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U. S. Department of the Interior

U. S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER
San Francisco Bay Estuary Field Station
505 Azuar Drive, Vallejo, California 94592
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Humboldt Bay NWR Sea-level rise modeling

Background:
Climate change scenarios typically address top-down global to continental scale changes; thus, few are easily interpretable to local land managers or contain a vertical resolution that is useful at the local level for planning climate change adaptation. Our studies are directed at a bottom-up approach to evaluating sea-level rise (SLR) effects at the parcel scale (however relevant at a landscape scale), providing information and databases useful in assessing local responses. We will evaluate the availability of and develop the following datasets required for a comprehensive assessment of SLR impacts to marsh habitats: detailed elevation and plant community surveys, tidal range and extreme climate event profiling (including local climatic condition monitoring), and wildlife habitats. This type of baseline data is needed to understand the impacts from sea-level rise to a local management parcel and can be used to detect changes into the future with climate change. The following methodology has been developed by the USGS under a grant from the National Climate Change and Wildlife Science Center at 13 salt marsh sites in San Francisco Bay estuary. Partnerships will leverage USGS climate change funds, FWS R8 I&M support, and CA LCC.

Scope of Work:

- Objective 1: Develop high-resolution digital elevation models (DEMs). A high-resolution vertical and horizontal DEM is needed to evaluate current and future inundation patterns under sea-level rise scenarios. We will develop a DEM of the management parcel to produce a high resolution elevation model using a Real Time Kinetics GPS (RTK Smart Pole, Leica Systems, +/- 3 cm vertical accuracy). DEMs will be created from field surveys in ArcGIS and cross-validated.

- Objective 2: Tidal range and extreme events: monitor water levels and tidal cycles to assess parcel level inundation patterns and extreme water events. To understand current tidal flooding patterns, datums, and cycles at local scale, we will deploy water-level loggers, placed in channel networks. The water-level monitoring provides detailed information on marsh flooding and drainage patterns including salinity, depth during tidal cycles, inundation periods of the marsh plain, and characteristics of flooding during storm events.

- Objective 3: Inventory vegetation species composition and relationship to elevation and tidal datum will be developed by integrating DEMs. We will assess the temporal and spatial availability of habitats under current tidal inundation as well as under future extreme tide levels and varying SLR scenarios. In addition, these spatial vegetation models can be reassess in the future to observe any changes resulting from SLR.

- Objective 4: Determine and quantify marsh wildlife species and assess impacts from sea level rise and storms. We will evaluate pre-existing wildlife surveys to unify definitions of acceptable biological response metrics to changing habitats. Species presence and abundance is the most common metric used to determine habitat quality. We will identify, with managers, wildlife species of concern and key ecosystem metrics to be integrating with objective 1-3 for evaluation.

Deliverables:

All deliverables are key components for the needed long-term monitoring to understand ecosystem responses to SLR and storms. These models will be at a level of detail relevant to local managers however applicable at a larger landscape scale. Products will be delivered to FWS include 1) high resolution elevation models and GIS coverages; 2) annual water inundation and salinity patterns recording extreme events, raw data in Microsoft EXCEL; 3) detailed maps of the vegetation community structure in GIS coverages; and 4) periodic email updates and a summary report synthesizing these data for local SLR impacts.