The importance of the U.S. coast: An in-depth look at coastal benefits and risks

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ABSTRACT

This paper highlights the importance of our coastal economy to America's economic and societal welfare, demonstrates the need to mitigate coastal risks associated with severe storms and sea level rise, and discusses lapses in federal government's efforts to redress coastal risks. As fierce storms such as Hurricane Katrina and Superstorm Sandy have demonstrated, America's coasts face substantial risks. The economic impact of coastal industry and tourism creates millions of jobs and generates billions of dollars of federal government tax revenue. Coastal communities' economic and fiscal impacts are so significant that any disturbance along the coast, even for a short period of time, could result in billions of dollars of lost income and tax revenue (Isidore 2012).

ADDITIONAL KEYWORDS: U.S. Army Corps of Engineers, superstorms, beaches, economic development, WRDA, water tesources.

For millions of Americans, ocean beaches have a special allure. We seek them out for their beauty, the sound of waves lapping against the shore, and for their peacefulness. While millions of Americans either vacation or reside in the country's coastal communities, the national economic importance of these areas is often overlooked. Coastal America generates nearly half of the country's annual gross domestic product and provides a significant source of government revenue and jobs in various industries. However, coastal businesses, infrastructure, and communities are increasingly exposed to greater coastal storm and flood vulnerabilities. Hurricanes, tropical storms, and sea level rise are significant threats to coastal communities' economic and societal epicenters, potentially hampering the vitality of the U.S. coastline.

Simple maintenance of water infrastructure through the use of a suite of measures, such as periodic beach nourishments and nature-based initiatives, will greatly reduce coastal vulnerabilities. In the event of a storm, well nourished beaches and tall dunes can mitigate wave attack and abate storm surges. With that said, the U.S. government has been unable and, in many cases, unwilling to adequately plan and fund coastal risk reduction measures, leaving these valuable areas vulnerable to adverse weather and sea level rise. Accordingly, renewed emphasis on protecting our nation's coasts is essential in order to enhance coastal resilience, maintain the U.S.'s economic vitality, and protect millions of Americans' lives.

POPULATION DENSITY AT THE COAST

Since a tremendous proportion of the U.S. populace resides in coastal communities, it is essential that these citizens' lives, property, and welfare are adequately protected. Out of the 313 million people who called the U.S. home in 2010, 39% (or 123.3 million people) live in counties directly along the U.S. coastline (NOAA 2013c). This means that more than one-third of the U.S. population is living on less than 10% of the country's land mass.

Coastal population growth, which has substantially outpaced the national average by as much as 89 persons per-square-mile throughout the last 40 years, is not expected to slow down. This escalating migration has increased coastal communities' average density by an additional 446 persons per-square-mile over this time period (NOAA 2013c). The United States as a whole only experienced an increase of 36 persons per square mile over the last 40 years, for a total average population density of 105 persons per-square-mile at the time of writing (NOAA 2013b). The National Oceanic and Atmospheric Administration (NOAA) predicts that coastal shoreline counties will add 10 million persons by 2020 (NOAA 2013c). Both the growth and density of population in these coastal areas increases American citizens' risk of harm from storms, sea level rise, tsunamis, and other natural events.

THE COASTAL ECONOMY

The coastal economy is one of the most significant contributors to the U.S. gross domestic product (GDP). In 2011, coastal shoreline counties generated 45% (or $6.6 trillion) of America's GDP. Comparatively, these counties only trail the U.S and China in total economic output. Moreover, coastal communities support 51 million American jobs that foster more than $2.8 trillion in wages annually (NOAA 2013d).

The federal government accrues a substantial amount of tax revenue from America's coasts. Considering that America's average yearly salary in 2011 was $42,900 (Social Security Administration n.d.), we estimate that the federal government collects at least $344.4 billion in tax revenues from coastal shore-

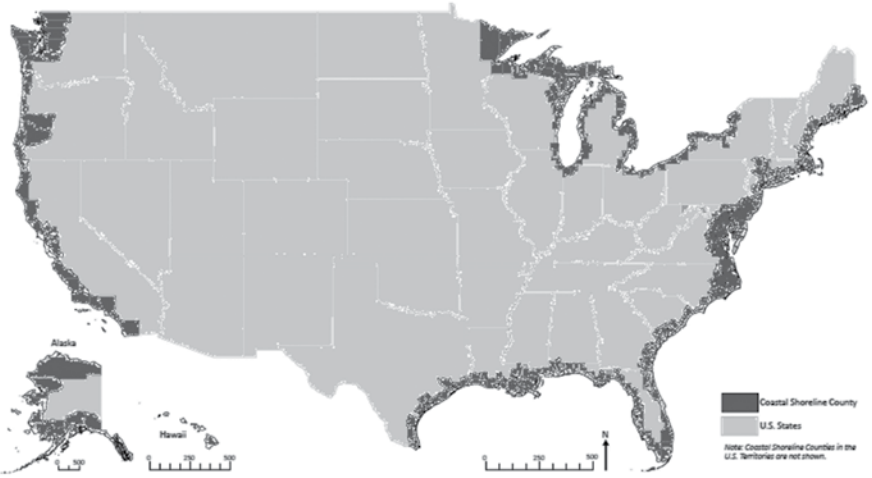

Figure 1. The coastal shoreline counties in the United States. Source: NOAA.

line counties every year. Yet, as almost half of U.S. households along the coast make $100,000 or more a year, actual tax revenue from wages earned within the coastal regions is likely to be substantially higher (NOAA 2013b).

INDUSTRIES ALONG THE COAST

Ports

The U.S. seaport system, consisting of 360 ports, is responsible for receiving, processing, and shipping over two billion tons of cargo annually, which is the equivalent of roughly $3.8 billion worth of imports and exports daily. There is an average of 15 seaports handling each of the 50 state's import and export needs. By 2020, the coastal port system, which currently supports 13 million American jobs and $650 billion in personal income, will need to handle nearly twice as much cargo as in 2001 (American Association of Port Authorities 2013) However, without the deepening of East Coast ports and significant improvements of the nation's infrastructure and intra-coastal waterways, our aging port system will not be able to handle such a dramatic rise in use and may lose traffic to ports in Canada or elsewhere.

Energy

The U.S. energy industry, which also relies heavily on the coast for transporting raw materials and refining energy resources, is expected to increase its dependency on the coast as domestic energy demand continues to rise. Currently 56% of all energy production comes from coastal states, with more than 25% of crude oil production originating in coastal waters (NOAA 2013a). In order for the U.S. to meet current and future energy demands, coastal energy facilities must remain operational. The U.S. coast, which is prime real estate for much of the nation's crude oil and liquid natural gas receiving, processing, and refining systems suffered severe damage and interruptions in the wake of both Hurricanes Katrina and Rita. These storms temporarily shut down 25% of U.S. crude oil production and 20% of natural gas output. At one point, about one-third of the nation's refining capacity was closed. Without implementing effective measures to increase the resiliency of coastal areas, a substantial portion of the nation's energy infrastructure will remain vulnerable to the risks of natural disasters.

Tourism

Tourism is the nation's third largest contributor to annual GDP, with the coast being the top-rated tourist destination among domestic and international travelers (Houston 2013). In 2010, almost half of all Americans owned or rented a vacation home in a coastal shoreline county (NOAA 2013b). It is estimated that coastal states annually receive roughly 85% of all tourist-related revenues in the U.S. In fact, coastal tourism is responsible for contributing hundreds of billions of dollars to both the shoreline states and the U.S. economy as a whole. A study conducted in 1998 found that beach tourism alone contributed $225 billion (in 2012 dollars) to the national economy (Houston 2013). Yet without a more concentrated effort on coastal resilience and sustainability by the federal government, the U.S. risks losing much of this crucial tax revenue. Furthermore, state and local governments that rely on hotels, restaurants, banks, and medical facilities tax revenues could suffer devastating tax revenue decreases should a severe storm impact or tsunami occur.

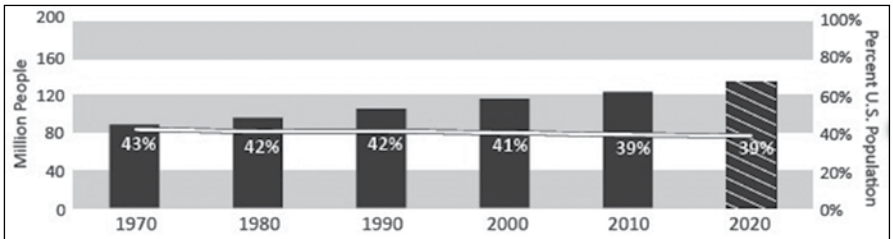

Figure 2. The population change in coastal shoreline counties over time. Source: NOAA.

COASTAL RISKS

Hurricanes pose a substantial risk to the citizens, industries, and infrastructure along America's coasts. A recent study of the most expensive weather disasters in America found that, of the Top 10 costliest natural disasters on record, seven were hurricanes. Six of these seven hurricanes occurred in the last 10 years (Emerson 2011). Since hurricanes and other severe tropical storms typically cause the most damage in low-lying coastal areas with high population densities, the effects of a relatively modest Category 2 storm can become greatly amplified. Today, as more high-value property and new businesses are located on U.S. coasts, the costs of disaster relief following a hurricane or flood (or both) will continue to grow.

Superstorm Sandy was the second costliest storm in U.S. history, with an estimated price tag of $65 billion (Rice 2013). The damages from the storm have captured how vulnerable our coastal regions have become. As of 2010, 16.4 million Americans, or 5% of the U.S. population, resided in flood-prone coastal areas as defined by the National Flood Insurance Program. Considering the 6-24 inches of sea level rise and natural coastal erosion rates projected within the next century, coastal shoreline counties will continually become more vulnerable to massive flooding and storm damages (NOAA 2013e). To account for these factors, the Federal Emergency Management Agency (FEMA) is currently redrawing

its floodplain maps. These changes will place more homes and businesses in areas that are officially determined to be at risk. There will be painfully higher flood insurance payments to pay, but there also will be an incentive for communities to reduce the premiums of residents by taking concrete measures that will reduce risks to the loss of property.

RISK REDUCTION

One of the most effective ways to protect coastal areas from flooding and storm damages is to implement shoreline protection projects. Through the U.S. Army Corps of Engineers' (Corps) Civil Works program, the Corps, partnering with state and local governments, restores wetlands and constructs and periodically nourishes sandy shorelines. The effectiveness of these restoration projects has been demonstrated numerous times, most recently during Superstorm Sandy. The "Hurricane Sandy Coastal Projects Performance Evaluation Study" confirms that the Corps-engineered shoreline protection measures protected communities from flood inundation. For those communities not protected by wide beaches and tall dunes, the report finds that these areas suffered far greater damage and loss of life (Assistant Secretary of the Army for Civil Works 2013).

CURRENT GOVERNMENT POLICY

For decades, Congress has chosen to authorize the planning and funding of each individual Corps project, whether for coastal protection, inland flood control, or the maintenance of ports and waterways. The Water Resources Development Act (WRDA) is the primary legislative vehicle that can be used for that purpose (113th Congress 2014).

WRDA bills have become increasingly infrequent, inhibiting the federal government from actively and effectively mitigating coastal vulnerabilities. Prior to 2000, WRDA bills were traditionally enacted every two years. Unfortunately, Congress has been unable to pass WRDA bills with any sort of consistent or frequency. Until this year, the most recent WRDA legislation enacted into law was in 2000 and 2007.

In just 40 years: 1970-2010

Coastal shoreline counties added **125** persons/mi^2
Coastal watershed counties added **99** persons/mi^2
United States as a whole added **36** persons/mi^2

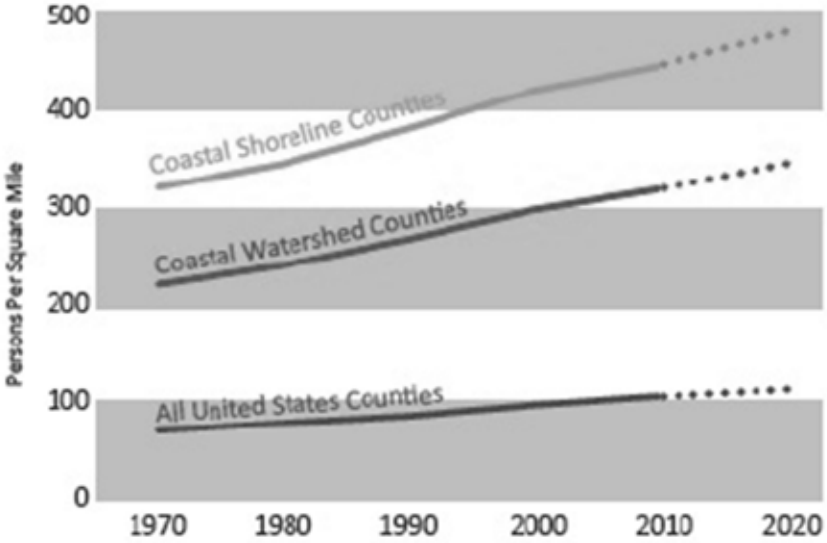

Figure 3. Population density trends in United States counties over time. Source: NOAA.

Figure 4. The differences in economic production that is seen in coastal shoreline counties. Source: NOAA.

Figure 5. The various ports and their capacities in the United States. Source: U.S. Army Corps of Engineers.

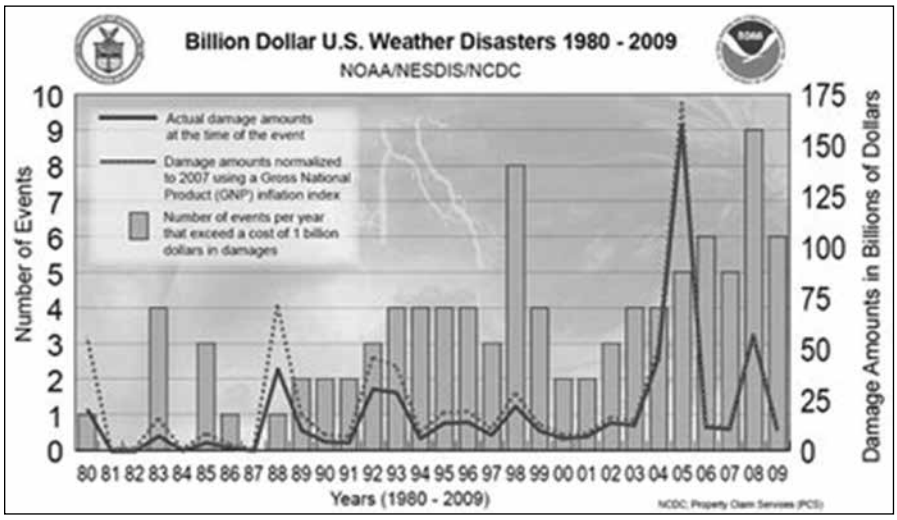

Figure 6. The number of billion-dollar weather disasters in the United States between 1980 and 2009. Source: National Climatic Data Center.

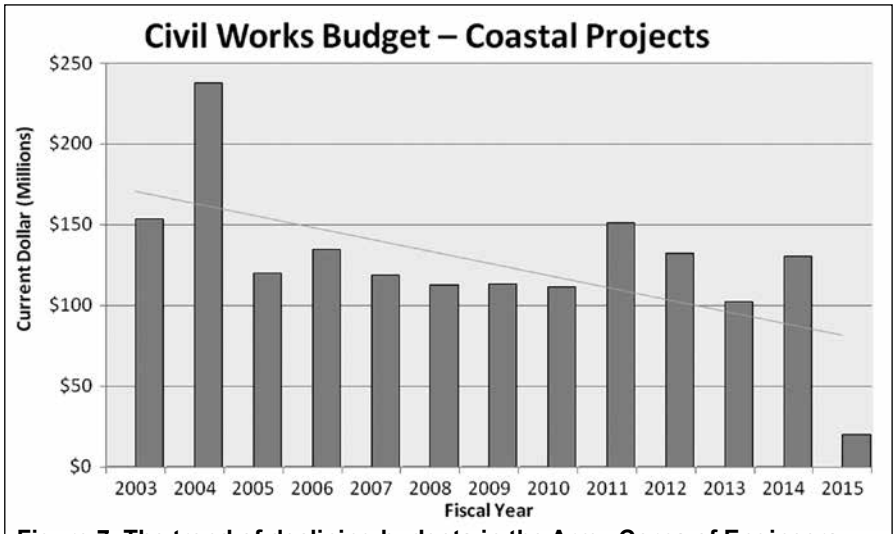

Figure 7. The trend of declining budgets in the Army Corps of Engineers between 2003 and 2014 (2015 figures are only proposed funding levels).

Earlier this year, Congress passed the Water Resources Reform and Development Act. Coming another seven years behind the last WRDA legislation, the bill authorizes new projects and directs the Corps to implement policies that are not in accordance with forward-looking regional approaches to water resource systems. Inconsistent WRDAs filled with individual projects but lacking more efficient and effective regional approaches to water resource project planning, delivery, and funding will neither adequately address the nation's water resources needs nor provide the states with the opportunity to partner with the Corps in order to promote regional resiliency.

Even when authorized, some shoreline protection projects are never implemented or renourished because of inadequate federal government funding. Indeed, the amount of federal funding for coastal storm protection projects is now less than $100 million a year, which is merely one-fourth of the funding required to construct and maintain the projects authorized by Congress (Figure 7) (Houston 2013). Moreover, the inability for Congress to routinely pass a federal budget has made water resource allocation inconsistent, severely undermining the Corps' ability to plan for future projects. Due to the immense build-up of unfinished coastal water resource projects over the years and a long history of unreliable federal funding for such programs, there is now a significant need for the government to develop alternative financing mechanisms

for these water resource projects. In doing so, the Corps can continue protecting the coast and the nation as a whole.

CONCLUSIONS

As the nation's coastal economy and population continue to grow, our coastal shoreline communities will become more vulnerable to the various risks associated with the coast: storms, sea level rise, and erosion, just to name a few. Since the coast is a substantial driving force behind the nation's economic wellbeing, these dangers will not only impact the 39% of U.S. citizens living along the coast (NOAA 2013c), but will also have a far-reaching impact on the nation as a whole. At a time in the nation's history where almost every discretionary dollar is extensively debated and Corps appropriations continue to diminish, changes must be made to ensure the continued funding of the various methods that protect this country's 95,000 miles of coastline. Making significant changes to the policies that dictate how water resource projects are planned, prioritized and implemented, such as instituting a regional project approach and developing alternative means to fund and finance water resource projects, will not only allocate federal dollars more efficiently, but will also have a positive impact on the effectiveness of these coastal water infrastructure systems in protecting the nation. As we have shown, due to the United States' overwhelming dependence on merely 10% of the country's land mass, the federal government must promptly and effectively act in order to preserve one of the nation's most important and at risk resources — the coast.

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