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Cobbles, An Innovative Technology from the Past

Experiences and Thoughts on Restoring Beach Resilience

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Outline

- Where do they come from
- Cobbles Beach Behavior
- Cape Lookout State Park, Oregon
- Montecito Debris Flow and Goleta Beach Cobble Groins
- Resilience Opportunities with Cobbles
- Legislative Thoughts

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Where do they come from?

Cobble Production

- Steep Topography
- Resistant Bedrock
- Episodic Flashy Hydrology
- Limited Floodplain Storage
- Active Cliff/ Hillslope Erosion

Sediment Type	Size (mm)	Velocity for Initial Movement
Sand	0.06–2	0.5–2 ft/s (0.15–0.6 m/s)
Fine gravel	2–16	1.5–3 ft/s (0.5–1 m/s)
Coarse gravel	16–64	3–6 ft/s (1–2 m/s)
Cobbles	64–256 (2.5-10 in)	6–10+ ft/s (2–3+ m/s)
Small boulders	256–512 (10-20 in)	10–15+ ft/s (3–5 m/s)
Large boulders	>512	15–25+ ft/s (5–8+ m/s)

*Often requiring debris flows or extreme floods

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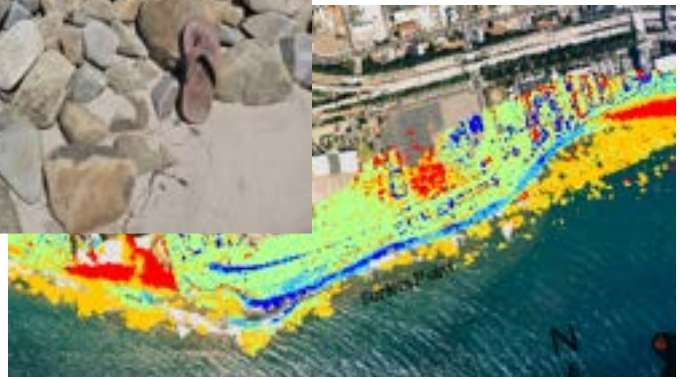
Cobble Beach Behavior

- Cobble shape, size and age
- Sediment matrix (sand or mud)
- Cobble volume
  - Higher = more stable interlocking, dissipative
- Strong sorting when exposed to waves
  - Stable when buried in sand
  - Mobile when partially buried
  - Berm formation when mainly cobbles



Berm formation requires cobble thickness of >3 diameters across wave zone

Cobble Shape	Typical Origin	Transport Method	Mobility
Round (old)	Rivers, surf zones	rolling, saltation, debris flow rafting	High
Flat	Sedimentary rocks, cliff erosion	slide, skip, SURF, debris flow rafting	Moderate
Angular (young)	Landslides, rockfall	saltation, debris flow rafting	Low

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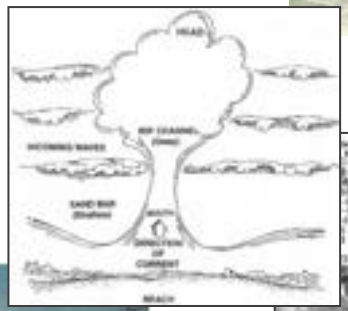
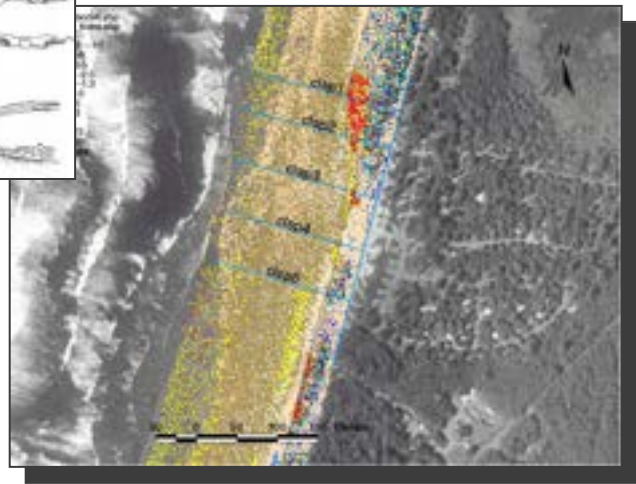
Cape Lookout State Park, OR

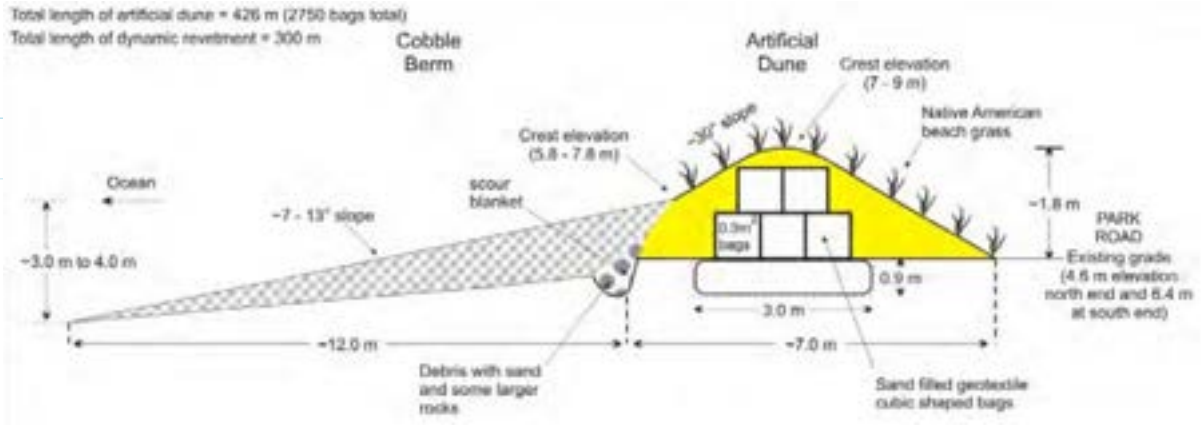
- November 1999, 46' wave heights eroded State Park breaching the fronting dune, undermining a restroom and exposing the campground to coastal hazards.
- Rip embayment set up and eroded cobbles allowing waves to impact the dunes more directly





Cape Lookout State Park, OR

- Built with cobbles eroded from hotspot found on Netarts Spit
- Included a geotextile core to the restored sand dune
- Survived 25 Oregon Coast winters exposed to 10m+ waves
- Actively being researched by OSU and others



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Fire/Flood Montecito Debris Flows

- Debris Flow ~10 cm (3 inches) of rain in 10 minutes
- Montecito 13 ft/sec (4+m/s) in debris flow
- House size boulders up to 20 feet diameter

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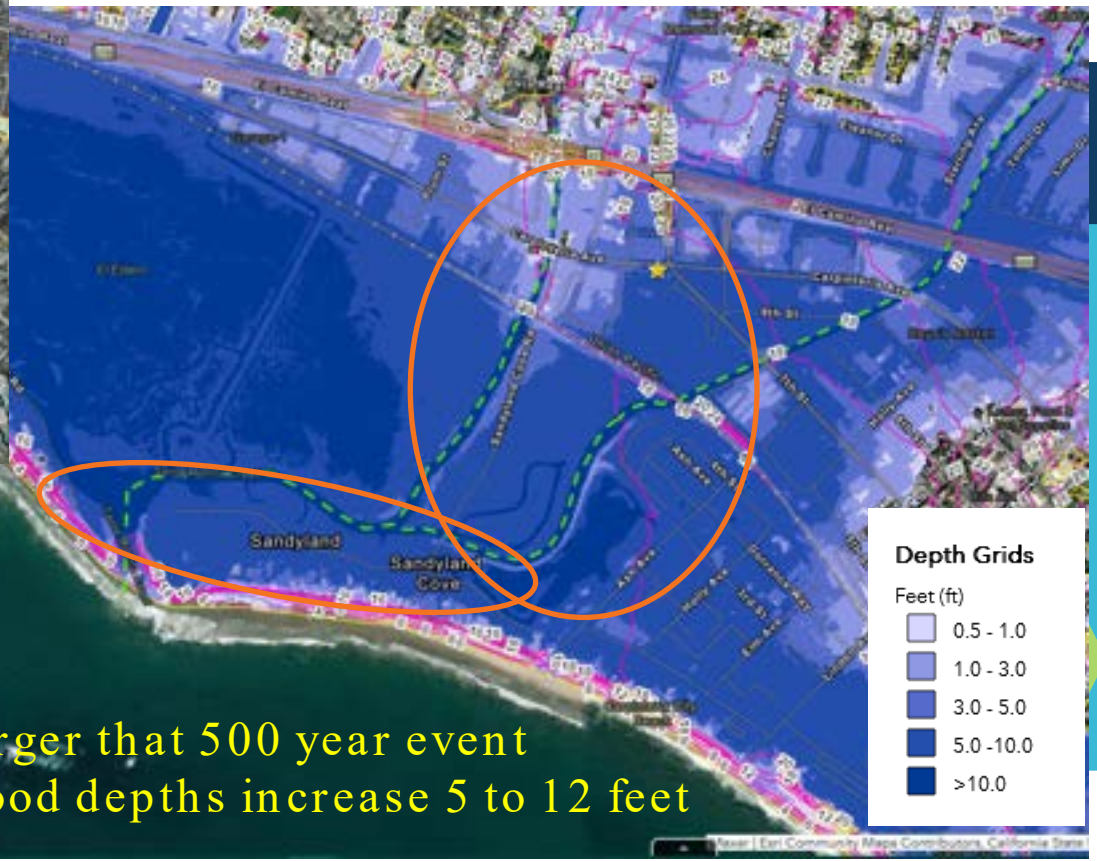
Debris Flow Impacts on Flood Hazards – Post Fire Debris



- Larger that 500 year event
- Flood depths increase 5 to 12 feet

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Cobble and Nearshore Rock Groins – Conceptual Overview

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Goleta Beach Cobble Groin Emergency Placement

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Resilience Opportunities with Cobbles

- Cobble with nearshore rocks
- Cobble feeders
- Cobble delta or landslides mimicking natural deposition
- Cobble placement in barrier beaches of lagoons

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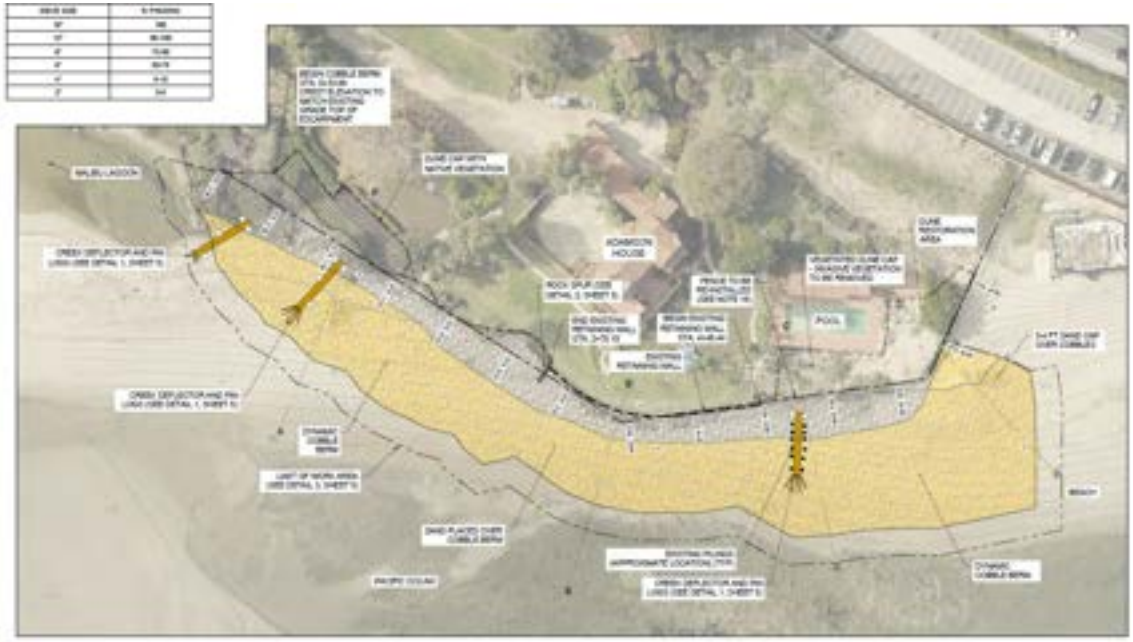
Opportunities for Beneficial Cobble Reuse

- Adamson House Living shoreline - Rindge Dam removal
- Carpinteria Living Shoreline – Santa Monica Debris Basin
- Oil Piers Artificial Surf Reef - Matilija Dam removal?
- Surf Break Enhancement – Everywhere!



Not Just Cobbles - What else does Nature Provide?

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Legislative Wish List – Cobbles

- Integrate sediment management into adaptation planning and disaster recovery
  - Opportunistic sediment placement projects
  - Adaptation pilot projects
  - Inventories of sediment by size – (E.g. Sedimatch)
- Disaster Recovery need to be viewed as opportunities to adapt
- Relax regulatory hurdles – strict 80/20 rule
  - Expand coarse grained placement
  - Expand different placement methods (sidecast railroad, landslide deposition)
  - Statewide Cobble Budget

David Revell

Surfing and Cobbles are Fun!

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