Group 2
Session B5

Effects of Dam Removal Sediment Releases on Coastal Lagoon Dynamics and Ecosystems

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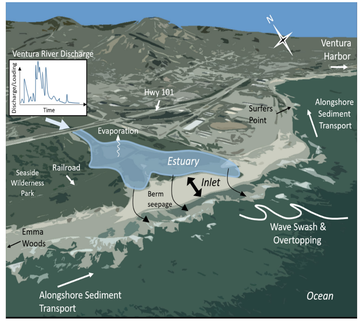
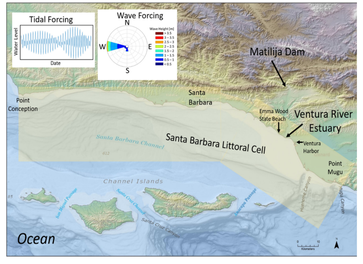
How does a large sediment release affect the coast?

Coastal systems are governed by complex processes.

- There are strong seasonal differences in wave energy and stream flow on the Ventura River Lagoon's wave-exposed, bar-built estuaries.
- Episodic or seasonal river discharge, inlet conditions, and beach berm breaches make the Ventura River Lagoon a dynamic feature.
- Lagoon dynamism supports sensitive river and coastal species such as southern steelhead (endangered), tidewater goby (endangered), and others.





Tidewater Goby

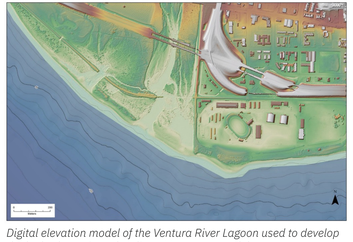
Dam removals pose a complex interplay of benefits and risks to the local physical and ecological environment.

- The Matilija Dam has impounded more than 6 million cubic yards of sediment.
- The removal of the Matilija Dam has the potential to provide much-needed sediment (fine and coarse) to the Ventura River Lagoon and the Ventura Coast.
- The influences of the restored sediment on lagoon and nearshore habitats are restorative; however, the short- and long-term effects on local ecosystems need to be understood.

How do we predict dynamics over a range of timescales?

Multiscale modeling provides a robust tool for management.

- A multimodel approach allowed us to predict dynamics over a range of time- and spatial scales.
- The project used a combination of short- and long-term hydrodynamic, sediment transport, and coastal evolution modeling with a combination of 3-dimensional surface water models, empirical models, and data assimilative shoreline evolution models.
- We evaluated factors affecting the system dynamics, habitat, and morphology; sediment erosion, deposition, and grain size; water depth and inundation; water velocities; and water quality.
- Overall, the multimodel approach provided a seamless description of the system and allowed the potential impacts to be fully characterized.

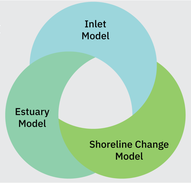


Digital elevation model of the Ventura River Lagoon used to develop the hydrodynamic and sediment transport model.

Model Inputs

- **Forcing conditions**
  - River discharge and sediment loading
  - Wave/tidal conditions
  - Seal level rise predictions
- **Site specific parameters**
  - Lagoon and shoreline geomorphology
  - Sediment grain size distribution
- **Model validation data**
  - Historical shoreline observations
  - Estuary water level/breaching events

Coupled Sediment Transport

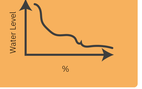


Model Outputs

- Estuary sedimentation/erosion and inundation
- Alongshore and cross-shore sediment transport
- Shoreline change (erosion/accretion)

Habitat Impacts

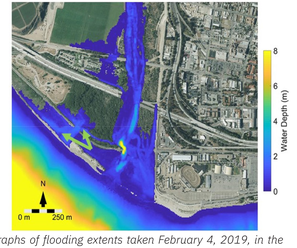
- Flower and water level exceedance curves
- Estuary and coastal sedimentation and erosion change over space and time
- Substrate type change over space and time



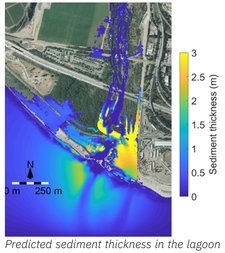
What are the predicted effects of the dam removal on the Ventura River Lagoon?

Robust system understanding developed using a combination of tools supports sound system management.

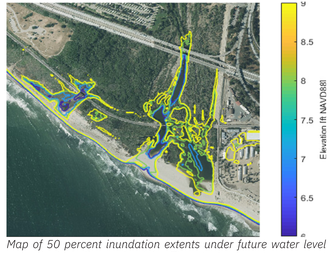
- The changes in the lagoon due to dam release sedimentation are relatively small, and changes to the lagoon hydrodynamics and breaching are expected to be negligible.
- The largest impact to the coastal ocean is associated with the initial sediment release following dam removal, but sediment is readily transported offshore.
- Sea level rise will have a larger impact on coastal processes and habitat in the region than the dam removal.



The model was validated with real-world events. Photographs of flooding extents taken February 4, 2019, in the Ventura River Lagoon (left) and model-predicted water levels (right) during the same flood with green arrows indicating regions with similar flood patterns.



Predicted sediment thickness in the lagoon after dam removal. The information was used to understand the potential habitat impacts of sediment deposition.



Map of 50 percent inundation extents under future water level scenarios including sea level rise. The extents support assessment of habitat changes after dam removal and expected sea level rise.

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