

CHAPTER 1: Overview of the Coastal Barrier Resources System

Coastal barriers, the narrow low lying landforms located at the interface of land and sea, buffer the bays, salt marshes, and wetlands behind them that in turn support a great diversity of plants and animals, including many threatened or endangered species, and protect people and property on the mainland from the full impact of hurricane winds and storm surge. Coastal barriers are continually shifting in response to the natural forces of wind, wave, and tidal action. The location and dynamic nature of coastal barriers makes them hazardous areas on which to build. Development of these areas not only puts property owners at risk of losing their homes but also disrupts the natural movement of the barriers, harming fish and wildlife habitat, and often increasing natural erosion processes. Maintaining the beneficial functions of coastal barriers as fish and wildlife habitat and natural storm buffers will be even more important as the Nation experiences and prepares for increased flooding and erosion associated with climate change impacts due to increases in sea level rise, storm surge, and more intense and frequent coastal storms throughout the 21st century and beyond.¹ Updating the maps through this Digital Mapping Pilot Project (pilot project) and other comprehensive mapping projects will help secure the future integrity of the Coastal Barrier Resources System (CBRS) by correcting legitimate technical mapping errors and adding eligible areas to the CBRS.

Geomorphology of Coastal Barriers

The term “coastal barrier” generally describes a class of low lying coastal landforms that are long and narrow and parallel to the coast. They are completely or mostly surrounded by open water, wetlands, or other

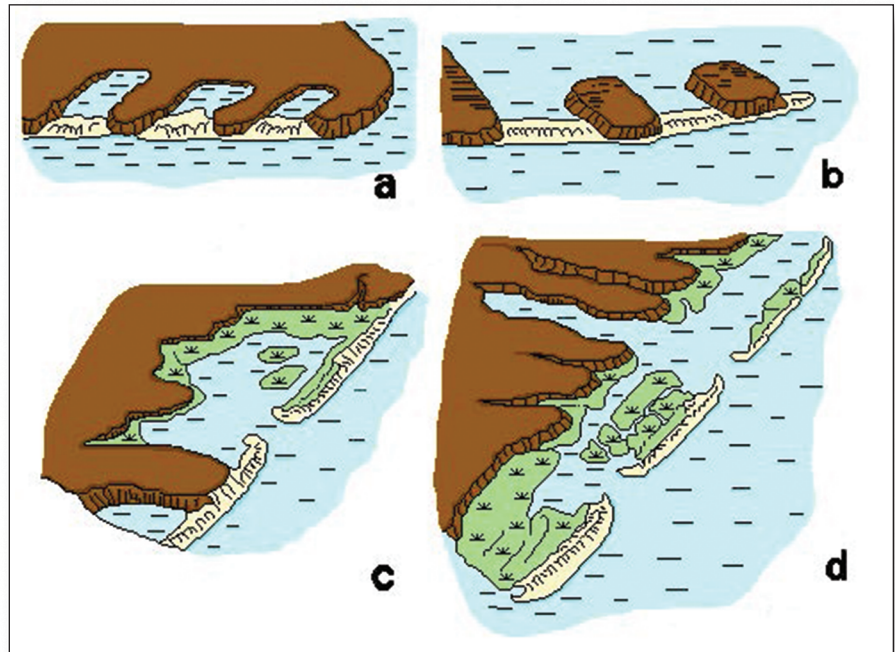


Figure 1. Types of coastal barriers. Bay barriers (a), tombolos (b), barrier spits (c), and barrier islands (d).

aquatic habitat that separates them from the mainland; and they protect these landward aquatic habitats from direct wave attack. Often, substantial portions are sufficiently above normal high tides that dunes and terrestrial vegetation are prevalent. Most coastal barriers are comprised of unconsolidated sediments (e.g., sand and gravel). Figure 1 illustrates the four common categories of coastal barriers, including bay barriers, tombolos, barrier spits, and barrier islands. Bay barriers have grown entirely across the mouth of a bay. Tombolos are formed when sand accumulates between the mainland and an island. Barrier spits extend into open water. Barrier islands are detached from the mainland. Coastal barriers are dynamic landforms that can, and often do, change position in response to storms, sea level rise, currents, and numerous other factors. The Coastal Barrier Resources Act (CBRA) definition of a coastal

barrier includes all associated aquatic habitats, encompassing the adjacent wetlands, marshes, estuaries, inlets, and nearshore waters.² The statutory definition is consistent with the fact that the upland component and the associated aquatic habitat are inseparable parts of a single coastal barrier ecosystem.

Costs and Risks Associated with the Development of Coastal Barriers

Coastal barriers serve as popular vacation and recreation destinations, though developing and redeveloping these vulnerable and often unstable areas is costly, not only to the American taxpayers who subsidize the development, but to the property owners who risk losing their homes and lives. Development also interferes with the natural movement of the barriers, disturbing important habitat for nesting sea turtles, migratory birds,

and other fish and wildlife resources. Despite the risks associated with building on narrow spits of sand, the aesthetic and recreational lures of coastal barriers continue to drive the development of these areas along our Nation's coasts. In many cases, this development is enabled by the availability of various types of Federal financial assistance, including Federal flood insurance.

The Federal Government spends hundreds of millions of dollars each year on insurance payouts for homes located in high-risk coastal floodplains, pumping sand back onto eroding beaches, and armoring the shoreline to protect coastal development from the naturally occurring processes that continually change the coastal barrier profile. Such expenditures are further exacerbated following major storms. Flood insurance claims paid by the

Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) following Hurricanes Katrina, Wilma, and Rita in 2005 totaled about \$17.7 billion.³ Since then, the Atlantic and Gulf of Mexico coasts have experienced Hurricanes Ike, Irene, and Sandy, which were among the costliest hurricanes in U.S. history.⁴ Congress appropriated approximately \$50 billion to Federal agencies for Hurricane Sandy response and recovery efforts.⁵ The U.S. Army Corps of Engineers alone received more than \$3.4 billion for construction activities along the North Atlantic coast following Hurricane Sandy.⁶

Effects of Climate Change on the Coastal Environment

The Intergovernmental Panel on Climate Change (IPCC) states that

“the population and assets exposed to coastal risks as well as human pressures on coastal ecosystems will increase significantly in the coming decades due to population growth, economic development, and urbanization.”⁷ In the U.S., sea level rise coupled with storm surges, and other climate-related changes, pose increasing risks to coastal water supplies, energy infrastructure, transportation including evacuation routes, tourism, commercial and recreational activities, and wetlands and other ecosystems and the many services they provide.⁸ At a global scale, the average rise in sea level has been approximately eight inches since recordkeeping began in the late 1800s, the rate of increase has been accelerating in recent years, and increases in sea level are expected to continue well beyond this century.⁹ Changes in sea level vary regionally, and the increase has been greater



Figure 2. Coastal flooding in Rodanthe, North Carolina after Hurricane Isabel in 2003. (Credit: Hillary Stockdon/USGS).

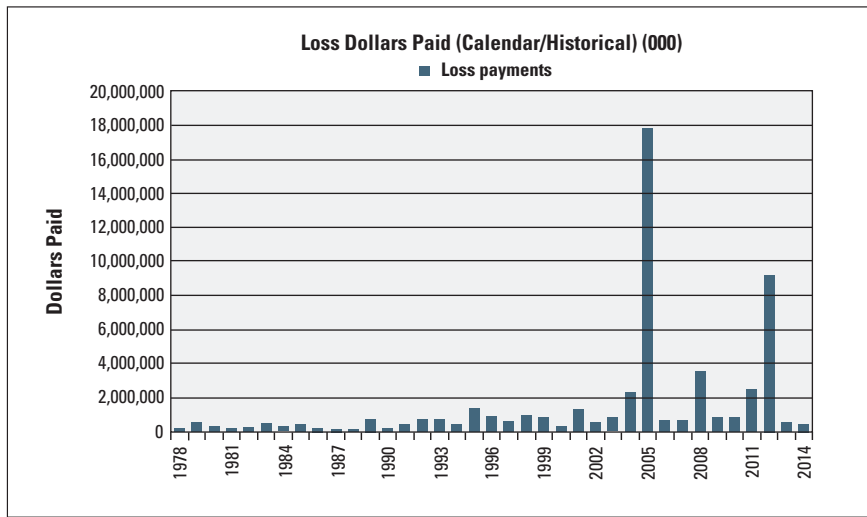


Figure 3. Historical loss dollars paid by the National Flood Insurance Program by year through 2014. (Credit: FEMA).

in U.S. coastal areas. The Third National Climate Assessment notes that at a global level the projected rise in average sea level is another one to four feet in this century, although the change in specific regions will vary from this global average. Storm surges that occur on top of higher sea levels are already having substantial impacts. A recent scientific study based on mid-range climate sensitivity scenarios has estimated that national economic impacts of storm surge and sea level rise will be about \$990 billion through 2100. Eastern coastal areas (particularly the mid-Atlantic and Southeast) and the Gulf Coast are especially vulnerable to sea level rise, and the mid-Atlantic coast has been identified as a “hotspot” of accelerated sea level rise.¹⁰

One of the many consequences of climate change is increased flooding and related flood damage. When storm surge is considered in conjunction with sea level rise, the flood hazard on the East Coast is projected to increase substantially over the 21st century.¹¹ Similarly, the East and Gulf Coasts face increasing risks of flooding and related impacts due to projected increases in the co-occurrence of storm surges and rainfall.¹²

Nuisance flooding also has increased on all three U.S. coasts between 300 and 925 percent since the 1960s, according to a 2014 National Oceanic and Atmospheric

Administration (NOAA) report. One main conclusion of the report is that acceleration of sea level rise, as is projected to occur in this century, will further intensify the impacts of nuisance flooding and further reduce the time between flood events.¹³

Millions of people reside in U.S. coastal counties that are subject to the increased risk of erosion, flooding, and other effects of climate change that can cause widespread damage. According to the Third National Climate Assessment, even more people will be at risk in the

future as sea level rises, due to the expansion of the floodplain and the continued movement of people to coastal areas: “By 2100, the fraction of the U.S. population living in coastal counties is expected to increase by 50 percent (46.2 million) to 144 percent (131.2 million) ... many of these new arrivals can be expected to locate in high-hazard areas. Thus, coastal population densities, along with increasing economic development, will continue to be an important factor in the overall exposure to climate change.”¹⁴

The associated financial risks of increasing coastal populations are substantial and this has significant implications for the NFIP. The NFIP is one of the Federal Government’s largest financial obligations. As of 2014, the NFIP insured over \$1.29 trillion in assets.¹⁵ According to a 2013 report commissioned by FEMA,¹⁶ the NFIP is expected to nearly double in size by the year 2100 due to the combined effects of climate change and population growth. The report also states that “as the number of flood insurance policies increase, particularly in flood-hazard areas such as those on the coasts, the NFIP could be exposed to much larger events (with respect to losses) than similar events would have produced in prior years.”



Figure 4. A home in the surf on the Outer Banks, North Carolina. (Credit: Jonathan Phinney/USFWS).



Figure 5. Nuisance flooding in Charleston, South Carolina. (Credit: NOAA).

As climate-related impacts to coastal areas have become more widely observed and the future risks become more obvious, interest has increased in adaptation measures that can avoid or reduce these impacts. This includes a growing recognition of the importance of maintaining and restoring natural coastal habitats to shield ecosystems, people, and property from the ongoing and projected increase in impacts.¹⁷

Coastal Barrier Resources Act

Building on an effort initiated by President Carter, President Reagan and Congress took action to protect undeveloped coastal barrier habitat from intensive development. The CBRA, enacted in 1982, recognized that certain actions and programs of the Federal Government have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources, threats to human life, health and property, and the expenditure of millions of tax dollars each year. The CBRA seeks to save taxpayers' money, keep people out of harm's way, and remove Federal incentives to develop coastal barriers by restricting most new Federal expenditures and financial assistance (e.g., beach nourishment, disaster assistance, flood insurance, loans, and grants) for areas designated within the CBRS. The CBRA does not prohibit or regulate development;

however, it removes the Federal incentives to build on these unstable and environmentally sensitive areas. Development can still occur provided that private developers or other non-Federal parties bear the full cost.

In 1990, Congress enacted the Coastal Barrier Improvement Act (CBIA) which expanded the CBRS by adding new units, enlarging some previously designated units, and adding "Otherwise Protected Areas" (OPAs) as a second type of unit within the CBRS. "System Units" are generally comprised of privately held areas, whereas OPAs are generally comprised of areas held for wildlife refuge, sanctuary, recreational, or natural resource conservation purposes (e.g., State parks, wildlife refuges, private conservation areas, etc.). Most new Federal expenditures and financial assistance are prohibited within System Units, whereas the only Federal funding prohibition within OPAs is on Federal flood insurance. The CBRA was again reauthorized in 2000 and 2006, demonstrating consistent bipartisan support for the law across decades.

The CBRS currently contains a total of 859 geographic units covering about 3.3 million acres (400,000 acres of fastland (land above mean high tide), 2.9 million acres of associated aquatic habitat (wetlands and open water) and approximately

2,500 shoreline miles in 23 States and territories along the Atlantic, Gulf of Mexico, Great Lakes, U.S. Virgin Islands, and Puerto Rico coasts. Of the total units within the CBRS, 585 are System Units (comprising about 1.3 million acres) and 274 are OPAs (comprising about 2 million acres). The CBRS units are depicted on a set of maps that is maintained by the Secretary of the Interior (Secretary), through the U.S. Fish and Wildlife Service (Service, we, our).

The Secretary, through the Service, is responsible for administering the CBRA, which includes: maintaining and updating the official maps of the CBRS; consulting with Federal agencies that propose spending funds within the CBRS; and making recommendations to Congress regarding removals from and additions to the CBRS.

Value of the Coastal Barrier Resources Act

The CBRA is a proactive planning tool that can help to significantly reduce the damage caused by storms, coastal flooding, and sea level rise. According to the IPCC, "planning by coastal communities that considers the impacts of climate change reduces the risk of harm from those impacts. In particular, proactive planning reduces the need for reactive response to the damage caused by extreme events. Handling things after the fact can be

more expensive and less effective.”¹⁸ A 2007 Government Accountability Office (GAO) report¹⁹ estimated that 84 percent of CBRS units remain undeveloped and 13 percent of CBRS units had experienced only minimal levels of development since they were added to the CBRS. The CBRA, especially when combined with State and local regulations or other protection measures, has been largely successful at reducing the intensity of development along our coasts. A 2002 Service economic study²⁰ estimated that between 1983 and 2010, the CBRA would save taxpayers an estimated \$1.3 billion from avoided Federal spending for roads, wastewater systems and potable water supply, and disaster relief, and will continue to save millions more in the future. This figure would have been even higher if additional Federal programs had been included in the assessment.

Map Modernization Efforts

The CBRA is a map-based law, and the official CBRS maps were last comprehensively updated more than 25 years ago with the CBIA of 1990.²¹ The CBRS maps from the 1990s are technologically outdated and in some cases difficult to interpret.²² The CBRS boundaries on those maps do not align precisely with the features they were intended to follow on-the-ground (e.g., shorelines, roads, park boundaries, etc.). As a result, some properties and projects intended to be eligible for Federal subsidies are not eligible, and vice versa. These errors can have an adverse financial effect on property owners and project proponents.

Aside from three minor exceptions, only Congress, through new legislation, can modify the boundaries of the CBRS. These exceptions are: (1) voluntary additions to the CBRS by the owners of undeveloped coastal barrier property;²³ (2) additions of excess Federal property, if such property is determined by the Secretary to constitute an undeveloped coastal barrier;²⁴ and (3) modifications to the CBRS made by the Secretary at least once every five years to account for changes to coastal barriers as a result of natural forces.²⁵ Neither the Service, nor the Department of the Interior (Department or DOI), is authorized to make any other boundary changes administratively, but may make recommendations to Congress. When technical mapping errors have been found, the Service has supported legislation to modify boundaries accordingly.

Congress recognized the challenges associated with the existing maps and took action to address them with the 2000 Coastal Barrier Resources Reauthorization Act (2000 CBRRA),²⁶ which directed the Secretary to conduct the pilot project by remapping 50-75 CBRS areas (representing about ten percent of the CBRS) using digital technology and preparing an accompanying report to Congress that describes the feasibility and cost of creating digital maps for the entire CBRS.²⁷ The 2006 Coastal Barrier Resources Reauthorization Act (2006 CBRRA)²⁸ directs the Secretary to finalize the pilot project, prepare digital maps for the remainder of the CBRS, and provide recommendations

for expansion of the CBRS.²⁹ The GAO and the Federal Interagency Floodplain Management Task Force³⁰ have also recommended updating and modernizing the maps.

In 2008, the Service submitted its *Report to Congress: John H. Chafee Coastal Barrier Resources System Digital Mapping Pilot Project* and accompanying draft maps for 70 CBRS units (located in Delaware, Florida, Louisiana, North Carolina, and South Carolina) to Congress. In 2009, we conducted a public review of the report and draft maps. Since the publication of the initial 2008 report, six units have been removed from the pilot project and one unit has been added, resulting in a total of 65 units in the pilot project at this time.³¹ Forty-one of the total pilot project units are System Units and 24 are OPAs.

Currently, the Service has two map modernization efforts underway: (1) “digital conversion,” which produces modernized maps that have very limited changes and can be adopted administratively (changes are limited to those authorized under 16 U.S.C. 3503(c)-(e)) and (2) “comprehensive map modernization,” which produces revised maps (such as those created through the pilot project) that contain more significant changes and must be adopted by Congress through legislation to become effective. These two mapping efforts and the benefits of each are discussed in more detail in Chapter 2.

¹ Global sea level rise already is occurring and, combined with storm surges, is anticipated to have an increasingly significant impact on coastal and low-lying areas due to more frequent and severe flooding and erosion, as well as impacts to many species of fish, wildlife and plants (IPCC 2014). Many coastal areas of the U.S. are at increasing risk. The east coast of the U.S. is considered to be particularly vulnerable to sea level rise and related impacts (Moser et al. 2014; Carson et al. 2016). The Third National Climate Assessment noted that in the mid-Atlantic region of the U.S. coast, sea level rise and related flooding and erosion threaten coastal homes, infrastructure, ports and other commercial development; the Assessment also raised concern about the potential for profound and in some cases irreversible impacts to coastal ecosystems and associated species (Moser et al. 2014). The highest projected change in sea level rise in populated areas of the world is along the east coast of the U.S. (Carson et al. 2016).

² 16 U.S.C. 3502(1)(B)

³ FEMA Significant Flood Events, 2016. <https://www.fema.gov/significant-flood-events>

⁴ As of December 31, 2015, flood insurance claims paid by the NFIP totaled about \$2.7 billion for Hurricane Ike, \$1.3 billion for Hurricane Irene, and \$8.1 billion for Hurricane Sandy. <https://www.fema.gov/significant-flood-events>

⁵ GAO. Report to Congressional Committees: High Risk Series, an Update. Publication No. GAO-13-283. February 2013.

⁶ Disaster Relief Appropriations Act of 2013. Chapter 4 of Pub. L. 113-2.

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- ⁷ IPCC 2014, pg. 67
- ⁸ Moser et al. 2014
- ⁹ Walsh et al. 2014
- ¹⁰ Moser et al. 2014, Walsh et al. 2014
- ¹¹ Little et al. 2015
- ¹² Wahl et al. 2015
- ¹³ Nuisance flooding is considered an inconvenience to the public and can compromise essential infrastructure (e.g., road closures). Sea level rise has contributed to more frequent nuisance flooding that no longer requires a strong storm or hurricane to produce flooding; in some areas, flooding is now a direct effect of high tide. The top U.S. cities that have experienced an increase in nuisance flooding are located on the East Coast. The impacts of sea level rise along our coasts will become more prevalent and severe over the next several decades (NOAA 2014).
- ¹⁴ Moser et al. 2014
- ¹⁵ FEMA Total Coverage by Calendar Year, 2015. <https://www.fema.gov/total-coverage-calendar-year>
- ¹⁶ AECOM. 2013. The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100.
- ¹⁷ For example, see Arkema et al. 2013.
- ¹⁸ Wong et al. 2014 (Chapter 5, Coastal Systems and Low-Lying Areas, in the IPCC report Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects).
- ¹⁹ GAO. 2007. Coastal Barrier Resources System: Status of Development that has Occurred and Financial Assistance Provided by Federal Agencies. Washington, D.C.
- ²⁰ USFWS. 2002. The Coastal Barrier Resources Act: Harnessing the Power of Market Forces to Conserve America's Coasts and Save Taxpayers' Money. Arlington, VA.
- ²¹ Pub. L. 101-591
- ²² USFWS. 2008. Chapter 2, Need for Map Modernization In Report to Congress: John H. Chafee Coastal Barrier Resources System Digital Mapping Pilot Project. Arlington, VA.
- ²³ The CBRA authorizes the Secretary to add a parcel of real property to the CBRS if: (1) the owner of the parcel requests, in writing, that the Secretary add the parcel to the CBRS and (2) the parcel is an undeveloped coastal barrier (16 U.S.C. 3503(d)).
- ²⁴ The CBRA authorizes the Secretary to add excess Federal property to the CBRS following consultation with the Administrator of the U.S. General Services Administration (GSA) and a determination that the property constitutes an undeveloped coastal barrier (16 U.S.C. 3503(e)).
- ²⁵ The CBRA requires the Secretary to review the maps of the CBRS at least once every five years and make any minor and technical modifications to the boundaries of the CBRS as are necessary to reflect changes that have occurred in the size or location of any CBRS unit as a result of natural forces (16 U.S.C. 3503(c)). This process is known as the "five-year review."
- ²⁶ Pub. L. 106-514
- ²⁷ Section 6 of Pub. L. 106-514
- ²⁸ Pub. L. 109-226
- ²⁹ Sections 3 and 4 of Pub. L. 109-226
- ³⁰ Federal Interagency Floodplain Management Task Force. 2013. FIFM Task Force Consensus Recommendations and Actions from a Federal Floodplain Management Policy Analysis Memo. Washington, D.C.
- ³¹ Units FL-64P, L07, L08, and L09 have been removed from the pilot project because comprehensively revised maps for these areas have been adopted by Congress. The Service's proposed map for Unit FL-64P was made effective via Pub. L. 110-419 on October 15, 2008, and the Service's final recommended maps for Units L07, L08, and L09 were made effective via Pub L. 113-253 on December 18, 2014. Units FL-19 and FL-78P have been removed from the pilot project because the areas within these two units have been incorporated into existing adjacent CBRS units (Units FL-19P and FL-78, respectively). Unit NC-01P has been added to the pilot project as a new OPA because it contains areas that are currently within a System Unit (Unit NC-01) but are appropriate for reclassification to an OPA. Information concerning FL-19, FL-78P, and NC-01P can be found in the unit summaries in Appendix C.