History of Dune Management in the NPS Assigned Area of Chincoteague National Wildlife Refuge
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Prepared by the National Park Service, Assateague Island National Seashore

Dune management in the National Park Service (NPS) assigned area and Chincoteague National Wildlife Refuge (the refuge) has a long history. Prior to 1962, a sand fence was put in place down the length of the refuge to create a dune line. Over the years, the sand fence/dune line had sustained some damage, and a tremendous storm in 1962 destroyed much of it and the natural dune system. Starting in 1963, the dune fence was completely repaired and a protective dune line was created all along the entire refuge ocean front. Most of the dune construction in the southern section of Assateague Island occurred in 1965 and 1966, after damage to the dunes in 1964 from Hurricane Gladys. Although records are sketchy, portions of the constructed dunes were destroyed by storms in 1981, 1982, with Hurricane Gloria in 1985, 1989, 1991, 1992, 1993, with Hurricane Gordon in 1994, 1998, and with Hurricanes Dennis and Floyd in 1999.

For NPS, the purpose of the constructed dunes was to try to protect the recreational beach, NPS Visitor Center, bath-houses 1 and 2, other visitor use structures, and the parking lots. In the NPS assigned area, NPS tried different strategies, including planting dune grass, repairing dunes, relocating dunes and eventually rebuilding only dunes that were mandatory for protecting NPS infrastructure. As the dunes were built, overwhelmed by storms and knocked down, and then rebuilt, it became obvious to park and refuge managers that the artificial dune system failed to prevent significant facility and infrastructure damage. In addition, it was evident that the recreational beach had begun to narrow, restricting the area available for beach use, especially during high tide.

During this period, NPS began relocating facilities to try to protect them from the ocean. Prior to 1993, the Visitor Center was located in an area that is now ocean. After it was overwhelmed by the 1991 and 1992 storms, in 1993, the Visitor Center was moved to a site east and slightly south of the current traffic circle. Dunes were manipulated and reinforced to try to protect it. However, back to back nor'easters in 1998 overwhelmed and washed around the Visitor Center, and it was moved to its current location and reopened in January 2000.

The Bath-houses and parking lots were also moved or reconfigured frequently during this period. After the two 1999 hurricanes, Bathhouse 1 could not be maintained and was dismantled. Bathhouse 2 was moved prior to 1998 to a new location further west, and then damaged again in 2000. It was dismantled after the end of that season. Parking lots were frequently overwashed and then relocated on the new sand, creating a hodgepodge of facilities that were inefficient and difficult to manage. During this period, NPS did not replace dunes that were not protecting infrastructure as they were lost to storm damage, although dunes that were thought to protect buildings or parking lots were maintained or manipulated.

In the late 1990s, NPS' accumulated knowledge—gleaned from significant new research and NPS' experience at several national seashores up and down the east coast—was showing that building and maintaining artificial dunes was actually accelerating ongoing erosion, rather than protecting against it.

“A high, continuous, artificial dune designed to prevent overwash may actually exacerbate erosion of the foreshore” (Godfrey and Godfrey, 1976). This probably happens because “dunes interfere with the energy dissipation process and thus accelerate the rate of beach erosion. During extreme events a high dune becomes vertically scarped; this impenetrable barrier to storm waves forces the runoff seaward and may actually reflect the waves” (Leatherman, 1979*).*

The fate of the dunes built by NPS at Cape Hatteras offered an opportunity to learn from past mistakes. “As the beach has narrowed, high wave energy is concentrated in an increasingly steeper beach profile. Because of the resultant increased turbulence, breakers have tended to grind the beach sand into finer pieces and then wash it away. The net effect is further erosion and narrowing of the beach” (Clark, 1983). “High dunes force the entire beach system out of equilibrium and result in a new set of erosional interactions…The present artificial dune system at Cape Hatteras has initiated or accelerated beach recession rates” (Dolan, 1972). Along the Cape Hatteras artificial dune, underlying erosion, "combined with the presence of a permanent dune structure has created a situation in which high wave energy is concentrated in an increasingly restricted run-up area, resulting in a steeper beach profile, increased turbulence, and a tendency for the beach sand to be broken up into finer pieces and washed away (Dolan et al., 1973).

1994 storm showing artificial dune, sand fence, and water encroaching from both sides; Eroded artificial dunes at recreational beach after another 90s storm

NPS had also learned that the artificial dunes could narrow the existing beach. During the 1990s it was not uncommon for high tides to push beachgoers up on the dunes, with waves reaching the toe of the dune. In the case of the dune built at Cape Hatteras, three decades of interference with overwash greatly altered the shape of the beaches on the Outer Banks compared to beaches on islands further south, where there was no artificial dune. On those islands, beaches are 125 to 200 yards wide. Beaches backed by the dune, by contrast, were 30 yards wide or less, and in many places there was hardly any beach at all (Dean, 1999). At Assateague State Park, beach widths between the dune toe and the high tide line ranged from 6 m to 25 m between 1998 and 2005. Just north of Assateague State Park, on Assateague Island National Seashore, there are no maintained dunes, and the dry beach ranges from 150 m to 250 m in width.

Finally, evidence was accumulating that artificial dunes could threaten the island's stability and resistance to narrowing and breaching, a threat to Toms Cove, its fishery, and ultimately to Chincoteague Island. Dunes prevent overwash, which bring sand to the bayside (thereby supporting the creating and maintenance of salt marsh) and to an island's interior (thereby elevating the island and increasing its sand supply). "Thus, islands held in one place become lower and narrower and inherently *less* stable" (Godfrey and Godfrey, 1976). Until the NPS construction of the artificial dunes at Cape Hatteras in the 1930s, overwash routinely carried tons of sand into the islands' sound-side marshes with every storm. After the dune was built, it blocked overwash except in the most extreme weather, leaving no source of sediment to feed the back side of the islands, which also began to erode (Dean, 1999). The dune-building at Cape Hatteras "led to geomorphological and ecological changes, caused primarily through the ousting of natural washover and blow-over processes. By the 1960s beach erosion and dune scrub invasion were persistent and pernicious problems, with NPS spending an ever-increasing amount of time and money in attempts to solve them. In the 1970s a reappraisal of the dune-building policy was undertaken and it was decided to allow barrier islands to revert to their original dynamic equilibrium state" (Carter, 1988).

Artificially stabilized dunes reduce "salt-spray exposure, sand movement, and the incidence of overwash, accelerating successional trends toward the climax woody vegetation community. Woody vegetation, not being resistant to salt spray and overwash, is vulnerable to extreme storms; grasses are able to adapt. By creating and stabilizing barrier dunes, man [causes] the development of a vegetation system that will suffer extreme disruption when the dunes are breached or destroyed" (Dolan et al, 1977). Artificially constructed sand dikes (continuous dune lines as constructed on the Outer Banks during the Great Depression)…are like seawalls blocking sediment derivation and migration; creating new problems on other parts of the island including the interior" (Coastal Hazards Information Clearinghouse, 2006).

With this information in hand, and after the 1998 and 2000 storms caused the destruction of facilities and the need to relocate the Visitor Center for a third time, NPS decided to abandon its program of stabilizing some artificial dunes. At that time, and because of the persistent storms, the artificial dune line was intermittent. By 2002, after the relocation or removal of facilities, the remaining artificial dunes had been bulldozed by NPS to allow natural overwash to occur in order to increase the natural buffering capacity of the barrier island. NPS hoped that this action would slow erosion, create a wider recreational beach, and most importantly, protect Toms Cove, its fishery, and Chincoteague Island from non-natural breaching on an artificially narrowed island.

In the late 1990s, the NPS also initiated development of the moveable facilities and sustainable road and parking infrastructure that is in place today. Stationary bathhouses were replaced with moveable facilities. The Naturalist's Shack, cabanas, shower and a weather protection structure were made mobile. Restroom facilities were developed by taking commercially available vault toilets and modifying them so that they could be removed in the winter or for summer hurricanes and replaced efficiently. Parking lot fencing is placed for the summer to delineate the lots and removed during the winter months. Asphalt was replaced by a clay and clamshell-type construction; this material does not harm

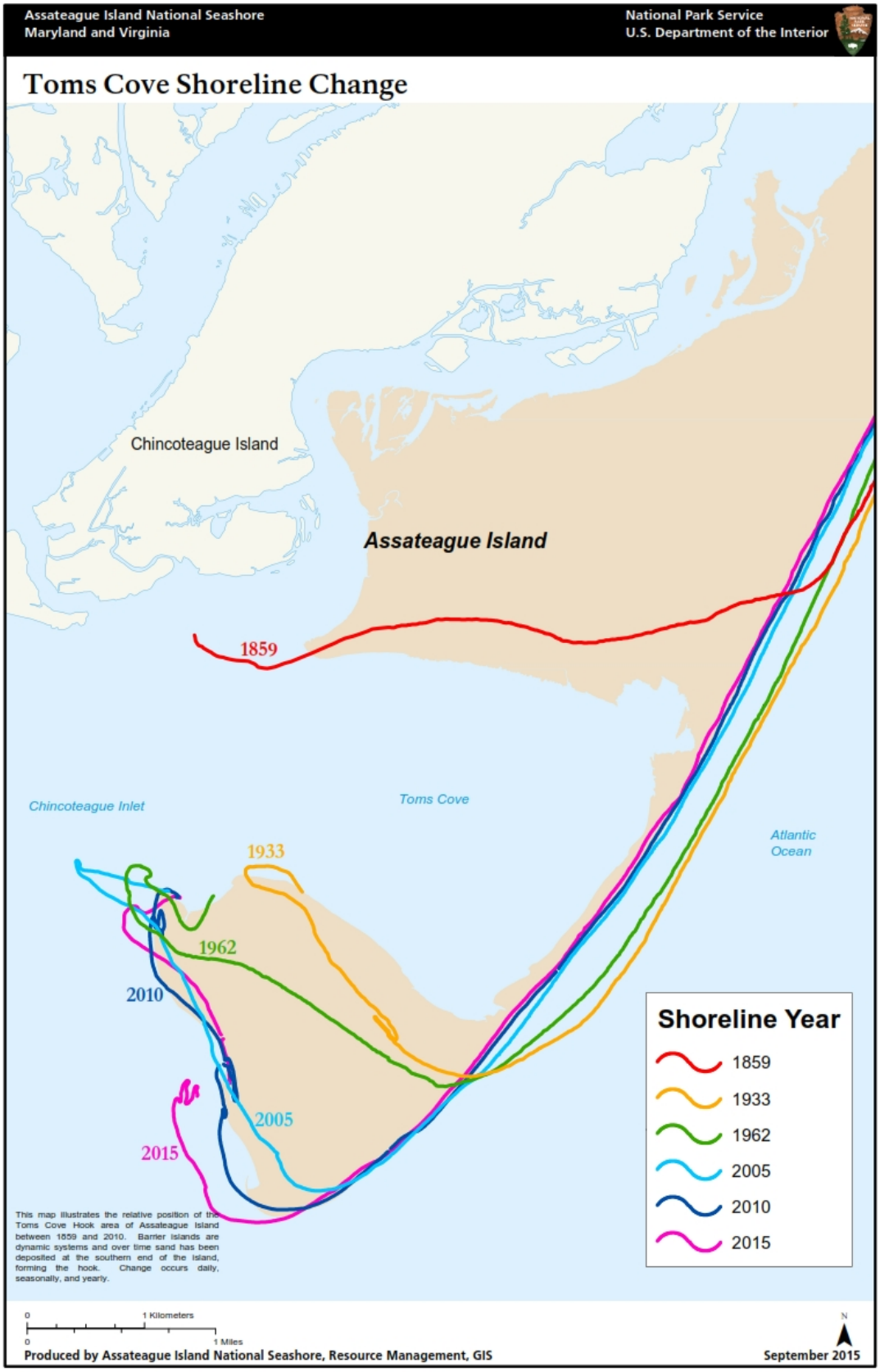
the bay or ocean when overwashed by a major storm, and can be salvaged and reused when storms force the relocation of the lots to the west. These actions have cumulatively made the NPS facilities much more sustainable.

The recreational beach and Toms Cove hook in July 2014

Finally, in 2012, with the concurrence of then Refuge Manager Lou Hinds, NPS Superintendent Trish Kicklighter confirmed to the Town of Chincoteague the NPS' ongoing practice of creating a small berm in front of the parking lots. NPS' intention is to set the berm and parking lots at an elevation that prohibits overwash during normal lunar high tides and minor nor'easters but allows for overwash during larger storms. With this compromise, NPS and USFWS hoped to limit monthly parking lot repair from high tides / storms while still allowing the overwash that is crucial to building the resiliency of the island. Recent shoreline surveys have indicated that several new overwash fans have been deposited along the Toms Cove shoreline suggesting that some island widening is occurring. Topographic Lidar data also indicate that portions of the island interior have increased in elevation up to 2.5 meters between 2002

and 2012. However, we remain concerned that permanent, higher dunes increase the risk of island narrowing and breaching that could unintentionally threaten Toms Cove and Chincoteague Island. For this reason, we do not believe planting dune grass or placing sand fence that might create a permanent barrier will increase the stability of the island, although we hope that new research underway will provide better and more specific guidance on the best way to manage and preserve this part of Assateague Island.

Before and After Photographs from Hurricane Sandy. This boardwalk runs from the park visitor center to the Tom's cove side of the island. You can see the overwash-placed sand that increases island elevation and replenishes the marsh.


Assateague Island National Seashore
Maryland and Virginia
National Park Service
U.S. Department of the Interior
Toms Cove Shoreline Change
Chincoteague Island
Assateague Island
1859
Chincoteague Inlet
Toms Cove
Atlantic Ocean
1933
1962
2010
2005
2015
Shoreline Year
1859
1933
1962
2005
2010
2015
This map illustrates the relative position of the Toms Cove Hook area of Assateague Island between 1859 and 2010. Barrier islands are dynamic systems and over time sand has been deposited at the southern end of the island, forming the hook. Change occurs daily, seasonally, and yearly.
0
1 Kilometers
0
1 Miles
N
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