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**WAYS TO PREVENT COASTAL EROSION**

There are several different methods that have been used in various places to prevent coastal erosion. Some of these methods have worked fairly well, but there are always different drawbacks and advantages to each. Some of the most common methods to prevent coastal erosion are as follows:

* **Groins:** These are long, wall-like structures that are built on beaches and extend into the ocean perpendicular to the shoreline. The idea behind groins is that they act as a barrier to longshore currents. This allows them to control and modify the movement of sand. As the longshore current hits the groin, it loses velocity and dumps sand and sediment on the upcurrent side of the wall. While this catches sand on the upcurrent side of the wall, it leads to more erosion on the downcurrent side of the wall, where the waves once again pick up sand and sediment.
* **Jetties:** This solution involves constructing a line (2 or more depending on the number of channels) of long structures perpendicular to the coast that reach into the ocean. These are usually made from stone, concrete, steel, or timber, and are designed to keep sand from entering a ship channel. As sand builds up on against the upcurrent side of the jetties, it can be redistributed along the beach to further reduce erosion. However, much like groins, erosion still occurs on the downcurrent side of the jetties.
* **Breakwaters:** These are barriers that are constructed offshore parallel to or at an angle to the shoreline. Breakwaters act as a wave barrier, allowing the beach to grow while preventing harmful erosion. As waves hit the breakwater, they deposit their load of sediment along it. However, any part of the coast not protected by the breakwater continues to experience erosion.
* **Beach Nourishment:** This is a soft solution (one that does not require a hard structure) that involves depositing sand on the beach in order to artificially widen it. Although this solution can be effective, it is costly and temporary.
* **Vegetation:** Strategic planting of vegetation can be used to help control erosion. the roots of coastal plants help to anchor the sand and ensure that it is not carried off in erosion. This is why many areas plant seagrass and build marshes along coasts to prevent erosion. However, this solution means that the beach may not be as functional as it once was, particularly if it is a tourist area.
* **Seawalls:** Seawalls are one particularly effective way to prevent erosion. These are structures that are built along the coastline to stop waves from ever coming into contact with the sand/shore on the opposite side. While seawalls tend to be quite effective at preventing erosion, they are only able to protect the coast that they are installed along.

**HOW COASTLINES CAN BE PROTECTED FROM COASTAL EROSION**

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).

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).

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. 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).

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.

**SUGGEST WHY SOME COASTAL AREAS NEED PROTECTING FROM THE IMPACTS OF COASTAL EROSION.**

 The main drivers of change in coastal geomorphology are geological structural resistance, changes in sea level, long-shore currents and storm surges. These factors are responsible for both coastal erosion and accumulation, as well as for the emergence and variability of beaches. Coastal protection measures are major factors at the local scale. At the regional and global scale, coastal erosion is induced by an increasing number of severe storm surges and sea-level rise. These factors are leading to the following:

* loss of sediment for coastal rebuilding
* loss of valuable dynamic coastlines
* loss of coastal resilience
* loss of valuable natural habitats
* loss of economic value and private property
* unpredictable land change due to extreme storm events
* increasing cost to society in terms of coastal protection measures.