Dam Removal to Support Climate Resilience in Coastal Systems

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Background/Objectives. The Matilija Dam in the Los Padres National Forest, California, is an arch dam built in 1947 for water storage and flood control. However, it has had the deleterious effects of blocking fish passage and limiting sediment loads since its construction. The Matilija Dam removal project has been developed with the goal of restoring river flow and sediment load to the Ventura River, Ventura River Estuary, and the nearby Coast of Ventura County. The restored river flow and sediment loading is anticipated to benefit the physical and ecological health of the region through enhancement of the local riparian, estuarine, and coastal habitats for the California steelhead trout and sustain high quality habitat for many other species. Sediment released during the removal project will have short- and long-term effects on the local ecosystem that are important to understand and manage. The objective of the project was to conduct modeling of the lagoon and local coast to characterize both the initial sediment pulse and restored sediment load due to the dam removal for assessment of the resilience of the local morphology and ecosystems in the face of climate change.

Approach/Activities. A novel multi-model approach was used to evaluate short-term impacts to the estuary and coast immediately following dam release and to evaluate the long-term effect of restored sediment loading to the system. The project team conducted short- and long-term hydrodynamic, sediment transport, and coastal evolution modeling using a combination of 3-D surface water models, empirical models, and data assimilative shoreline evolution models. Factors affecting the system dynamics, habitat, and morphology were evaluated, including sediment erosion, deposition, and grain size; water depth and inundation; water velocities; and water quality.

Results/Lessons Learned.
Key findings regarding long-term changes in the Ventura River estuary and coast are as follows:

- The changes in the overall lagoon water quality, benthos, and morphology due to dam release sedimentation are relatively small, and changes to the lagoon hydrodynamics and breaching over the next 50 years are expected to be negligible.
- The largest impact to the coastal ocean is associated with the initial sediment release following dam removal and occurs in the vicinity of the river mouth. Silt particles constitute the largest mass fraction of sediment delivered to the coastal ocean, but these particles are readily transported offshore and do not deposit in the nearshore.
- Long-term effect of restored loading to system is minimal (only 7 percent increase in estimated pre- and post-dam removal total sediment load); however, the sediment following dam removal will benefit downcoast regions.
- Sea level rise will have a larger impact on coastal processes in the region than the initial dam removal. The restored sediment loading will help support the system keeping pace with projected losses due to sea level rise.

Overall, the multi-model approach allowed for robust evaluation of dam removal effects on coastal dynamics and habitat over multiple time scales important to climate change evaluations.