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This presentation not peer reviewed.

# “Design with Nature” Strategies for Shore Protection: Successes and Limitations of a Cobble Berm in an Oregon State Park

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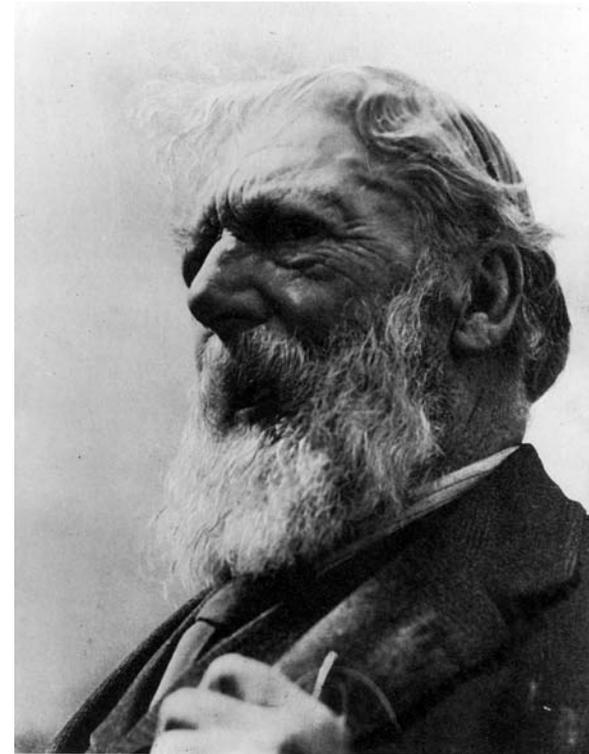


# DESIGN WITH NATURE

*On Growth and Form* 1917  
D'Arcy Wentworth Thompson

*Design With Nature* 1969  
Ian L. McHarg

*Gaia: A New Look at Life on Earth* 1979  
James Lovelock



by courtesy of the British Council

Emory Walker del. ph. sc.

*D'Arcy W. Thompson*

# COBBLE BEACHES

Natural Forms of Shore Protection



Lima, Peru

# Seawall, Maine



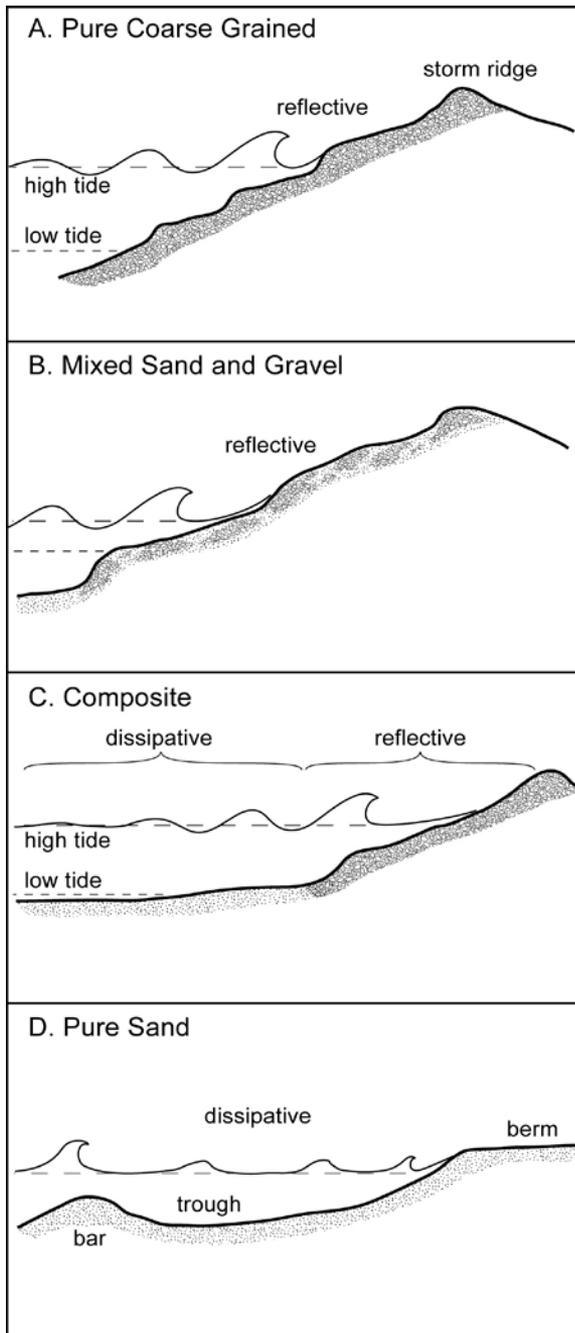
Oregon Coast

**Natural form of shore protection**



# Coarse-Grained Beaches (Jennings & Schulmeister, 2000)

## Oregon Composite Beach

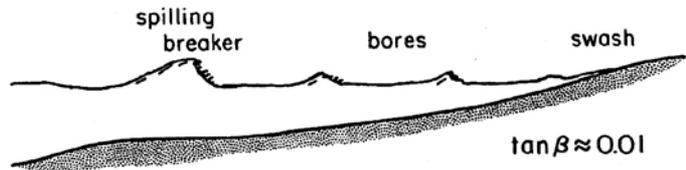


(photo Jonathan Allan)

# Morphodynamics Classification

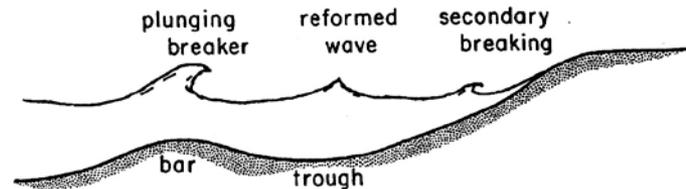
(Wright and Short, 1984)

## A. Dissipative Beach



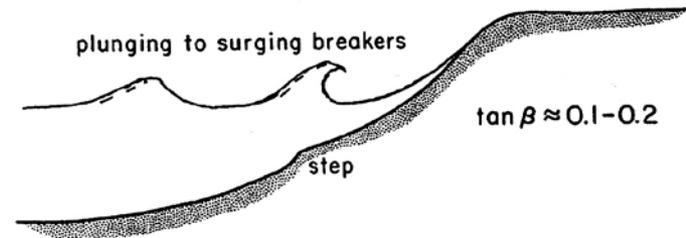
**Most Stable due to wave dissipation**

## B. Intermediate Beach



**Most Dynamic and Erosive**

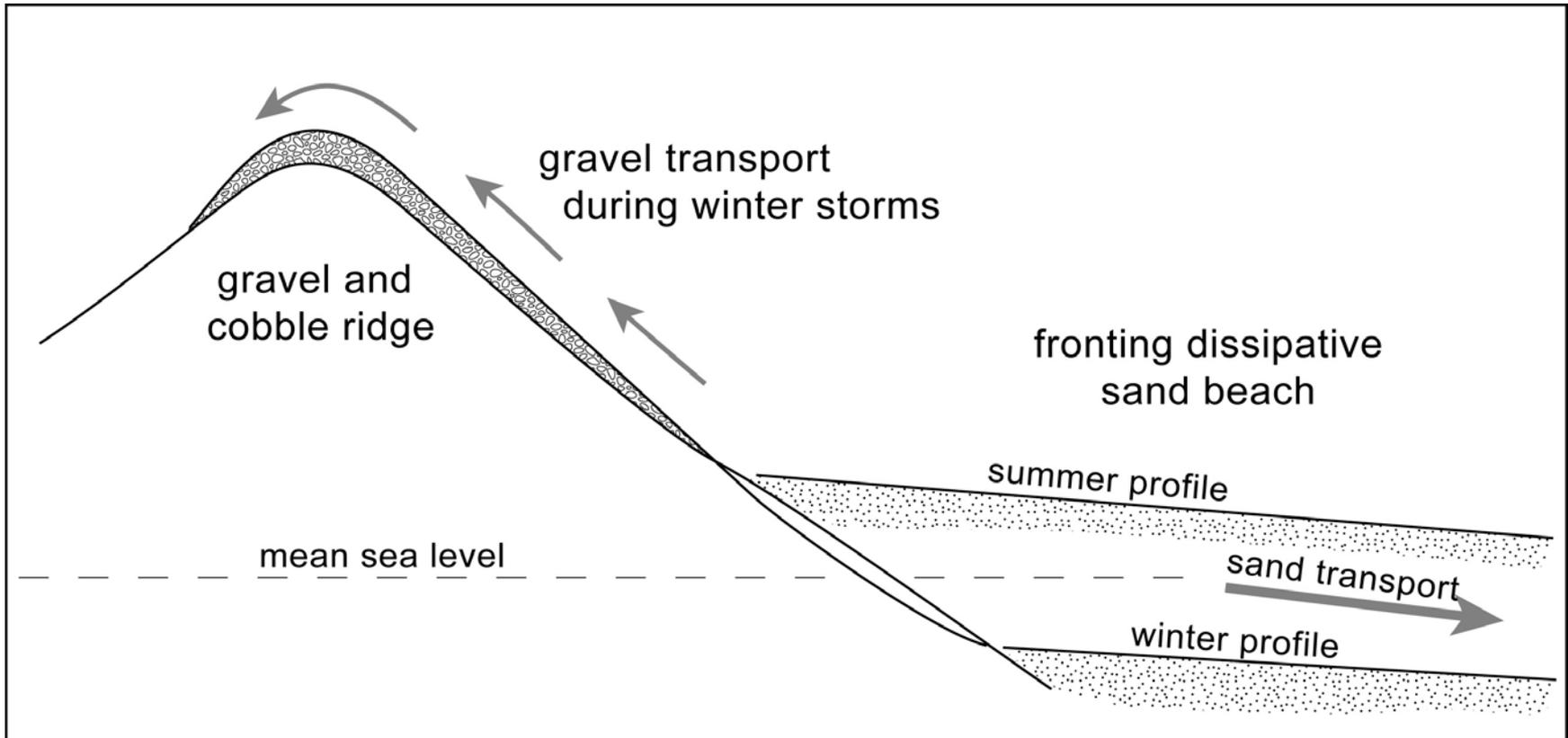
## C. Reflective Beach



**Stable due to wave reflection and when composed of cobbles**

# COMPOSITE BEACH RESPONSE DURING A STORM

- Sand of dissipative beach moves offshore to form bars
- Particles of reflective beach move onshore, elevating the ridge



# Netarts Spit, Oregon

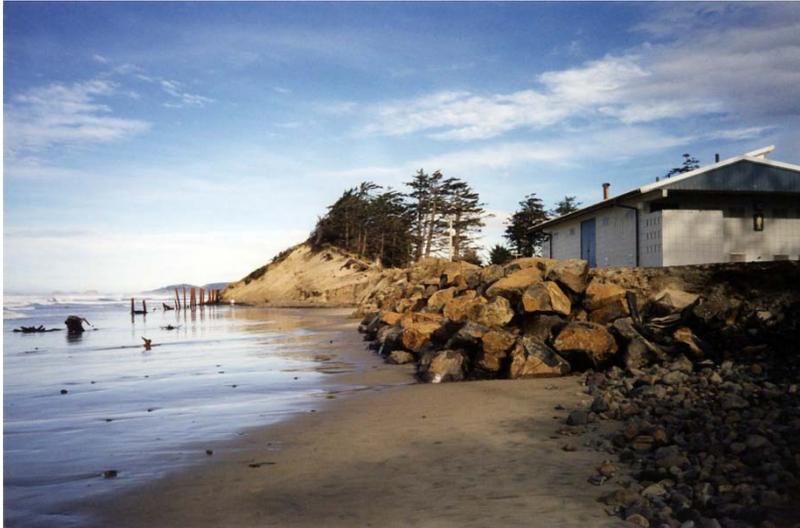


Pre-erosion 1960s and 1970s



# CAPE LOOKOUT STATE PARK, OREGON

## Erosion and Flooding Impacts



**El Niño Erosion of beach and dunes  
1982-83 and 1997-98**

**Overwash into park during major  
storm 3-4 March 1999**



# Cobble Berms/Dynamic Revetments

- Dynamic artificial cobble berm, rather than a static revetment
- Cobble movement does not necessarily represent failure of the structure, instead it is the natural adaptation of the cobble beach to storm-wave energies



**Natural Cobble Beach**

**Constructed Revetment**

Thornhill Broome Beach  
N. California

# COBBLE BERMS/DYNAMIC REVETMENTS

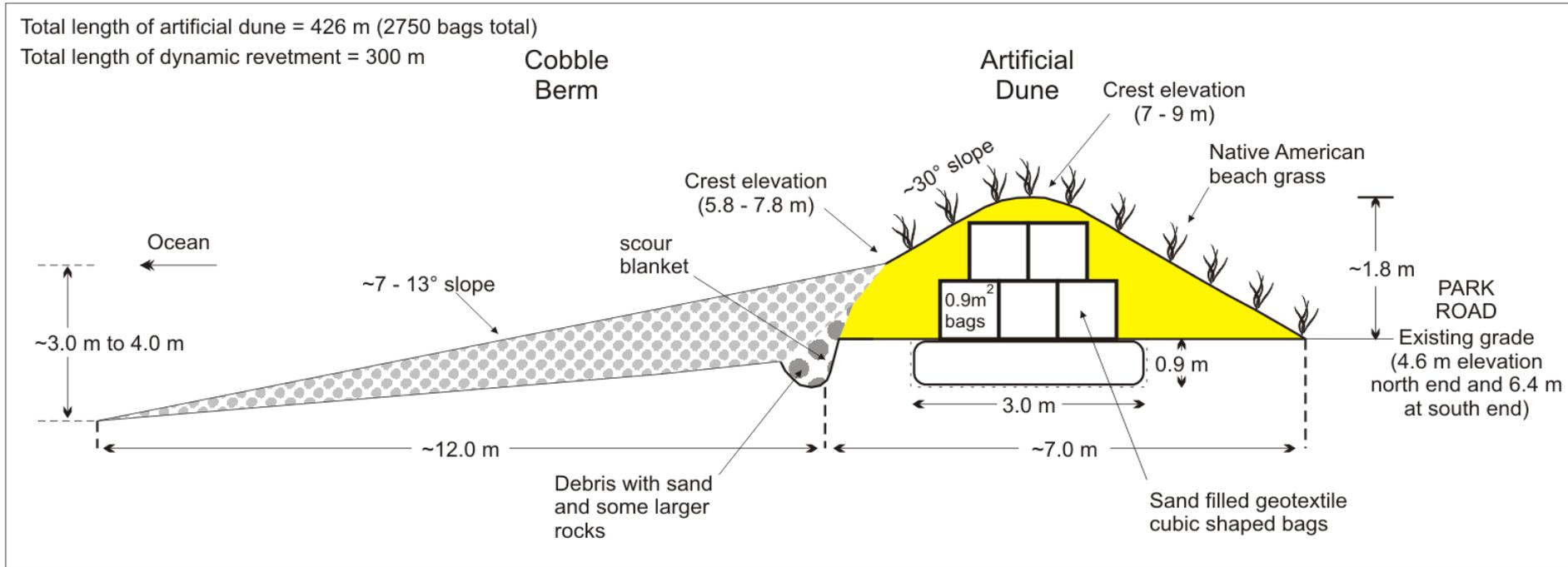
## Implementation of “Design with Nature”

- Sizes and sorting of gravel and cobbles
- Expected equilibrium slope
- Elevation of top of beach to prevent overtopping



# Cape Lookout State Park, Oregon

## Cobble Berm and Artificial Dune



- Reduce quantities of gravel and cobbles
- Dune limits overwash into park grounds



# Cobble Berm and Artificial Dune Cape Lookout State Park, Oregon



Artificial dune reinforced with 1 cubic meter bags filled with sand; planted with native dune grass

Placement of cobble berm with natural slope and desired elevations



# Completed Cobble Berm (Dynamic Revetment)



Winter View



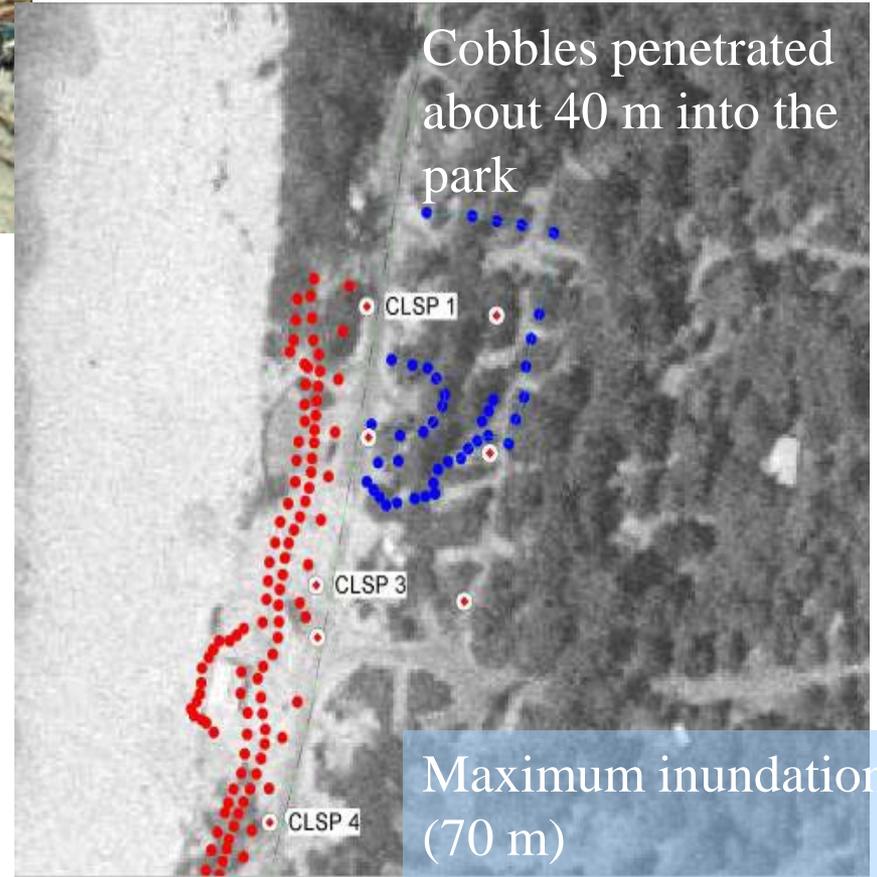
Summer View

- Length 300 meters
- Cost \$125,000
- Aesthetically compatible in this park setting
- Cobble berm covered with sand during the summer
- Elevation too low at north end

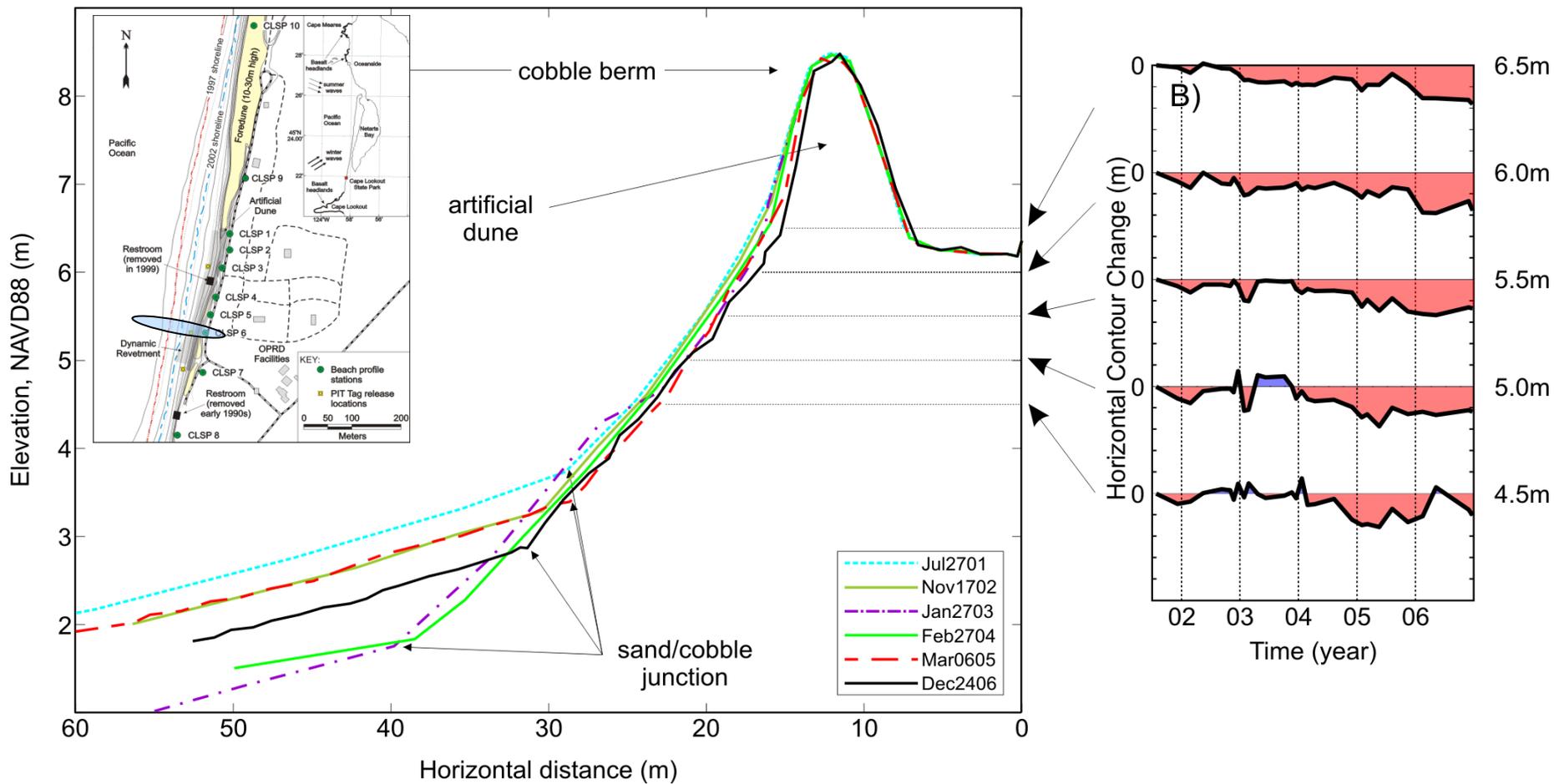


# Overwash Events

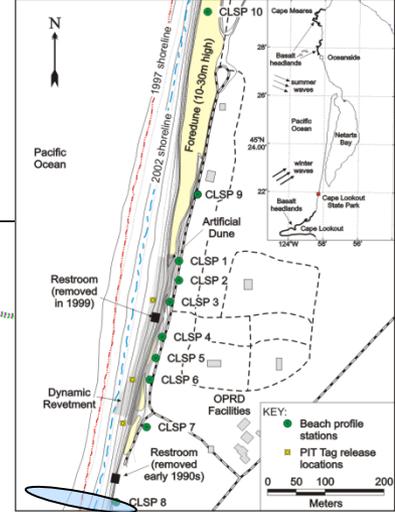
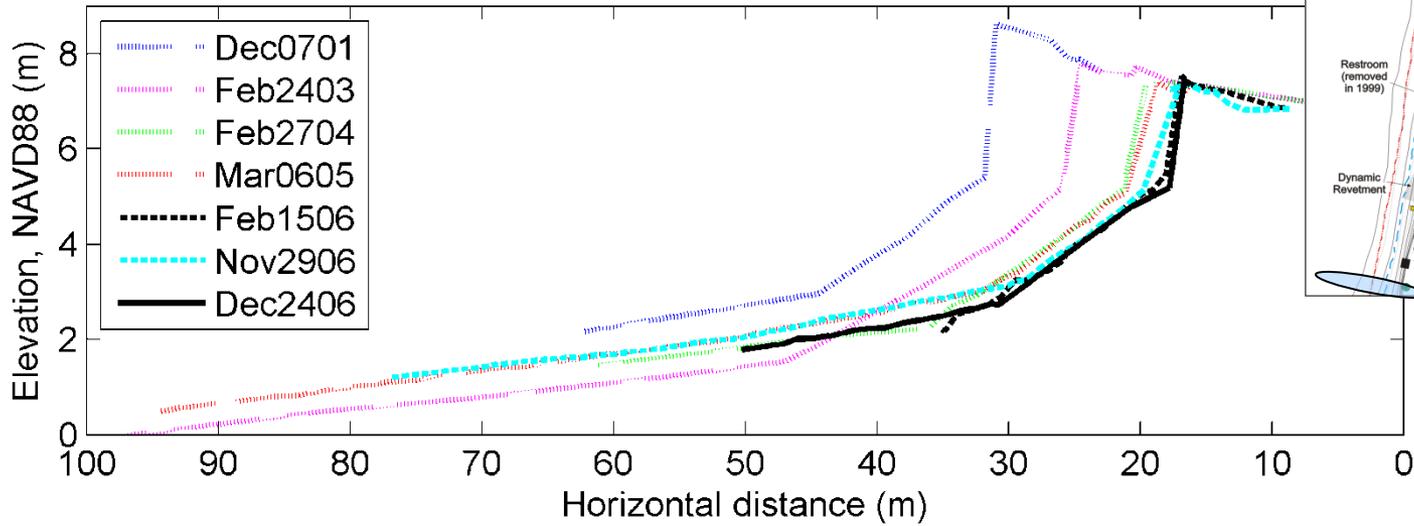
08 November 2002



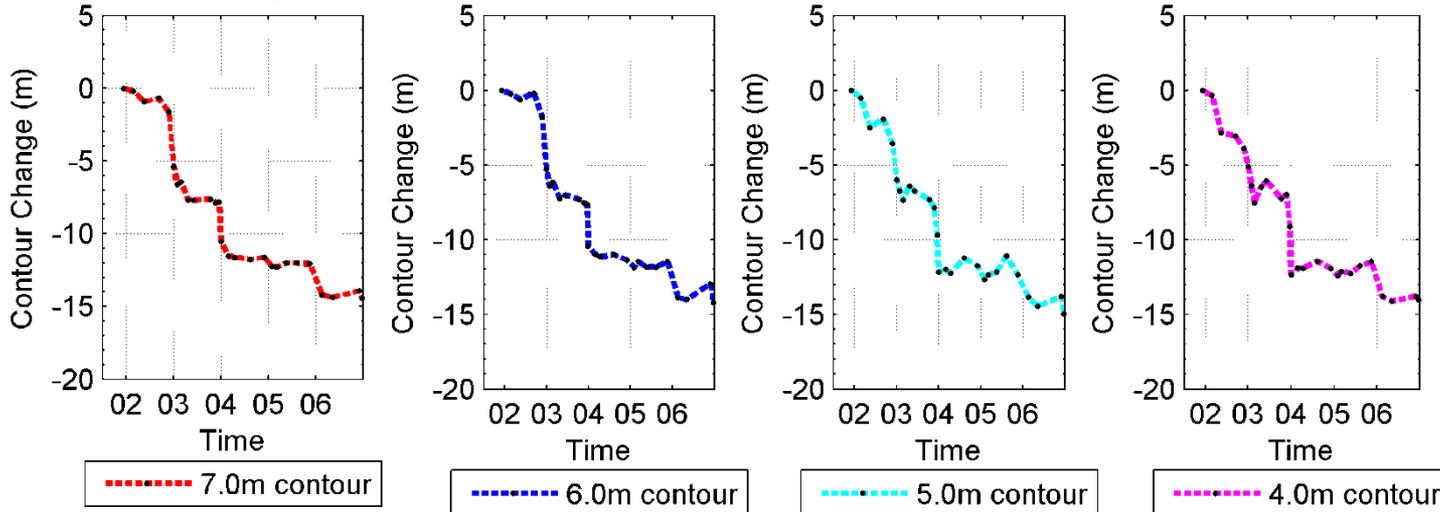
# Profile Responses – CLSP 6 (South End)



### Cape Lookout Profile 8



### Contour Change Plots



32 mm



Pit tag (RI-TRP-RR2B)



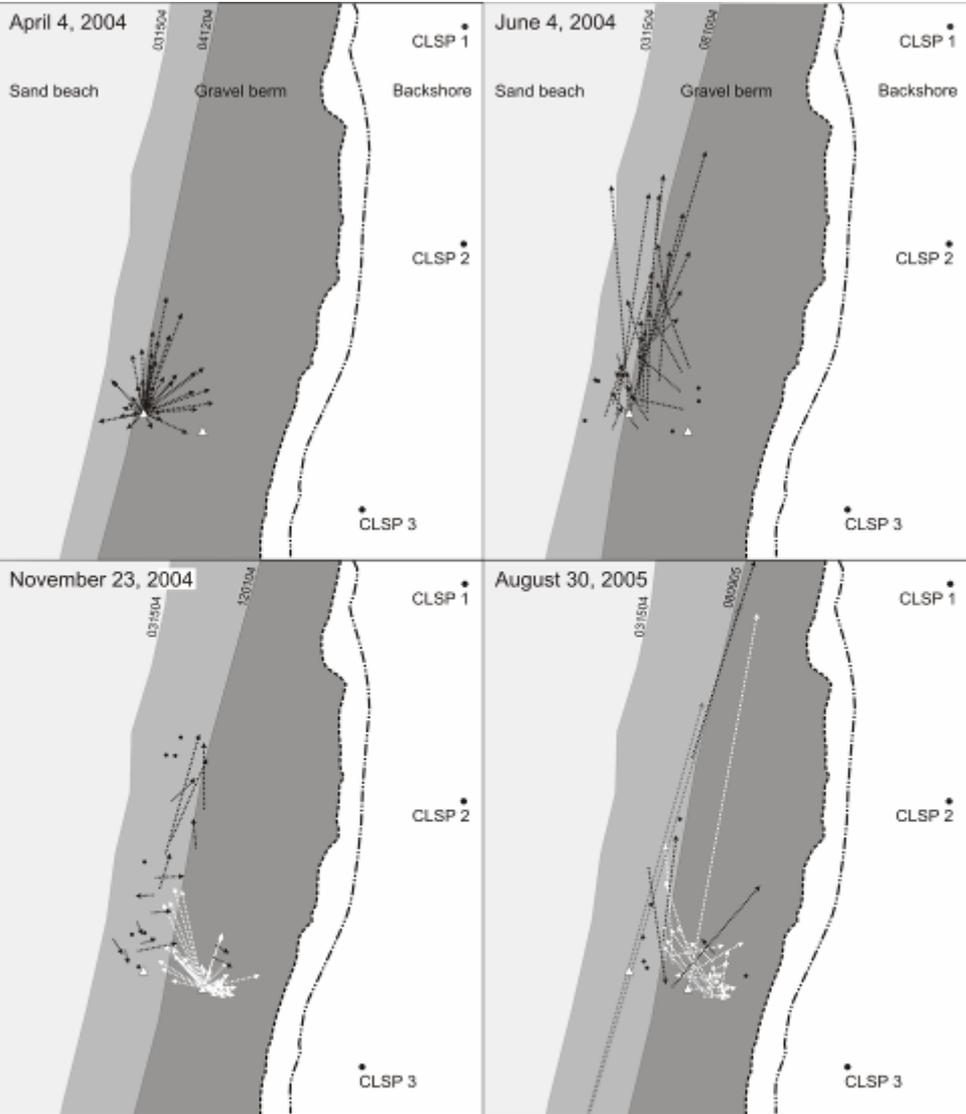
Silicone housing  
(RI-ACC-SHT3-00)



Pit tag inserted in rock (1/4" hole)

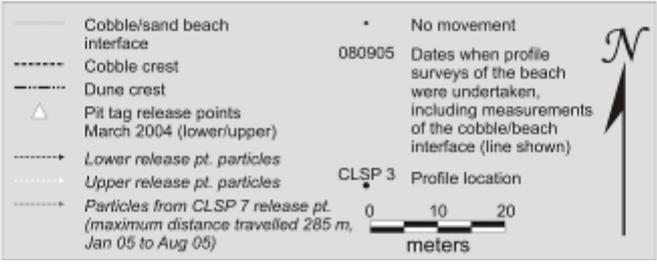
# COBBLE TRACING "PIT" tags





-Recovery rates 1 month after release ~90% ;  
 -27 months later ~33% recovery

May 2006

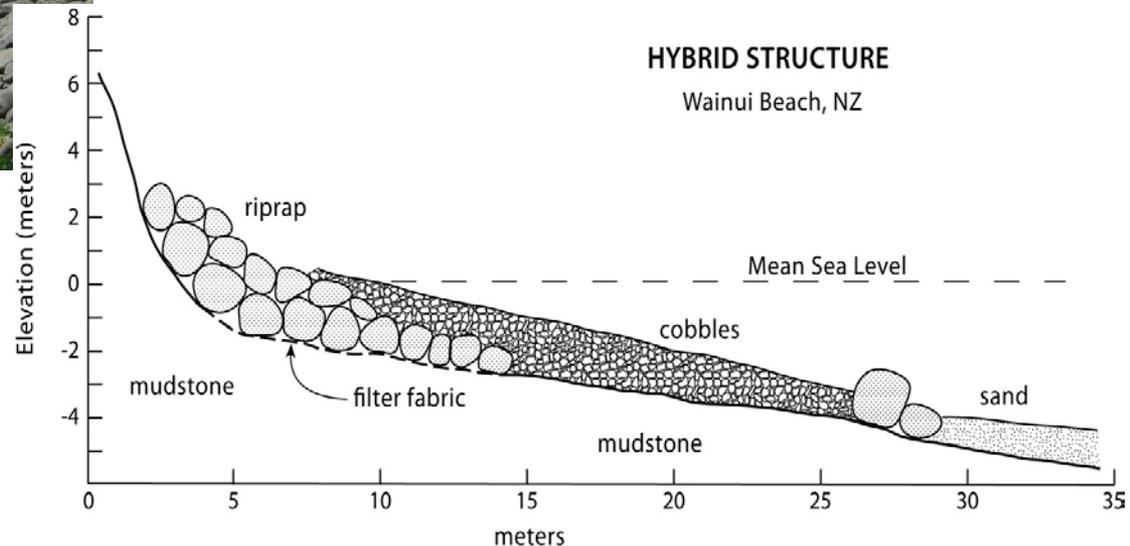


Conclusion: “Design with Nature” approaches to shore protection can in many cases provide an alternative to conventional structures (revetments and sea walls).



Natural

Designed based on Nature



# LONE TREE LANDSLIDE, CALIFORNIA

## Artificial Landslide and its Shore Protection Strategy



# Questions?



Ventura, California



# Hawke's Bay, New Zealand

## Elevation Increase and the Resulting Shoreline Stability



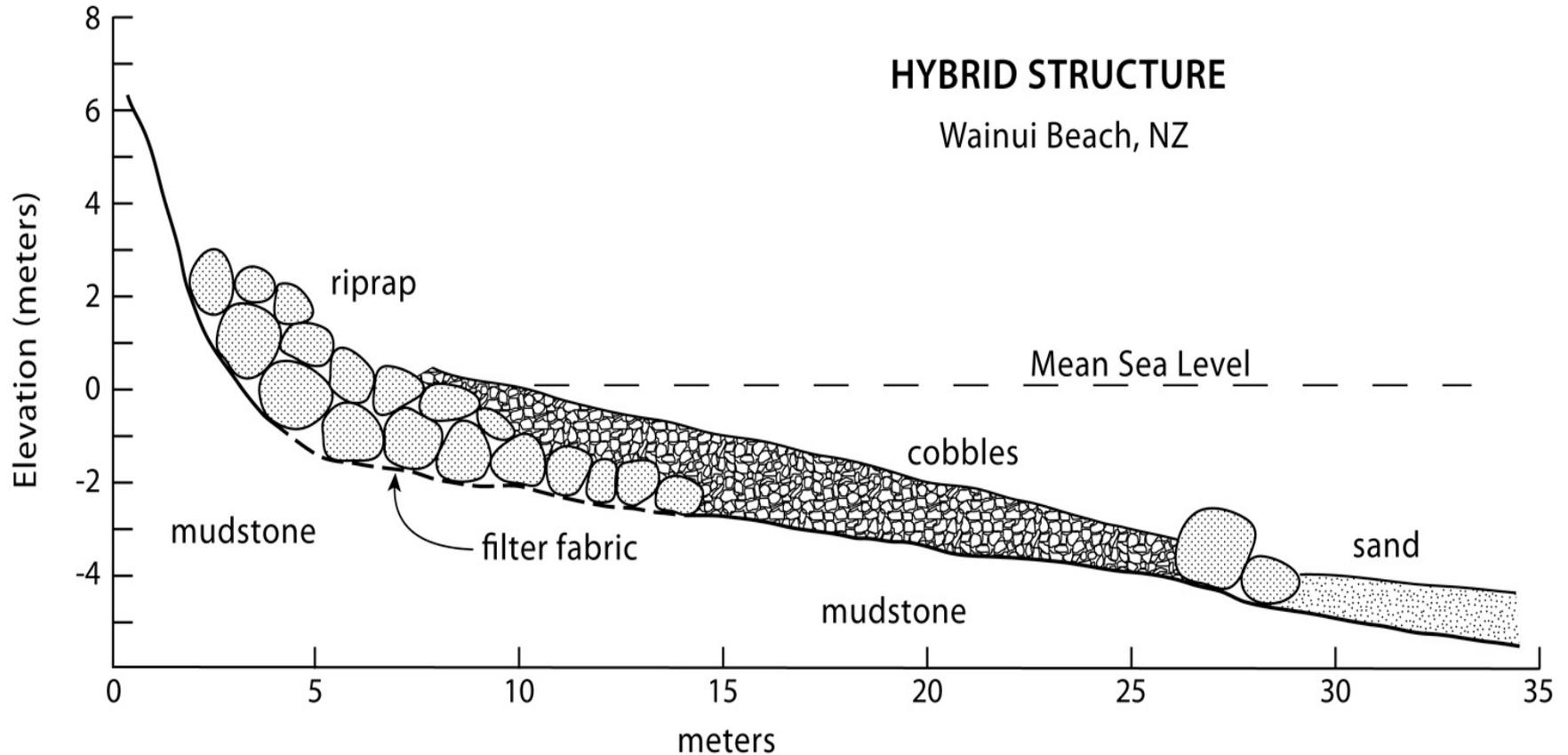


# NATURAL HYBRID STRUCTURES

Lone Tree Landslide, California



# HYBRID DESIGN (Cobble Berm + Riprap Revetment)



# Cobble Berm and Artificial Dune Cape Lookout State Park, Oregon

- Completed in 2000 at a cost of \$125,000
- Aesthetically compatible with park setting
- Withstood numerous storms with some overtopping

