The Preventive Methods of Beach Erosion

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Abstract

Erosion occurs in all parts of the world, but beach erosion is the most prevalent. Many ways to prevent erosion of the beach and coastal developments are available. However, each way has negative effects. Natural dunes and vegetation are slow forming but more durable than unnatural dunes and transplanted vegetation. Constructing man-made dunes obliterates habitats and disrupts the food chain. Man made structures, such as seawalls, sandbags, and sand fences have a plethora of drawbacks. Seawalls and sandbags actually increase beach erosion and destroy the beach, while sand fences create dunes that are temporary unless stabilized with vegetation. Erosion prevention methods temporarily halt beach erosion but do not compare to the power of the ocean.

The Preventive Methods of Beach Erosion

As long as earth has existed erosion has been taking place. The rate of erosion is faster in area with damper climates, so beaches have a constant struggle. Various forms of both natural and unnatural erosion contribute to the ever-changing structure and composition of the coastline. However, sand dunes, vegetation, and man-made structures all provide protection for beaches and communities, but may have negative effects as well.

Due to erosion, islands are becoming narrower and coastlines are retreating. Heavy rain and wind rapidly move sand off the dunes and cause oceans to climb higher and higher onto the beach. Hurricanes are common along coastlines and cause destruction not only to houses but also to beaches. The fierce storms rip apart dunes and cause sea levels to rise and take over beaches. Currents are another form of erosion that gather sand and move it down the beach. Longshore currents, or littoral drifts, are found close to the shoreline and are the most prevalent form of wave erosion (See Appendix A). As waves break, creating a small current, sand is stirred up and dispersed through the water along the shore. As a result, even a gentle current can move a large amount of sand. Littoral drifts are responsible for most of the sand movement on a beach (Neal, Pilkey, Rice, 2004).

Sand dunes are one of the most widely known ways to prevent erosion. Natural sand dunes are formed when wind blows the sand across the beach creating a build up. Anything on the beach from a bottle to a clump of seaweed can be a catalyst for sand dune creation. The object blocks the wind and causes sand build up around it. Usually, sea oat seeds are blown into the pile and begin to grow. If the forming dune is far enough from the water it continues to grow, forming a natural sand dune (Neal, Pilkey, Rice, 2004).

Bulldozers piling sand at the back of the beach form unnatural sand dunes. Man-made dunes lack all characteristics of natural sand dunes. Naturally occurring dunes consist of layers of different sand types, visible when the dune is eroded or cut (See Appendix B). On the contrary man-made dunes have no layers and the sand types are mixed together (Neal, Pilkey, Rice, 2004).

Natural sand dunes support the growth of vegetation better than unnatural dunes. The layers in natural dunes allow the root systems of sea oats and other vegetation to grow deeper into the sand and become stronger and more stable. Vanderwaal forces also help to strengthen natural dunes. These forces are electrical bonds that unite symmetrical sand grains and the water particles between the grains. In contrast, unnatural dunes do not have deep roots of vegetation to stabilize them and Vanderwaal forces are ineffective due to the irregular sizes of sand grains and shell fragments (Neal, Pilkey, Rice, 2004).

Man-made sand dunes disrupt the natural tendencies of beaches. Moving sand from the front of the beach to the back in order to build a dune is actually causing the beach to erode. The replacement of sand also kills thousands of organisms that live in the sand by destroying the species' habitats. After bulldozers have been at work, seagulls crowd the beach eating all the organisms that are left out in the open after their natural habitat has been obliterated. The process disrupts the whole food chain, from the birds to the fish. Unnatural dunes are destroyed in storms more easily than natural dunes and are expensive to maintain and rebuild. In strong winds they occasionally cover roads, making driving hazardous. Though natural and unnatural dunes help slow erosion, neither slows it very much. The amount of sand in a dune compared to the amount of sand on a beach is minute so dunes are usually easily swept away in the process of erosion (Neal, Pilkey, Rice, 2010).

Vegetation is a major part of preventing beach erosion. The roots that plants put down into the sand help to hold the sand in place and make dunes sturdier. The plants that grow on the beach must be exceptionally sturdy and persistent in order to survive the harsh conditions, so the variety of species is extremely low. They must be able to endure hot summers, and an environment scarce in nutrients along with being battered and buried by sand, sprayed by salt, and occasionally flooded by saltwater. (Broome, Seneca, Woodhouse, 1982).

Perennial grasses are the main form of vegetation that grows along the Atlantic and Gulf coasts. The northern coast is dominated by American Beachgrass (See Appendix C) while the southern coast is dominated by Sea Oats (See Appendix D). Beachgrass grows by rhizomes, which makes it an excellent plant to use as a replacement after another plant is damaged and to fill open spaces. However, it is susceptible to drought, heat, fungus, and insects so it should be planted with other species too. Seeds of Sea Oats germinate in naturally forming sand dunes and push up through the sand as the dune grows. Without these plants dunes would be easily destroyed by even the most minuscule storms, wind, and waves. The negative property of Sea Oats is that is it hard to grow out of its natural environment so its commercial use is low. The North Carolina coast is the line between Sea Oats in the south and American Beachgrass in the north, as well as being an excellent growing area for Bitter Panicum, another perennial grass (See Appendix E). There are a large variety of types of Bitter Panicum differing in stem size, height, and elasticity. It attracts grazing animals so it is rare and doesn't spread easily. American Beachgrass, Sea Oats, and Bitter Panicum are all dune grasses. Another grass called Saltmeadow Cordgrass, while not a dune grass by definition, is usually the start of natural dunes and the first vegetation on a beach (See Appendix F). It is also an excellent plant to transplant to areas that often have saltwater flooding. However, Saltmeadow Cordgrass usually does not

survive when planted in dry areas. In order to add variety to the plant species growing on dunes, a woody shrub called Seashore Elder is sometimes transplanted to a beach (See Appendix G). It is low-growing with roots that grow from the stem as it is covered by sand (Broome, Seneca, Woodhouse, 1982).

Often man will attempt to stop erosion by constructing various objects. Seawalls, sand bags, and sand fences are all results of this. Each method used has a large impact on beaches and communities. However, its impact is occasionally negative instead of positive. Deprivation of beaches, habitats, animal species, communities, and personal houses are only a few of the consequences of man-made erosion prevention structures.

Seawalls are one the strongest structures man has ever made (See Appendix H). They must be able to withstand hurricanes, brutal waves, corrosive saltwater, and strong currents. Typically, seawalls are made of concrete, steel, or boulders and run along the line of the water parallel to the beach. They are usually used when beachfront buildings or roads are in danger of being consumed by the sea. Seawalls are devised to hold back the ocean by halting natural sand and wave movement (Moriarty, 2010). However, seawalls are only temporary and are expensive to maintain. They also have a large negative impact on the beach. When a wave crashes into the wall it is pushed back into the ocean, taking sand with it, causing complete destruction of the beach and a drop-off. The amount of time for the process of demolition to be completed is between one and thirty years. The drop-off created by the seawall causes storm waves to have higher energy, which causes faster erosion and break down of the wall. Also, energy from waves and currents is focused on the ends of the wall, amplifying erosion at these points (Roberson, Stewart, 2007).

Sandbags are frequently made of burlap or polypropylene and can been seen lining the shores of numerous beaches (See Appendix I). The large bags filled with sand actually act like a seawall, contrary to seeming fragile. The advantage of a sandbag instead of a seawall is that a sandbag is much less expensive and easier to maintain. Bags are easy to transport and buy and can be filled with local sand or a similar material (Bullock, Bush, Cowan, Neal, Pilkey, Pilkey, Riggs, Webb, 1998). To make bags stronger, they can be buried on a beach. Buried sandbags are sometimes used while other more permanent options are being contemplated, arranged, and executed. Buried bags should only be utilized for about five years before a more permanent structure is constructed. Sandbags are similar to seawalls and have similar drawbacks, in addition to making a beach less visually appealing, sandbags cause rapid erosion of beaches. They interfere with the natural relationship between the beach, waves, and dunes, such as hindering the beach from supplying dunes with new sand. Since sandbags are made of burlap or polypropylene they are subject to ripping and vandalism (Jardine, 2009).

Sand fences are a simple, man-made method used to prevent erosion (See Appendix J). The spaces between the slats cause the reduction of wind velocity therefore the particles being carried by the wind drops next to the fence. Sand fences can be used to help dunes form by creating a barrier to trap wind-blown sand. They are usually about two feet tall and run parallel to the water. The slats are about one and a half inch wide and have the same distance between the slats. Sand fences can also be used to keep sand from covering roads and making driving unsafe. They are a fast way to create sand dunes and the created dunes can reach up to six feet high in one season. The negative side of sand fences is that the dunes it creates are not stable without vegetation, so transplants must be obtained and planted before the dune collapses in a storm or high winds (*Sand fence*,1991).

Erosion affects and shapes the entire world. From the mountains to the coast, erosion is evident everywhere. Since erosion is unavoidable, the problem becomes discovering ways to prevent it. Present beach erosion prevention methods include sand dunes, vegetation, seawalls, sandbags, and sand fences. Based on the research conducted, it is evident that new ways to prevent erosion must be obtained. Each way that is currently used has extensive negative effects on beaches and their natural tendencies. The research also points toward the fact that nothing man does to try to stop erosion can ever completely halt it, so the better solution is to avoid it. If houses and building were not constructed close to the coastline, erosion would not be such a pressing issue. Beach erosion is eternal but can be evaded and prevented.

Bibliography

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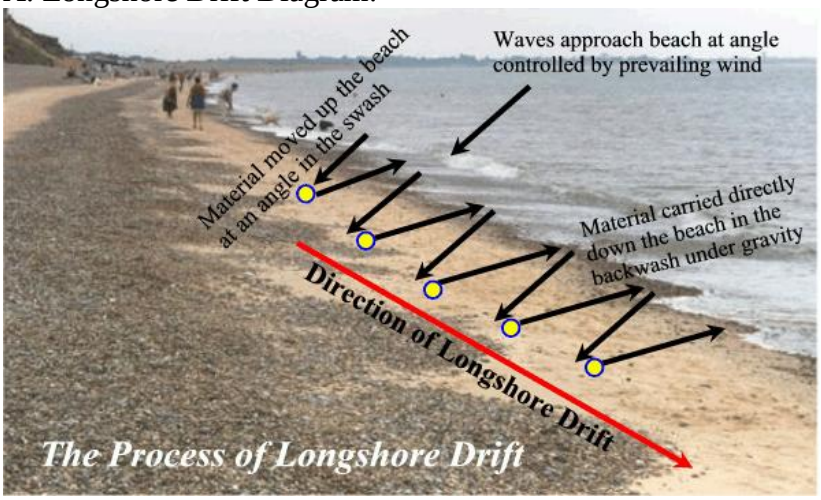
Appendix

A. Longshore Drift Diagram:



http://cgz.e2bn.net/e2bn/leas/c99/schools/cgz/accounts/staff/rchambers/GeoBytes%20GCSE%20Blog%20Resources/Images/Coasts/LongshoreDrift1.gif

B. Natural Sand Dune Layers

http://2.bp.blogspot.com/_FIolHwdBu3Q/S2_2vOps-TI/AAAAAAAAAts/-gtqsg4K-8k/s400/Go-sand-layers-g1.gif

C. American Beachgrass

http://www.savethebeaches.net/Gil%20image/beach%20grass%20close.jpg

D. Sea Oats

http://www.ugaecp.com/user_images/1186070808_ResizeSeaOats.jpg

E. Bitter Panicum

http://wfrec.ufl.edu/community_ecology/images/Panicum_01_resize.jpg

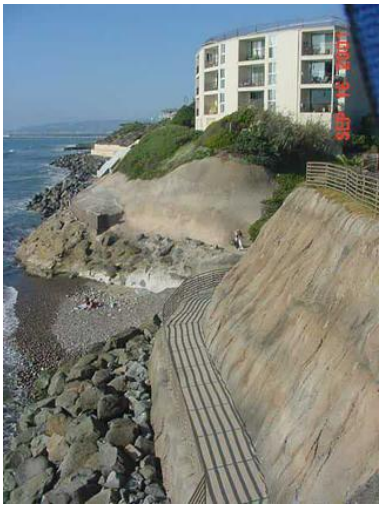
F. Saltmeadow Cordgrass

http://blackwaternurseriesllc.com/images/spartina_paten.jpg

G. Seashore Elder

http://www.coastaltransplants.com/images/CTC-Sea-Shore-Elder.jpg

H. Seawall



http://www.sandiegogeologists.org/images/PescaderoSeawall.jpg

I. Sandbags

http://1.bp.blogspot.com/_0VqsvV3q0J0/S2vP0F5TKyI/AAAAAAAAAX4w/z1bV7NU-6rY/s320/massive-sand-bags.jpg

J. Sand fences

Photography by Helen Robertson