Addressing Sea Level Rise in the San Francisco South Bay, California

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With the advent of climate change the possibility of sea-level rise is very real, and it is especially disconcerting when the area(s) of interest already lies below sea level. Our talk presents the Corps of Engineers evaluation of their alternative scenarios for the San Francisco South Bay Shoreline study. The ecological evaluation incorporates local area knowledge from the US Fish and Wildlife Service along with integrating multiple species, habitats, and functions assessment. The Combined Habitat Assessment Protocols (CHAP) evaluates the baseline condition and scenarios using a habitat and biodiversity valuation that tracks the values over time. These scenarios are evaluated to determine the most cost effective management effort. The final product was also informed by the California Rapid Assessment Method.

CHAP has been used in impact, mitigation, ecosystem restoration, flood risk management, and cumulative impact assessments and is viewed as a habitat and biodiversity crediting tool. The output metric from a CHAP assessment is a functional redundancy index that is spatially explicit and gives insight into the ecological integrity of a site or area. CHAP has undergone a number of independent scientific reviews and is a tool that can be consistently applied to produce a deterministic and unbasis value, which in turn helps organizations meet the intent of the President's Memo on Mitigation and the Draft Mitigation Policy of the US Fish and Wildlife Service. The CHAP approach has also been used for regional conservation strategies.

Keywords: climate change, functional assessment, habitat, value, tool, CHAP
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A Novel Approach to Sea Level Rise in the Baylands and Delta: Taking the "Habitat-Friendly" Levee to the Next Level

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The role of vegetation on flood protection levees has long been a hotly debated issue in the Delta. While vegetation near the levee core continues to be studied, there is increased support of "habitat-friendly" levees that incorporate a wide, vegetated gentle slope on the outboard levee face – also referred to as an ecotone slope. These slopes can provide additional benefits for flood protection by reducing wind or wave-driven extreme water levels and have the potential to increase habitat and provide transgression pathways for habitats to migrate as sea levels rise.

Where space allows, a vegetated ecotone slope can be sufficiently distanced to not compromise levee integrity. The "habitat-friendly" levee provides increased habitat value, reduced erosion potential and sea level rise resiliency compared to traditional prismatic levees. Habitat-friendly levees with ecotone slopes have been constructed in San Francisco Bay, and are being incorporated into many planned tidal marsh restorations in the Delta, including McCormack-Williamson Tract and Dutch Slough.

In the San Francisco Bay, the Oro Loma Sanitary District, in cooperation with the East Bay Dischargers Authority, U.C. Berkeley and several other stakeholders, has recently constructed the first Ecotone Demonstration Project that will use treated wastewater to irrigate the ecotone slope via the subsurface. This concept could provide water quality benefits by polishing treated wastewater while restoring natural freshwater inputs to the shoreline. This pilot project will help improve our understanding of how an ecotone slope could be utilized to adapt to sea level rise by building organic soils while improving water quality potentially leading to significant changes in flood protection and sea level rise adaptation in the San Francisco Bay-Delta. This talk will present the various design approaches being tested for the demonstration project, and consider potential implication of favorable results in the Delta.

Keywords: Levee, Vegetation, Sea Level Rise, habitat, transgression, wastewater, ecotone slope
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Planning for Transportation and Ecosystem Adaptation to Sea Level Rise

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I describe a generalizable planning and assessment process for adaptive co-management of transportation infrastructure and tidal-marshes to sea level rise (SLR). Sea level has risen in CA by >20 cm and by 2100 may be 1 to 1.7 m higher. Infrastructural and living systems adaptations will need to occur to avoid a wholesale change in the marshes, estuarine systems, low-lying urban areas, and exposed highway infrastructure along global coastlines. A single coastal California highway, State Route 37 (SR 37) in the North San Francisco Bay, and surrounding tidal and terrestrial ecosystems were used as the laboratory in a stakeholder-advised process because it is the California highway that may be most vulnerable to SLR. Like many other coastal highways in the US, SR 37 is adjacent to protected coastal ecosystems (e.g., beaches, tidal wetlands), meaning that any activity on the highway is subject to regulatory oversight. In order to understand vulnerability to SLR, and to what degree, a model of potential inundation was developed by a contractor (AECOM) using a recent, high-resolution elevation assessment conducted using LiDAR. The cost and (dis)benefits of adaptive structures varied between US$0.8 (berm option) to $4 (causeway option) billion. The tidal ecosystems in the North Bay both buffer infrastructure from wave and tidal energy and are vulnerable to impacts from SLR. In order to monitor SLR impacts at a timescale relevant to transportation and conservation planning. I developed a combined time-lapse camera and image analysis technique to monitor changes in tidal inundation and shoreline resulting from SLR and storm events. The technique is very sensitive to small vertical changes in SLR (<10 cm) because of the large horizontal changes in shoreline resulting from small vertical changes. This technique is high-resolution and scale-able from local to national extents. Early results from this system will be presented.

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