
Focus Question in Your Notes

What are the primary causes (think of the hazards) and environmental as well as economic impacts of coastal erosion, and how should human communities respond to this process?

Learning Objectives on Poster

1. Name the main types of Coastal Hazards: include –their impacts and how they are caused and impact the coast.
2. What is the season for hurricanes, do they cause a greater impact to coastal erosion than winter storms? Explain your reasoning.
3. What are the economic impacts that result from these types of coastal erosion problems and which type does your group consider to be the most damaging? Why?
4. How does human activity can increase the risks associated with coastal erosion.
5. When cities want to reduce risk of coastal erosion - what advantages can be considered when cities focus on reducing coastal erosion? What problems can result with options?
6. What beaches or coastlines can be more vulnerable to coastal erosion? Why? Key Words

Terms to include in your discussion/answers.

Erosion
Accretion
Longshore transport
Dune
Berm
Beach profile

Background Information

Almost half of the people living in the United States live near the coast. As the coastal population continues to grow, more people and property will be exposed to hazards caused by severe storms, floods, shoreline erosion and other natural hazards. Homes and businesses are often built in low-lying areas and barrier islands that are particularly vulnerable to storm damage. The potentially disastrous consequences of this trend became obvious during the summer of 2004 when residents of Florida were battered by four major hurricanes within six weeks, resulting in billions of dollars worth of damage. Much of the price is eventually borne by American taxpayers through federal government funds for disaster relief and reconstruction.

While erosion and land subsidence (land sinking below sea level), are less spectacular than strong storms, they are just as important in economic terms. Erosion alone is estimated to cause billions of dollars of damage every year along U.S. coasts. Subsidence around New Orleans has necessitated large expenditures for pumping and dike maintenance. Subsidence in Texas, Florida, and California threatens high-value land uses and causes damages that cost millions to repair.

Attempts to protect against coastal hazards can cause additional problems. Sea walls intended to protect against storm waves can actually accelerate beach erosion and reduce the capacity of beaches to absorb storm energy. As a result, buildings adjacent to the beaches are exposed to the

full force of wind and waves. Human activities such as diking and drainage of land around New Orleans, ground water removal in Texas and Florida, and extraction of oil and gas in California have accelerated subsidence in these areas. Experience has shown that prevention is the best approach to deal with these problems. It costs much less to prevent construction in areas unsuitable for development than to provide funds for emergency response, cleanup, and reconstruction. NOAA's Office of Ocean and Coastal Resource Management works in partnership with state governments to minimize the impact of coastal hazards by

- Identifying areas that are most likely to be severely affected by these hazards;
- Developing warning systems and response plans to minimize human exposure to hazardous events;
- Establishing appropriate building codes; and
- Restoring the natural protective functions of beaches and dunes.

Coastal Hazards

"As the coasts become increasingly populated, more and more people are placed in harm's way. Thus far, science has not found effective ways to reduce most hazards. Therefore, citizens must look to strengthening communities. Building safer buildings and strengthening infrastructure are important steps, but it is the manner in which societies are built that largely determines disaster resilience. A vital part of effective disaster planning—whether for mitigation, preparation, response, or recovery—is an understanding of the people and institutions that make up each community, including their strengths and their weaknesses, as a basis for developing policies, programs, and practices to protect them. In the end, it is human decisions related to such matters as land use planning and community priorities that will build stronger, safer, and better communities."

— H. John Heinz III Center for Science, Economics and the Environment, 2002, ["Human Links to Coastal Disasters"](#)

The U.S. coast is susceptible to a variety of natural hazards, including coastal storms, flooding, coastal erosion, tsunamis, and land subsidence. All of these hazards threaten lives, property, the natural environment, and, ultimately, economies—a problem that becomes more pressing as coastal populations continue to rise. Although coastal counties comprise only 17 percent of the nation's land area, they are home to over half the U.S. population. In 2003, 153 million people lived along the coast, 33 million more than in 1980.

Intensive development in the coastal zone not only places more people and property at risk to coastal hazards, but it also degrades the natural environment, interfering with nature's ability to protect the human environment from severe hazard events. For instance, seawalls accelerate beach erosion and inhibit the beach's ability to absorb storm energy, thus exposing buildings to the full force of wind and waves. Development can also destroy wetlands that serve as important buffers against storm surge and other types of flooding. So, while nothing can be done to prevent coastal hazard events, their adverse impacts can be reduced through proper planning.

Coastal Erosion

Coastal erosion is a process whereby large storms, flooding, strong wave action, [sea level rise](#), and human activities, such as inappropriate land use, alterations, and shore protection structures, wear away the beaches and bluffs along the U.S. ocean and Great Lakes coasts. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences.

In the United States, coastal erosion is responsible for approximately \$500 million per year in coastal property loss, including damage to structures and loss of land. To mitigate coastal erosion, the federal government spends an average of \$150 million every year on beach nourishment and other shoreline erosion control measures. Despite these efforts, a 2000 Heinz Center study found that erosion may claim one out of four houses within 500 feet of the U.S. shoreline by mid-century.

While coastal erosion affects all regions of the United States, erosion rates and potential impacts are highly localized. Average coastline recession rates of 25 feet per year are not uncommon on some barrier islands in the Southeast, and rates of 50 feet per year have occurred along the Great Lakes. Severe storms can remove even wider beaches, along with substantial dunes, in a single event. In undeveloped areas, these high recession rates are not likely to cause significant concern, but in some heavily populated locations, one or two feet of erosion may be considered catastrophic.

Significant coastal hazards that result in coastal erosion include:

- Coastal Storms
- Flooding
- Tsunamis
- Land Subsidence

Coastal Storms

Coastal storms take many forms and occur throughout the year. All coasts experience coastal storms and are susceptible to storm-related losses.

Tropical storms and hurricanes (typhoons) are intense summer storms. The main threats associated with these hazards are storm surge, high winds, heavy rain, and flooding, as well as tornadoes.

The North Atlantic hurricane season is from June 1 to November 30 and peaks between August and October. An average hurricane season features approximately 11 named storms. This includes six hurricanes, two of which are major. In the Eastern Pacific, the hurricane season runs from May 15 through November 30 and peaks between July and September. An average season includes 15 tropical storms, of which 9 become hurricanes and 4 become major hurricanes.

The 2004 Atlantic hurricane season was one of the worst on record. However, 2004 was quickly surpassed by 2005, the most destructive hurricane season on record. The 2005 season included 28 named storms, including 15 hurricanes, 7 of which were major (Category 3 or higher). Four major hurricanes made landfall along the U.S. coast. Combined, they caused an estimated \$170 billion in damage and approximately 2,000 deaths. Hurricane Katrina alone, which came ashore as an extremely large Category 3 storm and ranks as the costliest U.S. storm on record, caused roughly \$134 billion in damage and 1,833 fatalities. The effects of all of these storms, as well as the devastating storms of 2008, are still being felt, and will be for years to come as coastal communities struggle to rebuild their infrastructure, and people displaced by the storm struggle to rebuild their lives.

Winter storms can also produce rough seas, coastal flooding, and beach erosion. Nor'easters along the east coast, which are most frequent and strongest between September and April, typically account for more cumulative damage than hurricanes because they occur more frequently and may last for several days. Strong winter storms are also responsible for significant land losses in the Gulf and around the Great Lakes. Along the Pacific coast, most beach erosion and land loss can be attributed to winter storms and unusual oceanographic conditions such as El Niño, which occurs every four to five years and has a significant effect on weather patterns, sea levels, and ocean currents.

Flooding

Flooding causes more damage in the United States than any other severe weather related event. Flooding can occur in any of the U.S. states or territories at any time of the year.

Flooding may result from a coastal storm, tsunami, dam break, or a heavy precipitation event. Flood damages in the United States continue to escalate. From the early 1900s to 2000, flood damage in the United States has increased six fold, approaching \$6 billion annually. This occurred despite billions of dollars for structural flood control and other structural and nonstructural measures. However, development continues to intensify within flood-prone and marginal areas. Over the years, floodplain managers have become more aware of the benefits of protecting the natural functions of floodplains. Protecting floodplains preserves the natural functions of ecosystems and also helps prevent loss of life and property from damaging floods.

Tsunamis

Tsunamis are a threat to life and property to anyone and anything living near the ocean. The coasts and inland waters of California, Oregon, Washington, Alaska, Hawaii, the Pacific territories, Puerto Rico, and the Virgin Islands are most at risk among U.S. coastal states, but the Atlantic and Gulf Coasts are not immune.

A series of ocean waves generated by a rapid large-scale disturbance of the sea water, tsunamis do not have a season and do not occur regularly or frequently. Most tsunamis are generated by earthquakes, but may also be caused by volcanic eruptions, landslides, undersea slumps, or meteor impacts. Tsunami waves radiate outward in all directions from the disturbance and can move across entire ocean basins. A tsunami typically causes the most severe damage and casualties close to its source, where local populations may have little time to react before the waves arrive.

Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface. This loss in elevation can cause damage but, importantly, it increases the dangers posed by flooding and [sea level rise](#). Subsidence occurs naturally and as a result of human activities. Principal causes include groundwater removal, drainage of organic soils, underground mining, natural compaction, and thawing permafrost.

Texas and Florida are experiencing subsidence related to the removal of groundwater, and subsidence due to oil and gas removal has cost millions in damage and remedial costs in California. Loading of the modern Mississippi River delta, sediment compaction, faulting, and human activities are the main cause of subsidence in the Gulf states.