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The California State University
COUNCIL ON OCEAN AFFAIRS, SCIENCE & TECHNOLOGY (COAST)

Planning for Sea-Level Rise Along California's Coast

Planning for predicted levels and impacts

Global sea-levels are rising are due to both the melting of ice sheets and thermal expansion of seawater. Sea-levels off California's coast have risen approximately 0.64 ft (7.7 in) in over the last 100 years[i]. Sea-levels will undoubtedly continue rise in the next century and a half due to increasing global temperatures, though the rate at which levels will rise is highly dependent upon greenhouse gas (GHG) emissions and specific location. The recent sea-level rise (SLR) report commissioned by the state[ii] indicates that SLR in California will likely vary between 0.0-6.1 ft depending on both geographic location and GHG emissions with a possible worst case scenario of a 22 ft rise. For example, there is a 67% probability that SLR in the San Francisco Bay Area will be 1.0-2.4 ft by 2100 if GHG emissions are cut significantly, but the likely range increases to 1.6-3.4 ft if emissions are not significantly limited or reduced.

Long-term sea-level rise and shorter-term processes that temporarily elevate water levels such as storms, high tides and El Nino events increase the risk of coastal flooding and erosion. Sea-level rise of 4.6 ft will put around 480,000 Californians at risk from a 100-year flood event[iii]. Additionally, 31-67% of Southern California beaches may become completely eroded (up to existing coastal infrastructure or sea-cliffs) by the year 2100 under scenarios of SLR of 3.2-6.5 ft [iv]. Coastal armoring, or the building of hardened structures such as seawalls, has been the most prevalent mechanism to protect human communities from coastal flooding. However, coastal armoring results in greater scouring and the loss of sediment supply to shorelines down current and is therefore not an ideal solution.

Natural infrastructure to protect human and natural communities

Natural infrastructure (strategically planned and managed networks of land and water that provide value to people) is becoming increasingly viewed as a potential solution that protects human communities while also providing critical ecosystem services and benefits. "Living shorelines" are a type of natural infrastructure specifically designed to reduce vulnerabilities associated with sea-level rise. For example, California's remaining coastal wetlands are a valuable asset that can help protect both natural resources and human infrastructure from SLR. CSU scientists are working with local natural resource managers to investigate how the addition of

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Living shoreline projects using restored eelgrass and native oyster beds in San Francisco Bay.

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Rising groundwater (due to SLR) causing mobilization of toxins from contaminated sites.

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Economics of SLR, including studies that inform Local Coastal Plan updates.

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sediment to these systems may increase their resiliency to flooding and increased erosion in the face of SLR.

Another type of living shoreline involves the restoration of subtidal eelgrass, often in combination with native oyster beds. In San Francisco Bay, an experimental native eelgrass-native oyster project reduced wave strength by 30%, which could help reduce shoreline erosion and mitigate against SLR[v]. Scientists and managers are currently investigating the efficacy of living shoreline projects along California's open coast, including the use of rocks and sediments to stabilize coastal sand dunes. In all cases, natural infrastructure offers multiple benefits such as carbon sequestration, habitat for threatened and endangered species, ocean acidification amelioration, and the provision of recreational space in addition to protection from SLR, flooding and erosion.

Local and Applied CSU Research

Researchers throughout the CSU system are working in a variety of disciplines to fill gaps in the understanding of sea-level rise impacts and best practices for adaptation. CSU researchers are distinguished by their local work and its relevance to current challenges faced by local governments and state and federal agencies. The CSU is committed to training the future workforce and leaders in climate change research and adaptation for California and the nation.

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[i] https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=9414290
[ii] Griggs, G, et al. 2017, Rising Seas in California: An Update on Sea-Level Rise Science. California Ocean Science Trust.
[iii] Heberger M, et al. 2009. *The impacts of sea-level rise on the California coast*. Sacramento: California Climate Change Center.
[iv] Vitousek, S. et al. A model integrating longshore and cross-shore processes for predicting long-term shoreline response to climate change. Journal of Geophysical Research, Volume 22, Issue 4.
[v] Boyer, K. pers. comm.

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Changes in coastal sediment supply due to SLR and the development of sediment management plans.

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Restoration of native oyster beds to reduce wave energy in southern California.

The California State University Council on Ocean Affairs, Science & Technology (CSU COAST) is the umbrella organization for marine, coastal and coastal watershed related activities within the CSU, the nation's largest public four-year university system. Learn more at www.calstate.edu/coast.