Testing a Novel Adaptation Strategy in a Southern California Salt Marsh

Thin-Layer Sediment Augmentation at the Seal Beach National Wildlife Refuge

By Elizabeth Murray

Based on work from Evyan Sloane, Kirk Gilligan, Victoria Touchstone, Richard Nye, Andy Yuen, Christine Whitcraft, Richard A. Ambrose, Karen Thorne, Glenn McDonald, Jason Keller, and Mayda Winter.
From Planning to Augmentation

- 2012 – Comprehensive Conservation Plan complete
- 2013 – Sea-level rise studies continue
- 2014 - Refuge & Orange County agree on sediment source
- 2014 – Coordination with public agencies
- 2015 - $3,305,554 in grant funding secured
- 2016 – Project construction
- Present – Monitoring for 3 more years
Seal Beach National Wildlife Refuge
Relative SLR = 6.23 mm/yr
Light-footed Ridgway’s Rails
Dredge Material Opportunity
Sediment augmentation for sea-level rise adaptation
Completed April 2016
Legend
- Seal Beach NWR
- Sediment Application Area
- Control Area
- Deep YSI and ADCP Location
- Eelgrass YSI Location
- Eelgrass beds

Seal Beach National Wildlife Refuge

Pre-Augmentation

Post-Augmentation

10,220 cubic yard

7.57 acres (3 hectares)
Thin Layer Placement Basics

• What makes us think the marsh needs sediment?
• What kind of sediment are we going to put on the marsh?
• Where are we going to place it?
• How are we going to place it?
• How much should we place?
• How will we keep it there? How does the slurry behave?
• How long will it take for the marsh to recover? What temporary impacts are we willing to accept for longer-term resilience?
What kind of sediment are we going to put on the marsh?

Sediment Composition

- 84% sand (dredge)
- 51% sand (refuge)
Thin Layer Placement Basics

• How much should we place?
  • Seal Beach has lost over a foot of relative elevation since the 1960s, so we want to take this rare opportunity to lift as much as possible for long term goals
  • Site is used by endangered species, so want to minimize recovery time
  • These goals are in natural tension. Must balance between them
  • So get data...

• How will we keep it there? How does the slurry behave?
  • Slurries move – remember we have eel grass adjacent to the site
  • Slurries consolidate and compact – so we need to apply more elevation than we want in the end
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<th>Sediment depth</th>
<th>Pre-Tx</th>
<th>Week 0</th>
<th>Week 8</th>
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In year 3 of 5-year Monitoring Plan

Most revegetation from “the sides and the tides”

Some regrowth through the layer
How much vertical elevation was achieved from sediment application?

Mean elevation change was 0.24 meters (9.66 in) and a maximum of 0.76 meters (30 in)
How much vertical elevation change was achieved?

April 2016

May 2016

Elevation Change DEM

Inches, NAVD88

High: 29.4255

Low: -1.64299

SET Locations
Sediment Barriers
Keep the sediment in place a little too well
Tidal Creek Formation/Adaptive Management

Richard Nye – Richard_Nye@fws.gov
Lessons Learned

• Science was used to inform management planning
• Even so there can be surprises:
  • Robust source sediment analysis (more samples)
• Experimental design with robust monitoring program allow insights and adaptations
  • Many methods of determining elevation changes: accretion, compaction etc.
  • Understand that target thickness won’t be uniform, target elevation might be but will decrease from constructed elevation
  • Plant burial response studies may need to be repeated
• Adjacent habitat & protected species monitoring/constraints
  • Effect of barriers on tidal creek formation & tidal flushing
  • Notch earlier to foster creek development
Funding Partners

• U.S. Fish & Wildlife Service
• Orange County Parks
• California Coastal Conservancy
• CA Dept. of Fish & Wildlife - Greenhouse Gas Reduction Program
• USACE - Ecosystem Management & Restoration Research Program

Research Partners

• USGS – Western Ecological Research Center, Karen Thorne, Ph.D.
• UCLA – Richard Ambrose, Ph.D. & Glen MacDonald, Ph.D.
• CSU Long Beach – Christine Whitcraft, Ph.D.
• Chapman University – Jason Keller, Ph.D.

Additional Partners

• Southwest Wetlands Interpretive Association
• Naval Weapons Station Seal Beach (Landowner)
• State Lands Commission (Landowner)
• Moffatt & Nichol (Engineering contractor)
• Curtin Maritime (Dredge contractor)

https://www.fws.gov/refuge/seal_beach/