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Online Resources

RAE Living Shorelines, intro video

https://www.estuaries.org/living-shorelines

"Living shorelines" is a term used to define a number of shoreline protection options that allow for natural coastal processes to remain through the strategic placement of plants, stone, sand fill, and other structural and organic materials. Living shorelines often rely on native plants, sometimes supplemented with stone sills, on-shore or off-shore breakwaters, groins or biologs to reduce wave energy, trap sediment, and filter runoff, while maintaining (or increasing) beach or wetland habitat (National Research Council, 2007). Several of these techniques are hybrids of traditional shoreline armouring and the softer approaches to shore protection. The goal is to retain much of the wind, tide, and storm-related wave protection of a hard structure, while maintaining some of the features of natural shorelines.

RAE Report

Living Shorelines: From Barriers to Opportunities

https://www.estuaries.org/first-national-report-on-living-shorelines-institutional-barriers-challenges-traditional-coastal-management-across-the-united-states

Abstract Excerpt: "Coastal areas are especially vulnerable to hazards, now and in the future, posed by waves and surges associated with sea level change and coastal storms. Coastal risk reduction can be achieved through a variety of approaches, including natural or nature-based features (e.g., wetlands and dunes)…"

TNC, 2015, Coastal Resilience Resources Library, http://coastalresilience.org/our-approach/identify-solutions/coastal-defense/ (9-3-15)

Wetland Restoration and Carbon Market

https://vimeo.com/158238082?from=outro-embed

Massachusetts Coastal Bank Plant List

http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/coastal-landscaping/coastal-bank.html

http://www.livingshorelinesacademy.org/index.php (still under construction)

Resources from the NROC Living Shorelines Working Group:

- Gulf of Maine Council Climate Network and Living Shorelines
- NOAA's Living Shorelines brochure: Natural and Structural Measures for Shoreline Stabilization
- The Nature Conservancy's Connecticut Coastal Design Project
- from Restore America's Estuaries: Living Shorelines from Barriers to Opportunities

Sentinel-1

Training course: http://seom.esa.int/landtraining2015/page_programme.php

ESA publication:
http://www.esa.int/About_Us/ESA_Publications/InSAR_Principles_Guidelines_for_SAR_Interferometry_Processing_and_Interpretation_br_ESA_TM-19

Sentinel-1 User Handbook: https://sentinel.esa.int/documents/247904/685163/Sentinel-1_User_Handbook

Sentinel-1 toolbox tutorials: https://sentinel.esa.int/web/sentinel/toolboxes/sentinel-1/tutorials

http://www.depi.vic.gov.au/water/groundwater/groundwater-news-and-information/trial-of-satellite-technology-to-monitor-subsidence-along-the-gippsland-coast

Study using InSAR techniques for monitoring. The full report is apparently available from Victoria via email request.

Landslides and Tree Cutting

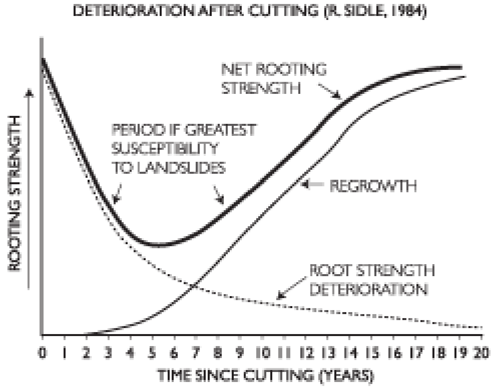
Washington State – Tree Removal on Bluffs

http://www.ecy.wa.gov/programs/sea/pubs/93-31/chap3.html

Shoreline Management and Stabilization Using Vegetation

"Special mention is warranted for stumps that sprout, thus keeping the stump alive and its roots functioning. Species such as maple, willow, and madrone usually sprout and, after several years, may provide the same slope stabilizing benefits as the standing tree. It is not unusual to see cut-over slopes slide except for the area at and below a single sprouted maple stump. Also, removing a stump on a bluff via hand labor is slow and expensive and creates a bare patch subject to erosion and increased infiltration. Except in isolated instances where a stump is an obvious hazard, they should be left."

FIGURE 2. CONCEPTUAL GRAPH INDICATING ROOT STRENGTH DETERIORATION AFTER CUTTING (R. SIDLE, 1984)



"Mitigation of damage to the slope from tree cutting and removal of debris should be a routine condition of permitting tree removals. Mitigation specifications should reduce both short- and long-term stability and erosion impacts which are likely to occur as a result of tree removal. Measures such as revegetation with suitable native species are often effective if an agency requires adequate monitoring and project maintenance during the establishment period (3-5 years). Vegetative buffers at the crest of the slope, as well as drainage controls of upland and slope surface-water run-off are also valuable mitigation tools."

http://www.greenbeltconsulting.com/ctp/treeremoval.html

Accessed 9/12/06 – Puget Sound, WA bluffs

Tree Cutting Permits

Tree cutting permits are required prior to the removal of trees in areas designated in Tree Cutting Permit Bylaw No. 350. The permit will be based on the recommendation in reports from a certified Arborist and a Geotechnical Engineer. These reports include an assessment of the health of the trees and the potential for erosion on the property, and certifies that **cutting will not cause erosion, landslide** or other hazard. The permit will require an application fee and bond based on an amount provided in the Arborist's report for any necessary replanting. Please contact the Planning & Development Division for more information before submitting a Tree Cutting Permit application." (emphasis added)

http://www.scrd.bc.ca/planning_dev.html

Accessed 9/12/06 - British Columbia requirement for cutting trees

CLEAR CUTTING FOR LOGGING

Going Downhill Fast

Logging steep, landslide-prone slopes greatly increases the number and frequency of landslides. Ministry of Forest studies have documented that logging these precipitous slopes increases the risk of landslides to "*15 to 20 times the natural rate.*"'

http://www.sierralegal.org/reports/landslide1.html

Accessed 9/12/06 – 15 to 20 times the risk of a landslide if clear cut steep slopes

A Tale of Two Rivers

"One U.S. Forest Service study concluded that landslides were up to five times more frequent in clear-cuts and roaded areas. An Oregon State University study found landslide frequency ranging from

24 to 253 times bigger in logged areas. In the mid-1980s, a federal judge used a similar study of the Coast Range to bait all logging in the Siuslaw National Forest's Mapleton Ranger District."

http://www.4j.lane.edu/partners/eweb/ttr/landslide/landslides.html

Accessed 9/12/06 - Clear cuts lead to higher probability of a landslide.

OTHER REFERENCES

Great Cascadia Earthquake and Landslide dated from trees

http://earthquake.usgs.gov/regional/pacnw/paleo/greateq/20020515.html

Humbolt Co., CA lawsuit for bad logging practices

http://www.sfgate.com/cgi-bin/article.cgi?file=/c/a/2003/04/03/MN299335.DTL

Oregon – Hubbard Creek Landslide and Clearcutting

http://www.umpqua-watersheds.org/local/landslides/slides_kill.html

Washington State – Tree Removal on Bluffs

http://www.ecy.wa.gov/programs/sea/pubs/93-31/chap3.html