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Coastal Erosion and the United States National Flood Insurance Program

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ABSTRACT

Coastal erosion and its impact on the National Flood Insurance Program (NFIP) as well as the economic viability and environmental integrity of coastal communities is a major concern of the United States. Homes along the U.S. Atlantic and Gulf coasts face a risk from erosion that is comparable to that of coastal flooding. However, the NFIP does not currently map erosion hazard areas and therefore is unable to inform homeowners of the risk to their property. Hence, insurance rates do not reflect the magnitude of the erosion risk.

The Federal Emergency Management Agency (FEMA) that is in charge of the National Flood Insurance Program should develop erosion hazard maps and make them widely available to the public, but the U. S. Congress has not mandated such an action because the political will is lacking. Coastal realtors are not in favor of such erosion maps because they would have to be revealed to prospective property buyers. The U. S. Congress should require FEMA to include the cost of expected erosion losses when setting flood insurance rates along the coast. Beachfront property owners are opposed to such an action as they have not been paying insurance rates that reflect the combined hazards of coastal floods and erosion. The National Flood Insurance Program continues to experience large deficits in the billions of dollars, which must be borne by the taxpayers—this amounts to a subsidy for coastal homeowners as the program has not been actuarially sound.

1. Introduction

There is a coastward migration of the population; it seems that everyone wants a waterfront view. Beachfront property has become some of the most expensive real estate in the United States of America. At the same time, sea level rise is causing progressive beach erosion, and hurricane landfalls along the U.S. East and Gulf Coasts are generally billion-dollar events or much higher.

The heightened hurricane activity in recent years has been attributed to both the Atlantic Multi-Decadal Oscillation (AMO) and to global warming. Increased activity since 1995 appears to be linked to the AMO, but global warming has the potential to make hurricanes more powerful (Mann and Emanuel, 2006). This increased activity and the tremendous amount of coastal construction have resulted in greatly increased storm damage over time. For example, Hurricane Wilma in 2005, a category 2 hurricane, resulted in $30 billion in losses to Florida residents. Hurricane Katrina also in 2005 caused the most destruction at $125 billion, largely because the levees protecting New Orleans were poorly constructed and were undermined by the storm surge (Washington Post, 2005).

Sea level rise is a significant driver of beach erosion; the rate of erosion is two orders of magnitude greater than the rate of sea level rise so that even small changes in sea level result in significant beach loss along the U. S. Atlantic and Gulf Coasts (Leatherman et al., 2000). While the rate of sea level rise during the 20th century was fairly low, estimated at 0.2 cm per year (Douglas, 1991), satellite altimeter data indicates that the rate may have accelerated in recent decades (Church and White, 2006; Cazenave et al., 2014). The rate of sea level rise will likely continue to rise in coming decades, causing progressive erosion, threatening more valuable beachfront properties and making it far more expensive and difficult to arrest this erosion. High-rise, waterfront condominiums are approaching $500 million valuations, and the “Gold Coast” of Florida from Palm Beach to Miami has an appraised value exceeding $1.3 trillion. Total insured property values for coastal states exceeds $10 trillion (Insurance Journal, 2013).

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Reducing coastal risk and increasing resiliency is a difficult proposition. Beach nourishment is seen as the panacea, but it is expensive, has to repeated fairly often in most areas, and does not work everywhere (Davison et al., 1992). Armoring with seawalls can stabilize the shore, but at the expense of the beach, which is the draw for tourists and hence the economic engine for most coastal communities. There is a counter argument made by Basco et al. (1997) that seawalls do not reduce sand volume as determined from a five-year study at Sandbridge, Virginia. Griggs et al. (1994) pointed out that seawalls might not produce active beach erosion through wave reflection, but surely result in passive loss of dry beach along eroding shores without beach nourishment. These assertions are well summarized by Wiegel (2002).

The National Flood Insurance Program of FEMA has provided a measure of coastal protection by providing incentives for new homes to be elevated above surge levels and to strengthen buildings against windstorm damage. Unfortunately, there has been no provision to deal with shoreline recession that is presently occurring, nor accommodate the accelerating pace of sea level rise, beach erosion, and likelihood of more intense hurricanes.

2. Coastal erosion management

Approximately 80%–90% of the sandy beaches along the U.S. Atlantic and Gulf coasts are experiencing erosion with rates averaging 0.6 m per year (Heinz Center, 2000); the well-studied coast from Long Island, New York to South Carolina (Fig. 1) illustrates the magnitude of the problem. While many factors contribute to shoreline recession, sea-level rise is the underlying factor accounting for nearly ubiquitous coastal retreat (Leatherman et al., 2000). This land loss has enormous economic impacts because some of the most expensive real estate in the United States are beachfront properties; examples include Atlantic City, New Jersey, Ocean City, Maryland (Fig. 2), Myrtle Beach, South Carolina, Miami Beach, Florida, and Galveston, Texas to name just a few of the cities on the beach.

Hurricanes are historically known to force retreat because a catastrophe is sometimes necessary to convince coastal inhabitants to abandon their property, especially when totally devastated. A better approach is to anticipate a certain rate of beach loss and prohibit construction within a designated distance from the shore, but this is un-palatable to most all beachfront homeowners. Ironically, hurricane devastation can stimulate urban development because (1) developers can consolidate distressed properties and build larger structures such as condominiums, (2) hurricanes act as urban renewal agents and create modern, desirable urban infrastructure, and (3) a hurricane in the news puts relatively unknown coastal areas "on the map" and attracts potential coastal residents and investors.

There are three approaches to progressive erosion: retreat, hard stabilization or beach nourishment. Retreat involves moving development and infrastructure landward as coastal erosion encroaches. This is the best method along little developed coasts, but in highly developed areas, such as Miami Beach, retreat is not economically or politically viable.

Shoreline stabilization with seawalls was once a common method of responding to storms and coastal erosion. A massive concrete seawall can successfully protect the land behind it, but the beach will continue to erode and eventually be lost without sand replenishment. Beach nourishment is now considered a much better solution than hard stabilization, but it can be more expensive. Nourishment through the introduction of new sand to build wide beaches protects buildings and infrastructure from storm damage, and the recreational beach is maintained. However, beach nourishment only sets back the erosion clock, and additional sand is required over time. Therefore, large quantities of high-quality sand must be available for re-nourishment projects, and buildings and roads need to be continually raised to deal with sea level rise.

2.1. Case study: Miami Beach, Florida

Miami Beach celebrated its 100th birthday in 2016. A number of articles have been written regarding the history of this world-famous beach, especially its great comeback after the "fall from

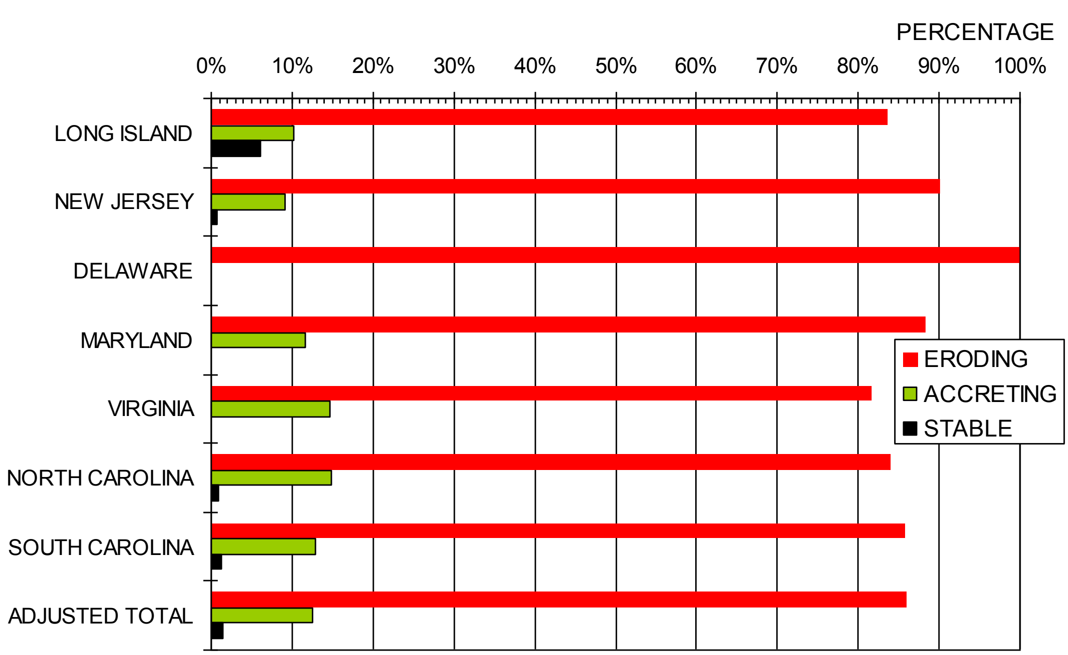

Fig. 1. Percentage of shore experiencing long-term (e.g., 100+year) erosion.

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