California Coastal Dunes: Restoration goals, Climate Resilience & Monitoring metrics

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California Coastal Dunes

- Long history of disturbance
- Plants as ecosystem engineers
- Capacity for adjustment & self-repair
- Dynamics of coastal dune systems
- What’s that mean for restoration & monitoring?
Red sand verbena hummock
Abbreviated list of ecosystem functions:
Store sand
Build topography & elevation
Increase resiliency during storms
Self-repair
“...disturbed by road & railroad tracks that the original pattern of foredune hillocks had been destroyed.”
“Here was a striking demonstration of the vigor which makes red sand verbena so effective a pioneer.”
“In 1911...a tar and gravel road was built ... close to the beach. It was soon breached by the surf and abandoned.”
“...sand verbena seedlings... began to grow in the lee of the road... increased in height... formed hillocks... advanced over the road... against the wind... to a meter in height by 1919....”
Coastal strand vegetation
Lower Limit Set for Vegetation
25 May 2013

No storm
No king tide
Not winter
Coastal vegetation zone is dynamic

1) Germination with Fall/Winter rain

2) Erosion - Swells & Storms

Beach berm

Distance from bluff (m)

May 2011

June 2011

May 2012

May 2013
Coastal vegetation zone is dynamic

1) Germination with Fall/Winter rain

2) Erosion - Swells & Storms

Beach berm

Distance from bluff (m)

Bluff

June 2011

May 2012

May 2013

Acreage changes

Vegetation

May 2011

Seaward berm

Vegetation

55
50
45
40
35
30
25
20
15
10
5

Ocean
Surfers’ Point Phase I

- County Fairgrounds
- City of Ventura
- Coastal Conservancy
- ESA/PWA
- Surfrider Ventura

Pre-project photograph
Surfer’s Point - pre-project
Before- old bikepath

Not a great bike path
Not a great beach
Cobble fill & sand topping
Surfer’s Point, August 27, 2012 during project. Dark lines on bare sand areas are temporary sand fencing installed to slow wind-driven sand movement. Dark patches in the sandy area are a mix of native plants and weeds introduced to the site (as seeds and vegetative propagules) when the sand was imported. Note the establishment of vegetation in the swale between the bikepath and parking lot.
Surfer’s Point January 1, 2015. Dune vegetation has increased greatly since the April 18, 2013 photograph. The square gap in the vegetation on the left side is a designated kite-surfing launch area. Plants which grew from seeds are now blending in with the older vegetation along the southern edge of the site. Vegetation is also sparse at the east end in a surf contest staging area and in the rock garden within the boardwalk loop where people are encouraged to play.
Surfer's Point January 1, 2015. Dune vegetation has increased greatly since the April 18, 2013 photograph. The square gap in the vegetation on the left side is a designated kite-surfing launch area. Plants which grew from seeds are now blending in with the older vegetation along the southern edge of the site. Vegetation is also sparse at the east end in a surf contest staging area and in the rock garden within the boardwalk loop where people are encouraged to play.
Santa Monica Dune Restoration Pilot Project
Santa Monica Bay Foundation, City of Santa Monica

Vision: Increase resilience to sea level rise

Restore:
- Native plants & fauna
- Ecosystem services - dune & beach

Educate
Inform management
Beach Grooming
Santa Monica Pilot Project after one year- December 2017
Santa Monica Pilot Project after one year - December 2017

First winter extreme high tide line
Santa Monica Pilot Project
Vegetation- April 2018
Accretion & erosion on beach face & terrace

**Control Transect**

- 13-Dec-16
- 24-Mar-17
- 13-Sep-17

**Restoration Site Transect**

- 13-Dec-16
- 24-Mar-17

Winter storm wrack line
Hummock formation

Small hummocks after 2 growing seasons

Fine, wind-blown sand in hummocks
Border Fields State Park

Test three dune enhancement techniques

Measure changes in:
• Vegetation cover & diversity
• Sand volume (storage or loss)
• Elevation (accretion or erosion)
• High tide line position (ambient and extreme)
Dune projects

• Accommodation space is crucial
• For coastal dunes providing a full range of ecosystem functions, acreage metrics are complicated
• Incorporate process metrics in coastal resilience projects