

# As the seashore shifts

Trying to stabilize barrier beaches appears to be a losing proposition

by Dietrick E. Thomsen

From Cape Cod to the Rio Grande del Norte the east coast of the United States is characterized by the presence of barrier beaches, long, low sandy islands lying off the shore of the mainland, separating salt or brackish bays from the ocean.

These barrier islands are regions of what might be called instant geology. The granitic face of a mountain in the interior of the continent may stand virtually unchanged for centuries; wind and water work only slowly on it. But the interface between ocean and sand is highly volatile. The topography can be changed overnight. One severe storm is enough to open new inlets, close old ones, and alter the line of the beach perceptibly.

It is not on record that the shiftiness of these sands bothered the aboriginal inhabitants of the continent very much,

but it has bugged the Europeans ever since the first time an explorer failed to find an inlet charted by his predecessor. The seashore resort business got started in the late eighteenth century—Cape May, N.J., was advertising in Philadelphia papers at the time of the Constitutional Convention—but it really took off in the late nineteenth when cheap transportation brought the masses to the boardwalk. Large and small towns grew up on the barrier islands: Atlantic City, Ocean City, N.J., Ocean City, Md., Miami Beach.

The people found that they had indeed, in the sense of the Gospel parable, built their houses upon sand. As a result, beach erosion is a cry that can squeeze millions out of public treasuries in a state like New Jersey. Man took heroic measures to stabilize the shore as he found it. In developed

areas sea walls, jetties and sand bags are common. Along the undeveloped islands, especially those under the jurisdiction of the National Park Service, artificial dunes were built.

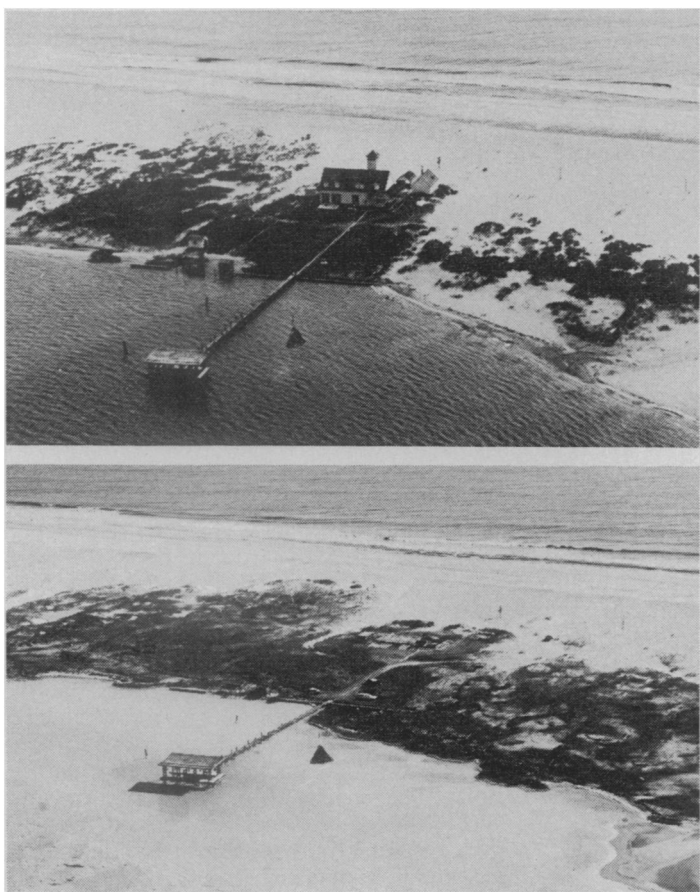
Erosion is a natural process. Recent studies under the sponsorship of the National Park Service, especially those by Paul J. Godfrey of the University of Massachusetts and Robert Dolan of the University of Virginia, tend to show that nature is not interested in a stable beach line, and that it would be more beneficial in the long run to lie back and let the changes occur.

"Erosion is a man-conceived evil that only man worries about, especially when it threatens his structures," remarks Godfrey. "In the natural order of things, a dynamic stability exists on the barrier islands, where the power of the sea is met by flexibility and erosion is met by subsequent buildup elsewhere."

Two major kinds of erosion affect the beaches. One sort is accomplished by longshore currents that are generated when waves strike the shore obliquely. The longshore currents carry sand up and down the beach, taking away in one place and adding in another. Longshore erosion can be important in many places as it gradually alters the beach line. But, says Dolan, in most places 70 to 90 percent of the erosion comes from the other cause, surging seas such as those caused by storms. Nor could longshore erosion have built the islands. The composition of the island material indicates, says Godfrey, that most of it could not have been brought by longshore currents. It must have been brought up by the ocean and been worked and reworked in place by surging seas.

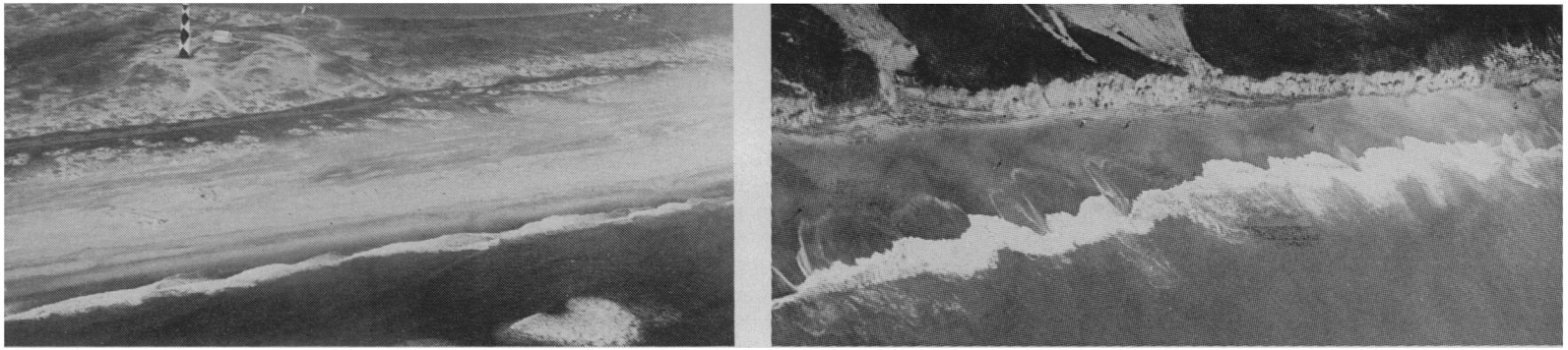
It is against storm seas that the sea walls and dune lines have been built, to prevent them from washing over the islands. Such overwash is considered an unmitigated evil by residents of the islands. Dolan and Godfrey say it is necessary to the survival of the islands.

As Godfrey describes it in a National Park Service publication, *Oceanic Overwash and its Ecological Implications on the Outer Banks of North Carolina*, if these high seas are allowed to wash over the islands, they deposit on the bay side the sand they dig from the beach on the ocean side. Thus what is eroded from the ocean side goes to build new land on the bay side. Since the level of the ocean has been rising more or less steadily since the Pleistocene era—in the North Carolina region it is rising about three feet per century—overwash is facilitated, and the island marches steadily backward toward the mainland. Along most of the Atlantic and Gulf coasts, the mainland shore is very flat so that



*Increase of land on the sound side of the barrier beach at Core Banks, N.C., between 1963 and 1970. (The building burned in 1968.) Arrow indicates the same mooring post in both pictures. Marsh is developing and vegetation has spread considerably.*

Godfrey/NPS



R. Dolan

Wide beach at Core Banks contrasts with narrow Cape Hatteras beach. Dunes are stabilized at Cape Hatteras.

the mainland shore recedes too as the water rises, and the bay stays more or less the same width. The ecology of the barrier islands, their native vegetation, especially the hardy species of beach grasses, are well adapted to these processes, Godfrey found. When inundated by overwashed sand, they come back up through it.

If overwash is prevented by dunes or sea walls, Dolan writes in the April 21 *SCIENCE*, the heavy seas must dissipate their energy against the beach alone. They gradually cut it narrower and steeper. In the process they grind up the sand grains to a fine sediment that will no longer stay on beaches. This is washed out to sea and down to the bottom and lost to the geological economy of the island. Furthermore sand that would increase the marshes in the bay and raise the bay bottom is

not brought in. Says Godfrey: "A paradox will soon develop in which erosion occurs on both sides of the barrier islands because man thought he was creating a stable system by building high barrier dunes."

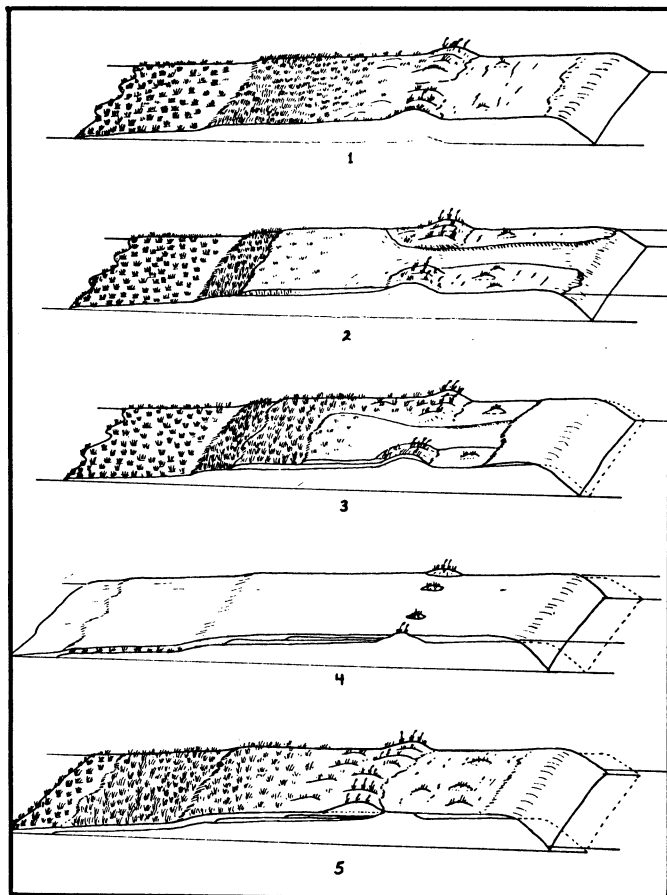
Dolan therefore suggests that in the remaining undeveloped islands dune stabilization be abandoned and nature be allowed to take its course. Buildings should be confined to the bay sides (as settlers in colonial times in fact did), and they should not be of such expensive construction as to require 30 or 40 years to pay themselves back. He argues that the costs of cleaning overwashed sand from roads or around buildings, even "plugging an inlet now and then" would be less than maintaining the dunes.

The National Park Service quite agrees with these recommendations,

says Robert M. Linn, director of the Park Service's Office of Natural Science Studies, and allowing nature to take its course is already policy on uninhabited islands. On islands where some people live—Cape Hatteras, for example—"you get into the realm of politics," notes Linn. "Very few people really understand what it is he's [Dolan] proposing." Substantial buildings, even motels, exist near the ocean and owners put on pressure for a permanent-dune policy. "In the long run more is lost and probably lost quicker that way," says Linn, and the Park Service is trying to convince people. But Linn is afraid that beach property owners will hang on "till the last grain of sand is on the chimney." He wishes there were some program by which appropriate Federal or state agencies could buy up the land within a mile of the ocean, which is the greatest danger zone for the foreseeable future.

For the really developed beaches, says Dolan, the only possibility is replenishment. Sources of beach sand must be found at sea, the sand dredged up and dumped on the beaches to make up for what is eroded away. The alternative is gradually abandoning the seashore communities. If the sea continues to rise, Linn foresees a day when the fight for stabilization will become too costly. But that will not be for a long time because of the extremely high property values in the developed communities.

Fortunately for them, and probably fortuitously, the large barrier-island communities like Atlantic City, Ocean City and Miami Beach are in regions where the seas are on the average gentler and the erosion slower than on the North Carolina Banks, for example. "If you look at a chart of hurricane tracks," says Linn, "you will see that a lot of them seem to converge near Cape Hatteras." Godfrey counts at least 149 hurricanes that have affected the North Carolina coast since Sir Francis Drake recorded one on his visit in 1586. "You could not maintain a large city at Cape Hatteras for very long," says Linn. Or as they say on television: It's not nice to fool Mother Nature. □



*How overwash works. A typical barrier island (1) is overwashed by a storm that drops sand on vegetated areas (2). In (3) a less severe storm brings more sand; meanwhile grass has come up through previous deposit. Sketch (4) represents result of very severe storm. In (5) island has recovered with lateral displacement of various zones.*

P. J. Godfrey