ridgway's rail and other species.

WERC partners in this project include: U.S. Fish and Wildlife Service • UC Los Angeles • UC Davis • Oregon State University • California Department of Fish and Wildlife • Southwest Wetlands Interpretive Association • State Coastal Conservancy • Southwest Climate Science Center

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.