In Search of a Green Alternative to Conventional Engineered Shore Protection: The Rootwall Concept

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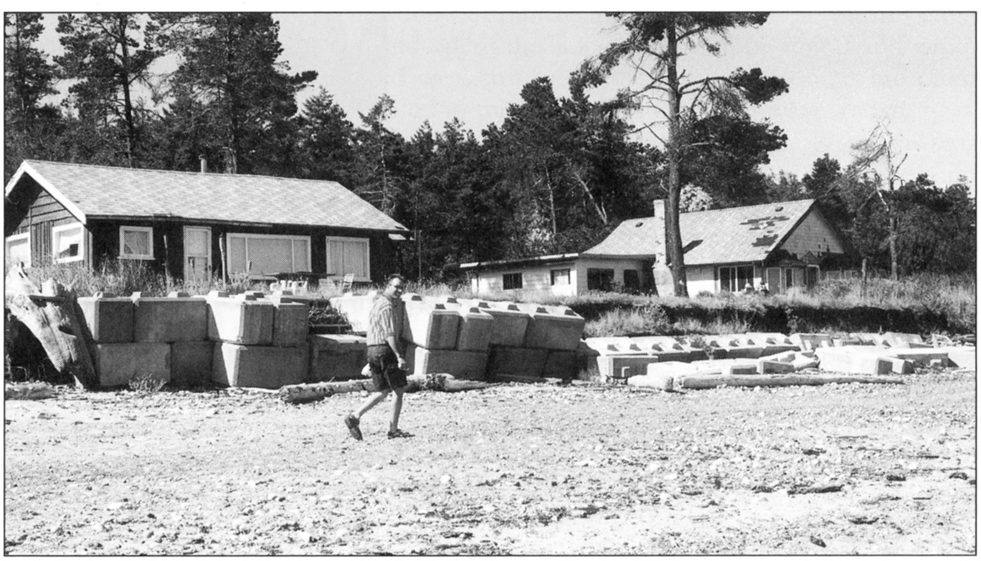
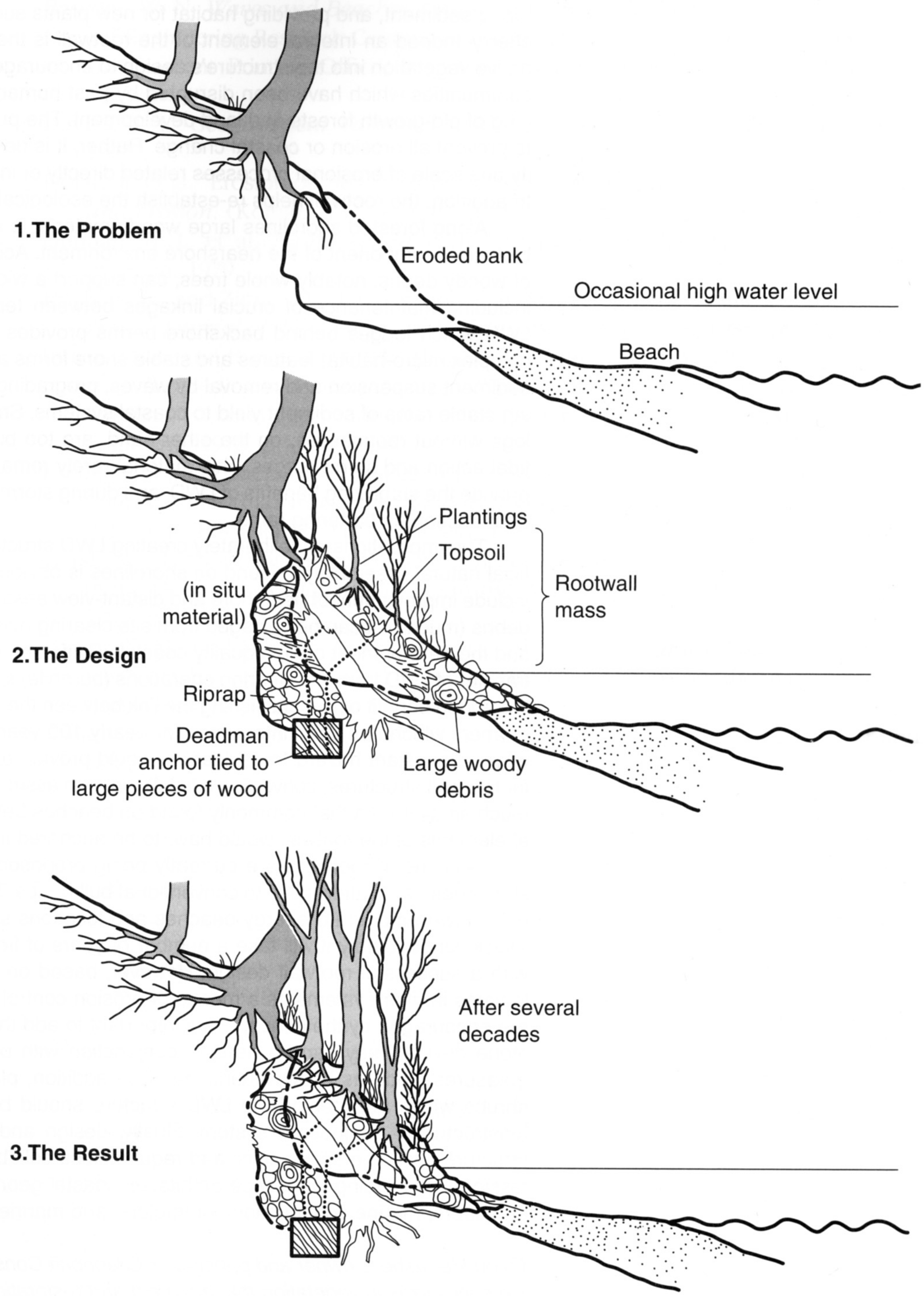
Shoreline home sites afford stunning views and are coveted properties, but they can also be unstable and hazardous places to live. Finding a balance between land use pressures and shoreline health and stability is an on-going challenge. Common development practices, such as insufficient setbacks, clearing and grading, vegetation removal, and stormwater runoff, contribute concurrently and cumulatively to increased incidence of the erosion, slope destabilization and environmental degradation which in turn plague communities, planners, and landowners themselves. Ironically one of the most profound and damaging coastal modifications is the widespread construction of conventional engineered structures designed to protect shorelines from erosion. Known variously as seawalls, bulkheads and revetments, they are widely employed to stop erosion and hold banks in place. However, shorelines are dynamic systems and it is becoming evident that building permanent structures and attempting to impose a static equilibrium to these dynamic landforms is both doomed to failure and damaging to coastal ecosystems.

The scope of the environmental impacts associated with these "hard structures" is also becoming better understood. Research findings indicate that shoreline armoring can actually increase erosion and contribute to more severe slope failures by effectively lowering the level of beaches and interrupting the movement of sediments along shorelines. Biological impacts may include reduction of terrestrial organic matter, loss of shoreline vegetation, and resultant reductions in biological diversity and abundance of intertidal biota. Equally important are the losses to the shore's recreation value and aesthetic appeal.

Various "soft-shore" alternatives are being explored. The rootwall is one such promising alternative which is being explored in the Puget Sound region of the



A failing seawall on a beach cleared of large woody debris and trees. Notice the accentuated erosion of the bank on the right.



Pacific Northwest. The rootwall employs large-tree and root masses, called large woody debris (LWD), as primary structural components to provide immediate protection from wave attack and slope erosion. The concept is based on the observed role of large trees, both living and dead, in helping stabilize shorelines in heavily forested coastal zones. Trees and their root masses, not only add strength to backshore slopes, but adapt to changing conditions as the bank and shore retreat and change form around them. Moreover, when a tree topples onto the beach its root and trunk mass become natural armor for the shore, dissipating wave energy, capturing sediment, and providing habitat for new plants such as dune grass and sand cherry. Indeed an integral element of the rootwall is the incorporation of desirable native vegetation into the structure's design to encourage the establishment of plant communities which have been disrupted by past human activities such as the logging of old-growth forests and land development. The purpose of the rootwall is not to prevent all erosion or coastal change. Rather, it is designed to reduce the severity and scale of erosional processes related directly or indirectly to human activities. In addition, the rootwall helps re-establish the ecological character of the shoreline.

Along forested shorelines large woody material is an important structural and biological component of the nearshore environment. Accumulations of large pieces of woody debris, notably whole trees, can support a wide range of biotic functions, including maintenance of crucial linkages between terrestrial and marine areas. LWD which lodges behind backshore berms provides the framework from which complex micro-habitat features and stable shore forms are created, reducing beach sediment suspension and removal by waves, prograding of beaches, and maintaining stable rates of sediment yield to coastal systems. Smaller woody debris and cut logs without rootmasses, on the other hand, are too buoyant and mobile to resist tidal action and storm surges. This material rarely remains in place long enough to provide the stabilizing benefits of LWD, and during storms, can become water-borne and function as battering rams.

The implications of deliberately creating LWD structures which mimic the beneficial natural assemblages found on shorelines is obvious. Additional benefits would include improvement of nearshore and distant-view aesthetics, the low cost of woody debris (much of it can be salvaged from site clearing operations inland of the coast), and the development of high quality coastal wildlife and fishery habitat features. The transfer of LWD from site clearing operations (burnpile) to marine shorelines provides the added benefit of re-establishing the link between the forests and the marine environment which has been interrupted for nearly 100 years. Drift logs in inland waterways, a constant hazard to navigation, would provide an additional source of LWD for rootwall structures, converting a liability into an asset. Since available LWD is now much smaller than that commonly found on beaches before the 1850s, the structural elements of the rootwall would have to be anchored in beach substrates.

Versions of rootwalls are currently being proposed for selected Puget Sound shorelines as an alternative to conventional bulkheads. They appear to be best suited to low-to-moderate energy beaches and locations sporadically subject to wave attack. Undoubtedly it will take a number of years of field experiments to come up with a successful rootwall design. However, based on the success of engineered logjams in river systems as a means of erosion control and habitat restoration, we are encouraged by the concept. It is important to add that rootwalls are not a stand alone device. They can be used in conjunction with other "soft-shore" protection measures, such as beach nourishment. In addition, plantings of native trees and shrubs within and behind the LWD structure should be a crucial element of this biostructurally engineered system. Finally, design and construction of a rootwall structure would be site specific and require close collaboration among several professionals, including landscape architects, coastal geomorphologists, geotechnical engineers, marine construction contractors, and marine vegetation restorationists.

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