May, 1980

COAST WATCH

Photo by J. Foster Scott

Bare, shifting dunes threaten the abandoned Pennys Hill Coast Guard Station

Dunes: Where the sea and the land mix it up

Sometimes North Carolina's coast seems like a battleground where people and regulations butt heads almost as regularly as the surf and shoreline. Many of the major skirmishes have been fought over dunes. Property owners have been denied building permits over them, off-road vehicles have been barred from them, and millions of dollars have been spent to maintain them.

What is a dune? It is a lot more than a pile of sand. Dunes store sand from the ocean, provide housing for ghost crabs, offer nesting grounds for loggerhead turtles and waterbirds, and serve as a last hold for beach grasses and sea oats. And, dunes are a flexible buffer between land and waves.

The clash between dunes and the ocean occurs along a line of scrimmage defended by the primary dunes. Primary dunes, the first large sand ridge back from the beach, are capable of holding off the waves of most storms. In front of the primary dunes are often smaller sand mounds called frontal dunes. These dunes offer less protection from the ocean.

Usually the interplay between the ocean and the dunes is equal. Each gives and takes a little. But occasionally, a team of waves and wind, often from a strong storm, comes along that breaks the defense, topples the dunes and rushes landward.

Sometimes, this defensive breakdown occurs because of holes in the dune line. People cut away at the dunes and its vegetation with their feet, their vehicles and their construction. These holes may allow the ocean to pierce the dune defense on the next high tide or during the next storm. The result can be flooding and erosion behind the dune line.

Continued on next page

Keeping an eye on this scrimmage is a referee—the Coastal Area Management Act (CAMA) and its enforcers. CAMA tries to lessen people's impact on the dunes in "ocean hazard areas" by regulating stabilization and construction near and on the dunes.

There would be little need for CAMA to referee, however, if people today would take a hint from earlier coastal settlers. They understood the dunes were changing, moving constantly westward like the sun. Then, people built on the backside or soundside of the barrier islands. And, if the ocean started creeping too close, they would put their houses on huge logs and roll them out of its path.

The dunes along the Outer Banks were smaller then, and the ocean often mounted their crests, surged landward and retreated, leaving large deposits of sand. But during the 1930's, the Civilian Conservation Corps stabilized the dunes in a large continuous mound of sand from Currituck to Ocracoke. Beach grasses and sand fences held the tall dunes in place. The ocean no longer overwashed the dunes and people began building closer to the sea.

But these man-made dunes may have hurt more than they have helped the Outer Banks' barrier islands, says East Carolina University geologist Stan Riggs. "Much of the Outer Banks are eroding from both sides now," he maintains. "The ocean can no longer overwash the dunes and build up the backside of the islands. At places like Rodanthe the estuarine erosion is as bad or worse than the ocean erosion. The barrier islands are becoming very skinny in places."

Riggs says the high barrier dunes may also be increasing beach erosion by making the beach narrower and steeper. They may allow the ocean to take larger bites of sand, especially during storms. But Riggs says he is not convinced of this "overwash" explanation of barrier island dynamics. Other scientists, also, question its validity. "We don't know as much about the dunes and barrier islands as we once thought we did," he says. "We need to do more research before coming up with any definite answers."

Taking root in windy sand
is not an easy
way
to go about
finding a place to stay.

from "Dunes" by A.R. Ammons

While the dunes may be a temporary defense for man and a replenisher for the barrier islands, the dunes are also a storage bin for sand. During storms, the ocean washes large amounts of sand from the beach and dunes out to sea. There, the sand forms ocean sand bars that lessen wave action. After the storm, the ocean gradually pushes these sand bars landward until the sand is again deposited on the beach. The sand particles dry in the sun, then are picked up by the wind for a ride down the beach. This ride may come to an abrupt halt when the sand particles meet a blade of beach grass or a sand fence head-on. The sand particles collect around the grasses or fence. The result can be a dune.

These ocean dunes are part of the beach-berm system that is built from the tug-of-war between the beach and the waves. But there are other types of dunes along our coast and they're not all on the beach.

Behind the beach dunes is a massive dune ridge that includes dunes like Jockey's Ridge, Pennys Hill and dunes on Shackleford Banks. The dunes have been formed from excess sand, Riggs says, that has blown and washed over the beach dunes. The excess sand comes from an old shoal system that lies off the North Carolina coast. Some of the dunes remain active and semiactive, Riggs says, which means they're still moving. "For instance, Jockey's Ridge is an active dune," he says. "It has little vegetation, so the wind continues to move the dune. It's not a change that you can see from day to day, but one that can be seen over the decades."

Behind this moving dune ridge is another series of dune hummocks that were formed during the last glacial age. It is on these dunes that the maritime forests have grown, Riggs says. These dunes and their forests are important to the barrier islands as collection points and storage areas for the only fresh water on the islands.

"There is a lot we still don't know about the dunes and a lot we have to learn," he says. "But, we do know the dunes are an integral part of the coastal community."

Beach grasses trap sand, rein in galloping dunes

If the dunes are so important to our beach system, then how can we make sure they'll always be there to protect us?

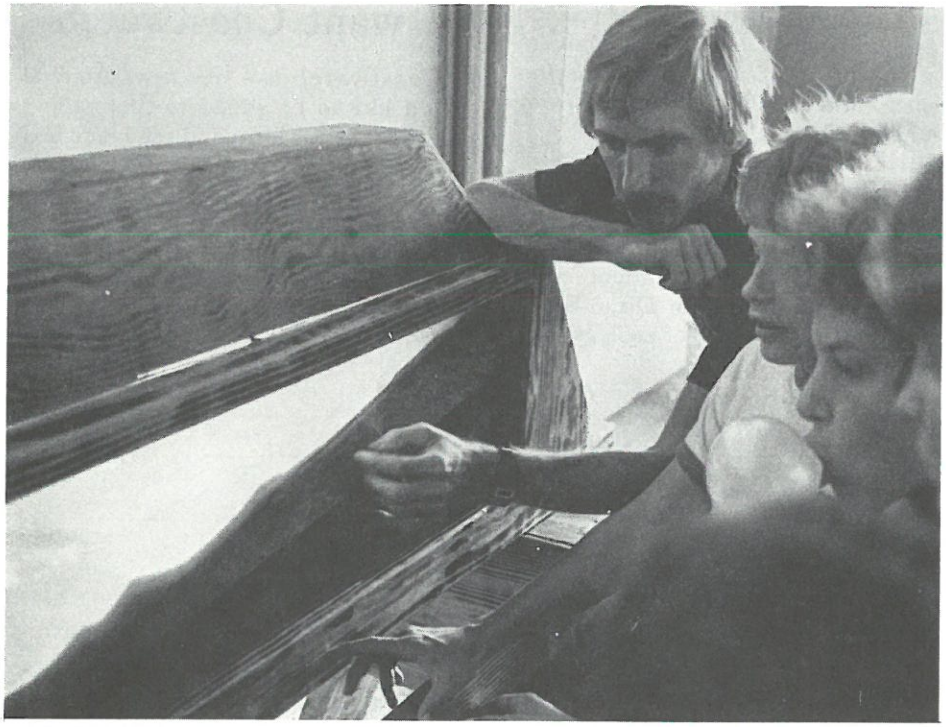
"The dunes are a mobile part of a mobile system," says Stan Riggs. "They're not a stable entity. The best way to protect them is to let them do their own thing."

The Coastal Resources Commission agrees that the dunes should be left to themselves, so they've developed some dune standards which provide the dunes some protection from man.

The Coastal Resources Commission enacted the following dune regulations:

- Landowners must build behind the crest of the large primary dune or the erosion setback line, whichever is farther landward.
- In building new dunes, a landowner must align the new dune with adjacent natural dunes.
- Existing dunes cannot be extended seaward unless they are extended naturally with vegetation or during an emergency.
- Sand used to build new dunes must come from outside the ocean hazard area.
- No dunes can be created in inlet hazard areas.
- Pedestrian crosswalks should not alter the dunes and should not be greater than six feet in width.

"It's time we started zoning and building structures that are designed to live with the changing environment," Riggs says, "instead of trying to make the environment change for us."



Beach dynamics

Using a wave tank at the N. C. Marine Resources Center at Ft. Fisher, Sea Grant coastal engineer Spencer Rogers can simulate the workings of the ocean, beach and dunes. The tank, which Rogers designed, gives a cross-sectional view of the ocean-berm system from the dunes to a few hundred feet offshore. By changing the turbulence in the tank, Rogers can demonstrate how different wave sizes can affect the beach and dune. For instance, during calm weather when waves are smaller, the beach is wide with a gradual incline toward the dunes. But during storms, when the waves are larger, the beach is narrow and steep.

In a small test area near Ft. Fisher, Rogers has anchored several old Christmas trees (left) to rebuild the dunes.

The National Park Service has adopted just that philosophy in its management of the man-made dunes along its Outer Banks national seashores. The park service has decided to abandon its upkeep of the high, man-made dunes.

Dunes built with bulldozers and dump trucks are costly. A simpler and less expensive way to build or restore them is to plant salt-resistant grasses. Planted in an area rich in sand-laden winds, beach grasses can collect a natural dune.

North Carolina State University soil scientist Steve Broome, a Sea Grant researcher, recommends three types of grasses for building dunes in North Carolina—American beachgrass, sea oats and bitter panicum. Why these grasses? They're tough. They can tolerate accumulating sand, wind gusts, salt spray, flooding, drought, the beaming beach sun and a meager food supply. But, they do have one weakness in their armor—they can't withstand being trampled by people and vehicles.

Beach grasses grow upward with the dune. Sometimes, during a storm, the ocean cuts away a slice of the dune and you can see the extensive network of roots and rhizomes that run through the dunes.

Broome says it is best to plant a combination of beach grasses. The American beachgrass, which makes a good dune starter, usually only survives a few years. Not native to North Carolina, the American beachgrass must have a constant supply of accumulating sand. It also falls easy prey to insects and disease. Sea oats are hardier, Broome says, but unlike the American beachgrass and bitter panicum, they can't be purchased at a nursery. Sea oats do not grow well under nursery conditions and must be dug from existing dunes. It's illegal in North Carolina, however, to dig up sea oats or cut-off their oat-like tassles. But Broome suggests that you find a neighbor who is willing to let you remove a few sea oat plantings or seeds from his or her property.

If you would like to know more about when, where and how to build or restore dunes, read the Sea Grant publication, *The Dune Book, How to Plant Grasses for Dune Stabilization*. For a free copy, write UNC Sea Grant, Box 5001, Raleigh, N.C. 27650. Ask for Sea Grant publication, UNC-SG-76-16.

But grasses aren't the only way to build a dune, just one of the more natural ways. Sea Grant coastal engineer Spencer Rogers says you can build a dune with sand fences, brush pilings and even old Christmas trees.

Once a dune is planted over with grasses, it's stronger. But no dune is permanent. A ferocious nor'easter or hurricane can erase dunes. "A lot of people along the coast have a false sense of security where the dunes are concerned," Riggs says. "They can't save you every time."

Caution: ORVs can be hazardous to a dune's health

So what happens to this thriving community of sand, grasses and wildlife when it's overrun by off-road vehicles (ORVs)? It's in trouble, according to Sea Grant researcher Paul Hosier of UNC-Wilmington.

Hosier, who has been studying the effects of ORVs on dunes for almost two years, has found that the same dunes that can hold off a pounding ocean cannot tolerate being trampled by feet and vehicles.

The first pass or two over the dunes by an ORV kills off the grasses and the sea oats by breaking the stems and exposing the roots to the sun, Hosier says. Voiding the dunes of vegetation not only keeps the dunes from growing, but also destroys the "fingers" that hold the dune together. The bare sand is prey to the wind and other vehicles.

"It takes the wind and the vehicle working together to create a large dune blowout," Hosier says. "When a vehicle traverses the dune, the first few passes disrupt the dune and move sand down slope. Following that, the wind removes more sand. The whole process is repeated when the next ORV passes. Before long, there's no dune left."

"I've seen four and five-foot dunes leveled by ORVs," he adds. "These are dunes that can't be duplicated without a gradual rebuilding process that may take years."

Leveling the dunes makes a hole in their defense for high tides and strong storms to come sweeping through. "It's like the Dutch boy taking his finger out of the dike," Hosier says.

Not only is it harmful to drive on the dunes, but it's destructive to drive along the dune base. Driving along the seaward foot of the dune destroys its growing edge by killing the beach grass that collects new sand. Hosier suggests that people who need to drive on the beach should stay on the wet sand area between the low and high tide marks. And, he adds, using designated access ramps to reach the beach will lessen the impact of ORVs on the dunes.

Hosier points to the Fort Fisher area in New Hanover County as an example of what unregulated ORV traffic can do. "There is no law enforcement there and people drive all over the dunes," he says. "The dunes are devastated; there is a 20 percent reduction in the vegetation; and so many crossovers have been made perpendicular to the beach that the next big northeaster or hurricane is going to cause a massive washover."

Fortunately, there aren't many sites as trampled as Fort Fisher. Many coastal communities have begun regulating ORV traffic. But the regulations have drawn controversy. ORV supporters say the regulations hurt local economies and unfairly limit the fisherman's access to the beach. Opponents say the vehicles damage dunes, plants and animals.

Hosier points out that ORV use along the North Carolina beaches has increased dramatically over the last ten years. In 1977 alone, 100,000 people drove the beaches of the Cape Hatteras National Seashore.

About 85 percent of the ORV drivers are fishermen, Hosier says. "But fishermen generally cross the dunes at prescribed crossovers, run up and down the beach to fish and then come back across the dunes at a crossover," he explains. "That's fine." Hosier thinks it's the people who "bust dunes" for fun that cause the most trouble. "They're why we need dune ordinances," he says.

Hosier says there are federal, state, county, municipal and private island ordinances in North Carolina that limit dune driving in one way or another. Some ordinances limit the time of year ORV operators can drive on the beach. Still others limit beach access to fishermen and some use a combination of limitations.

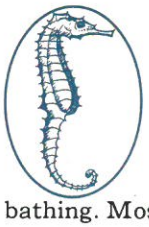
Sea Grant publishes a free pamphlet, *Making Tracks, A Guide to Off-Road Driving at the Beach*, which lists some of the dune regulations for beaches along the coast. The pamphlet also offers other ORV information. For a free copy, write UNC Sea Grant, Box 5001, Raleigh, N.C. 27650. Ask for Sea Grant publication 79-06.

Photo by Neil Caudle

An ORV rides over the crumbling dunes at Ft. Fisher

THE BACK PAGE

"The Back Page" is an update on Sea Grant activities—on research, marine education and advisory services. It's also a good place to find out about meetings, workshops and new publications. For more information on any of the projects described, contact the Sea Grant office in Raleigh (919/737-2454).



The point was to convince 24 teachers, most of them mountaineers and Piedmonters, that there's more to the North Carolina coast than beaches and sunbathing. Most of them got the message somewhere between the knee-deep trek through a salt marsh and the heave-ho as they hauled in an otter trawl full of sea urchins, blue crabs, shrimp, croaker, rays and sponges.

The teachers were part of a workshop conducted June 23-27 at Ft. Fisher by Lundie Mauldin, Sea Grant's marine education specialist. The coastal environment so intrigued the teachers that most of them are writing units on coastal studies into their fall lesson plans.

During the workshop, teachers identified plants and animals in the salt marsh with botanist Pat Ashton, fished aboard the *Cyclops* with biologist Gil Bane of the University of North Carolina at Wilmington (UNC-W), reviewed marine literature for children with Mary Wasson of UNC-W, toured historic Southport and Brunswick Town with anthropologists Tom Loftfield and Jim Sabella of UNC-W, and discussed coastal development and barrier island dynamics with Spencer Rogers, Sea Grant's coastal engineering specialist.

There were other highlights, but one event was clearly the most savored: a seafood dinner of fresh fish and shellfish donated by the A. C. McGirt Seafood Company of Carolina Beach.

Crab lovers know that good eating comes two ways—in a hard shell and a soft shell. But Collington crabber Murray Bridges knows a third version. Bridges has found that "papershell" crabs are similar in flavor and texture to the soft shell crab.

Soft crabs are crabs that have just shedded their shells. After about five hours, the crab's new shell begins to harden slightly and the crab is a papershell. After removing the papershell crab's legs and thin shell, the crab can be fryed in a light batter and eaten just like the soft shell crab.

Right now, only crabbers know about the papershells and how good they taste, Bridges says. In fact, many crabbers have had to throw the papershells in their catches away, for lack of a market. But Sea Grant advisory agent Hughes Tillett of Manteo and seafood specialist Sam Thomas of the NCSU Seafood Laboratory in Morehead City are trying to help Bridges spread the word about the papershell. Thomas is asking restaurant owners in Morehead City to put the papershell crab on their menus.

If all goes as planned, the papershell crab will begin to take its place on the plates of seafood lovers.

The National Marine Fisheries Service (NMFS) wants to know more about big game fish such as marlin, swordfish and sailfish: Where do they winter? How far do they migrate? What are their numbers? To find the answers, the NMFS is asking fishermen and longerliners to tag the fish they catch and plan to release. That way, if a fish is caught again, scientists will know how far it has travelled, its weight gain and other vital statistics.

If you catch a fish that has already been tagged, send the tag to the address stamped on the tag, along with information about the approximate weight and length of the fish.

If you're interested in tagging your catch, contact either Dennis Regan at the Marine Resources Center on Roanoke Island or Jim Bahen at the Marine Resources Center at Ft. Fisher.

Commercial fishermen trawling for croaker, trout, bass and porgies have found one serious limitation to conventional trawl nets: they can only fish along the bottom. When the fish rise into mid-water, as they often do during the day, standard gear is ineffective.

Foreign fleets have solved the problem with mid-water nets, which are designed to ply almost any depth. American fleets have been slow to use the new gear.

But two fishermen from Wanchese, Kenny Daniels and Will Etheridge, are giving the system a try.

Daniels and Etheridge learned about the net through Hughes Tillett, Sea Grant's marine advisory agent stationed on Roanoke Island. Fishermen from the Wanchese area had also attended a Sea Grant workshop on mid-water trawls, conducted in Manteo during June. The fishermen were impressed by what they heard, but wanted to know more before they plunked down thousands of dollars on new gear.

So Tillett helped Daniels and Etheridge arrange a trip to Nova Scotia to see some mid-water trawl equipment firsthand. Both men bought nets, and will put them to work this summer. In return for Tillett's help, Daniels and Etheridge will keep track of the net's performance and report to Tillett, who will pass the information on to other interested fishermen.

Continued on next page

What do birds, folklore, underwater archaeology and hurricanes have in common? They're all topics for a summer-long series of talks about the Outer Banks of North Carolina.

Dennis Regan, a Sea Grant marine advisory agent on Roanoke Island, has organized the discussions, which will be at the Nags Head Cove Clubhouse at 8 p.m. each Thursday until the end of August.

Discussion leaders and topics are:

July 24—Robert Needham on summer birding on the Outer Banks

July 31—Virginia Ross on legends and folklore of the Outer Banks

Aug. 7—Lt. John Leslie on the historical background and current responsibilities of the Coast Guard on the Outer Banks

Aug. 14—Gordon Watts on underwater archaeology and Monitor research

Aug. 21—Dr. Jerry Machemehl on the effects of coastal hurricanes

Aug. 28—Spencer Rogers on a homeowner's guide to hurricane-proof construction

Two graduate students have received Sea Grant fellowships to further their studies in marine science.

Richard Miller, one of the recipients, will be starting his work toward a Ph.D. in the field of marine science and engineering at North Carolina State University this fall. Miller received his bachelor of science degree in zoology from Duke University and his masters degree in marine science and applied statistics from Louisiana State University.

Jurij Homziak will be working toward his Ph.D. in the Curriculum in Marine Science at the University of North Carolina at Chapel Hill. Homziak received his undergraduate and masters degree from San Diego State University in the fields of zoology and biology, respectively.

Before January 30 of this year, a boat's "head" (or toilet, to landlubbers) could legally discharge directly into the ocean. Now, the law requires that boats operating within three miles of shore be equipped with sanitizing gear or onboard holding tanks—expensive items, especially for recreational boaters.

Sea Grant coastal engineer Spencer Rogers has devised a low-cost portable holding tank for use on smaller boats that can be attached to an existing head. Designed for light use, the tank can be carried home and emptied at the end of the day. The portable tank is made from a five-gallon collapsible jug that can be purchased from camping or auto supply stores.

For detailed instructions on how to make and install the tank, write Spencer Rogers, Marine Advisory Service, N.C. Marine Resources Center/Ft. Fisher, Kure Beach, N.C. 28449.

I want Coastwatch

Coastwatch is a free newsletter. If you'd like to be added to the mailing list, fill out this form and send it to Sea Grant. Box 5001, Raleigh, N.C. 27650.

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