Coastwatch

UNC SEA GRANT ▪ MAY 1989

Photo by Scott Taylor

DUNES

The Making Of A Dune

By Nancy Davis

For some folks, dunes are little more than piles of sand they cross to reach the beach.

Sunbathers trample them. Surf fishermen plow through them in four-wheel drives. And some property owners don't appreciate the services they provide.

Sometimes it seems only artists and photographers take notice of them.

But sand dunes are much more than pretty backdrops for paintings and pictures. They provide a front line of defense against the power of ocean winds and waves.

"Dunes are an integral part of a barrier island's ability to maintain itself," says Sea Grant researcher John Wells.

"The most important thing about a dune is that it's a natural buffer to storm waves and an essential component in the sand-sharing system," says Wells, a coastal marine biologist at the University of North Carolina Institute of Marine Sciences.

But in their role of island protector, dunes take a terrible beating. Winds and waves pound them. And occasionally, storms sweep them away.

But even though one dune disappears, eventually another mound of sand will take its place.

The continual waxing and waning of a sand dune is part of a natural process, Wells says.

He describes a dune as a reservoir of sand. During storms, waves may carry part of the sand in the reservoir a short distance offshore. There, the sand may form sand bars that lessen wave action.

Eventually, the sea's natural wave action will deposit some of that sand back on the beach where it will be available as building material for another dune.

If you've ever felt the twinge of fine grains of sand blasting your ankles as you walk along the beach, you've witnessed a dune under construction, says Sea Grant coastal engineer Spencer Rogers.

"All it takes to build a sand dune is windblown sand and something to trap it," Rogers says. "And all it takes to get it to fall out of the breeze is something near the surface to slow the wind velocity."

The sun and winds blowing off the ocean dry tiny grains of sand on the beach. The lighter, finer grains become airborne.

The sand is whisked across the beach, and wherever there's an obstacle—a piece of driftwood, a sand fence or beach grass—the wind drops its load of sand.

Eventually, the wind will deposit enough sand to form a new dune.

How long that takes is up to the availability of sand and the speed and direction of the wind, Wells says.

The wind also controls the shape of the dunes and whether there's a single ridge or a series of dunes, Wells says.

By examining the dunes on a beach, you can tell a lot about an island, Wells says. In North Carolina, islands that are oriented in an east/west direction tend to be more stable and have better developed dunes than islands oriented north/south.

As an example, Wells points to the differences in the dunes on Shackleford Island, an east/west oriented island, and Core Banks, with a north/south orientation.

The dunes on Core Banks are small and poorly developed. But Shackleford's dunes are high and stable.

On the Outer Banks, you can see evidence of another kind of dune ridge. But this is the work of man.

Before the 1930s, the dunes from Currituck to Ocracoke probably were much smaller, and during storms the ocean frequently surged landward. But the Civilian Conservation Corps stabilized the dunes in a continuous mound of sand.

At Jockey's Ridge, you can see an example of yet another kind of sand dune. It's the East Coast's highest dune, but it's not even on the beach.

Jockey's Ridge was formed from excess sand that has blown and washed over the beach dunes. With little vegetation on it, the dune continues to move.

A dune similar to Jockey's Ridge is the site of the Wright Brothers Memorial. But that dune has been stabilized with grasses, Rogers says.

Photo by Clay Nolen

Mounting A Sandy Defense

By Kathy Hart

Thirty years ago, most North Carolinians thought the dunes were. . .well, pretty. They provided some relief to an otherwise flat terrain, and the dune grasses and sea oats that topped their crests waved majestically in the sea breeze.

Developers of hotels and motels saw the dunes as an unnecessary barrier between their patrons and the ocean they came to see and play in. So, they bulldozed the dunes flat.

No one understood that these swells of sand may well have been what kept their home, hotel or favorite vacation spot from washing away during big storms and hurricanes.

Dunes, you see, are the first line of defense against the sea.

And that's a concept Sea Grant, the N.C. Division of Coastal Management and environmental groups have drummed into North Carolinians' heads during the last 25 years.

Now a developer or potential property owner wouldn't consider buying property that didn't have dunes hugging the beach.

In fact, Sea Grant coastal engineer Spencer Rogers, says, ''North Carolinians now have a dune fetish. They know that dunes are a good thing to have and that they can offer substantial protection to their island home and development.

''And although we've successfully heightened awareness, the public has a perception that dunes do some things they can't do and never will do,'' Rogers says.

Rogers warns, for instance, that sand dunes do not stop day-to-day beach erosion. That kind of erosion is gradual and dictated by offshore events and shoreline processes.

But dunes do play a major role in slowing the erosion from big storms such as hurricanes and northeasters. They act as temporary protective barriers. But, they are not permanent structures that can hold off the ocean indefinitely.

''During storms, the more sand you have between you and the ocean, the more time it takes to wash it away,'' Rogers says.

And when it comes to storm protection, it's not the shape of the dune that counts. It's the volume of

Continued on next page.

Photo by Gene Furr

sand and maybe even the grain size of the sand that influence how long a sand dune will hold the ocean back, says Sea Grant researcher John Fisher.

Fisher and Margery Overton, two civil engineers at North Carolina State University, are studying the relationship between storm waves and dune erosion as part of a Sea Grant project.

The duo have experimented with simulation dunes at the U.S. Army Corps of Engineers Research Facility at Duck and in the Oregon State University wave tank.

Fisher and Overton learned that the height and frequency of the waves and the duration of a storm affect how fast a dune erodes.

"Now, I know those seem like obvious factors that you don't need a study to determine, but it's really more complicated than that," Fisher says.

By feeding dune and storm measurements into a mathematical model that Fisher and Overton are developing, they may soon be able to predict dune erosion for a given set of storm conditions.

And that's valuable.

Resource managers could predict which storms are likely to cause erosion and pinpoint areas that would be hardest hit. And the information could help property owners rebuild or reshape their dunes for better durability in the future.

If you're planning to build a dune, be it with sand fences or vegetation, Rogers has some tips.

Always build your dune well behind the line of vegetation. And, he says, if you have a deep lot, it's better to build your dune either underneath or immediately in front of your house as far away as possible from the beach.

Don't build your dune at the edge of the beach or build your house on or just behind a pre-existing beachfront dune if possible, Rogers warns. Dunes just off the beach are the first ones gnawed away by storm surf and surge.

"Just remember to put as much sand as possible between you and the ocean," Rogers says.

And before building any dune, check with your local Coastal Area Management Act permit officer. There are some specific regulations regarding dune building, especially with bulldozers. And other CAMA regulations govern how far behind the dune or first line of vegetation a house should be sited.

Above all, Rogers advises not to build a dune with a bulldozer or front-end loader.

"They're ineffective," he says. "They make property owners feel better, but they provide little or no actual protection because of where they're placed."

Bulldozed dunes are made of sand just pushed off the beach and placed well in front of the first line of the vegetation. They're too close to the ocean to provide any defense.

Besides, you can't just push a pile of sand in front of your house and expect it to stay there. Dunes need vegetation to hold them in place.

Sea Grant researchers Stephen Broome, Ernest Seneca and W.W. Woodhouse pioneered dune stabilization research in North Carolina 15 years ago.

Broome and Woodhouse, soil scientists, and Seneca, a botanist, learned that the roots and rhizomes of dune grasses and sea oats provide a skeleton for the dune that holds it stable. And the heads and stems of the vegetation trap wind-blown sand to gradually enlarge the dune.

Vegetation is extremely important to any dune system. That's why when

vegetation is destroyed by foot traffic, off-road vehicles or construction, it means more than dead plants.

When there are no dune grasses or sea oats to anchor the dune's sands, it blows away. Then, there's a hole in the dunes and the defense they offer. It's an open invitation for the ocean to come rushing in during the next big storm.

To prevent damaging dunes and their vegetation, use wooden walkways to access the beach. And don't drive ORVs on the dunes.

If you would like more information about building or repairing sand dunes with grasses and sea oats, write Sea Grant for a copy of **Building and Stabilizing Coastal Dunes with Vegetation.** Ask for UNC-SG-82-05. The cost is $1.50. This booklet was written by Broome, Woodhouse and Seneca.

Photo by Scott Taylor

Oh, Christmas Tree!

By Kathy Hart

Oh Christmas Tree, Oh Christmas Tree
How thick are your branches
They trap the wind and blowing sand
And make the dunes all strong again
Oh Christmas Tree, Oh Christmas Tree
How thick are your branches

It was a novel idea.

Instead of tossing the ol' Christmas tree out by the curb for the garbage men to pick up, why not put it to use—repairing the dunes.

That was exactly the idea Spencer Rogers had 10 years ago.

The Fort Fisher State Recreation Area had been flattened by dune-busting off-road vehicles. And the area was a sure bet for increased storm damage.

The recreation area needed to have its dunes repaired and rebuilt. But that could be an expensive proposition if the state had to use sand fencing or bulldozers.

Instead, Rogers suggested that they ask folks in New Hanover and Brunswick counties to bring their Christmas trees to Fort Fisher for some repair work.

Each year, no matter what the weather, several hundred people and their Christmas trees would show up at Fort Fisher on the first Sunday of the new year. Rogers would lead them out to the beach to help them position and stake their Christmas trees.

Then Mother Nature would take over. Strong winter winds would blow sand across the beach until it met the branches of one of the trees. There, it would pile up, often as much as one to two feet in just a few days. Later, vegetation would spread onto the new dunes and repair would be complete.

Altogether, Rogers and his volunteers planted more than 8,000 trees in 10 years.

The Christmas tree project, run in conjunction with the Fort Fisher Recreation Area and the N.C. Aquarium, was so successful that the job is done, Rogers says.

The dunes have been built back up to a safe, protective height. The state saved $55,000 in expensive sand fencing. And hundreds of volunteers have learned more about the value of our coastal dunes.

Dune Plants & Animals

By Nancy Davis

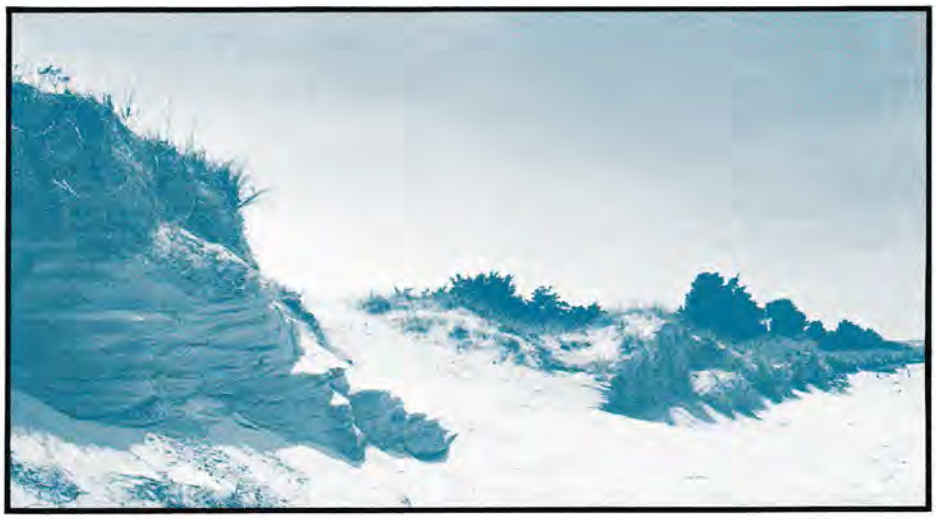

Photo by Scott Taylor

When you take a field trip to the dunes with Jeannie Kraus, the assignment is simple.

Just imagine what life would be like here.

Close your eyes. Feel the sun pounding down on you. Taste the salt spray as it settles on your lips, dries and robs your mouth of moisture.

Feel the wind as it does its best to make life miserable for you, alternately pelting you with sand, then whipping it out from under you.

Kraus' message: Life is rough on those mounds of sand just above the high tide. You might as well live in a desert.

Kraus is the natural science and education curator of the N.C. Maritime Museum, and she's the author of **A Guide to Ocean Dune Plants Common to North Carolina**, a book published by Sea Grant and the UNC Press.

Dune plants deserve respect, she says. After all, they've managed to adapt to one of the harshest of environments.

Next time you're tromping across the dunes to the beach, take a moment to reflect on how the plants manage to survive, she says.

Kraus reels off some of the conditions that dune life doles out:

- Salt spray that limits growth there to salt-tolerant plants
- Storm waves that uproot plants
- Coarse sand that is quickly drained of rainwater
- Few soil nutrients
- Intense sunlight that causes plants to dehydrate
- Extreme temperatures
- High winds that bury plants or expose their roots

"Plants that live on dunes have developed special adaptations to live there," Kraus says. "They can withstand a lot of wind, moving sand and getting washed over once in a while."

Back on the dune again, Kraus urges her students to examine the plants' leaves and stems for clues about how each survives the desert-like environment.

Notice how the blades of sea oats and beach grass are flexible enough to withstand high winds.

The waxy leaves of yaupon, wax myrtle and sea elder resist salt spray and help the plants retain moisture.

The prickly pear cactus stores water in its stem.

Next, notice that there's a pattern to where certain plants are located on a dune.

Closest to the beach, where waves frequently lap at the plants, you'll find the hardiest of plants—sea rocket, sea oats, beach grass and sea elder.

Between dunes where there's more protection, beach primrose, goldenrod, pennywort and wax myrtle can survive.

The further you get from the ocean, the less harsh the environment, Kraus says. Behind the dunes, some shrubs can survive.

Dune life is just as rough on animals as plants, Kraus says.

"Most animals are just passing through," she says, because they find life on the dunes too harsh and the food supply too limited to make it a permanent home.

But if you look closely enough, you may see ghost crabs poking out of holes in the sand and scurrying about for food. Twice a day, they head toward the water to wet their gills, Kraus says.

If there is sufficient shrub cover, you may notice some birds, such as painted buntings, warblers and sparrows, and field mice.

If you'd like to take your own field trip through the dunes, order a copy of **Ocean Dune Plants**. The 72-page illustrated guide provides an informative look at the ecology and biology of North Carolina's dunes.

Kraus identifies more than 50 trees, shrubs, vines, herbs and grasses. And she provides keys, brief descriptions and other facts that will help you identify dune plants.

For your copy, write Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695. Ask for UNC-SG-87-01. The cost is $4.50.

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 offices in Raleigh (919/737-2454). For copies of publications, write UNC Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605.

In late March, Sea Grant agent Jim Bahen and Varnamtown netmaker Steve Parrish tested four turtle excluder device designs at the U.S. Navy's David Taylor Research Center in Bethesda, Md.

The TEDs were tested in the Navy's flume tank, a long trough that circulates water. The Navy uses the tank to test ship hull and submarine designs. Bahen and Parrish were using the tank to see how TEDs worked underwater and to determine how shrimp loss could be minimized. The project was funded by the National Marine Fisheries Service.

Parrish had built scaled-down versions of four TEDs: the Georgia Jumper with an accelerator, a modified Matagorda TED, the original Parrish TED and a modified Parrish TED with an accelerator.

NMFS had approved the use of the accelerators, funnels made of webbing that increase the speed at which shrimp pass through the main body of the net to the tailbag. It was believed that accelerators shot shrimp past the TED opening created to extrude turtles.

Many Florida shrimpers had been installing the accelerators in their nets and claimed they reduced the loss.

The duo worked with Cliff Goudey, a marine engineering specialist of the Massachusetts Institute of Technology Sea Grant College Program, and a New England netmaker to run the tests and exchange ideas.

"We learned a lot," Bahen says. "We learned some techniques for fine-tuning the [excluder] opening and ways to minimize loss."

For bottom-extruding excluders, Bahen and Parrish found that floats need to be added to the headrope to lift the tailbag and extruder opening off the bottom. This change could make for an easier escape by the cumbersome sea turtles.

And, they found that exit holes could be sewn tighter to reduce shrimp loss but still allow turtles to exit.

Overall, Bahen and Parrish observed that top-extruding TEDs allowed too much shrimp loss. The force of water that swept across the top of the net gapes open the extruder hole, permitting shrimp to escape.

Now Bahen and Parrish will make some modifications in the TED designs to test this summer aboard *The Georgia Bulldog*, a boat operated by the Georgia Sea Grant College Program.

The National Marine Fisheries Service's Beaufort Laboratory is conducting research on sea turtles, and they need your help.

NMFS has distributed posters requesting beachgoers to report any sea turtle sightings. The posters contain pads of removable postcards for noting the date, location and species of turtle you see, whether the turtle was alive or dead, and whether it had been tagged.

If you're at the coast, look for the posters in the N.C. Aquariums, the N.C. Maritime Museum, dive shops, fish houses and bait and tackle shops.

Six species of Atlantic sea turtles are endangered. They include the Kemp's ridley, leatherback, hawksbill, olive ridley and the Florida breeding population of green sea turtles. All but the olive ridley have been spotted in North Carolina waters.

But the role of North Carolina's waters in sea turtle ecology is poorly understood. The NMFS project to obtain data on sea turtles here began in 1988. They want to know what turtle species inhabit Tar Heel waters and where they are commonly found.

If you see one of the NMFS posters, be sure to take one of the postcards. And if you see a sea turtle, dead or alive, and don't have one of the data cards, make some notes about the sighting, then call the NMFS Sea Turtle Project Coordinator at 919/728-3595.

If it's May, fishermen must be shedding blue crabs in coastal North Carolina. May is the month when virtually all blue crabs slip out of their hard exoskeleton. For a few hours, the crab becomes entirely soft and edible when cooked.

Blue crabs shed their shells to grow, but females must molt to mate. Females only reach sexual maturity during the last molt of their life. It's this mating response that makes soft crabs so numerous in May, especially around the full moon, crabbers say.

First the males shed in late April or early May. Then the females molt one to two weeks later, and the pair mates. If all goes as scheduled, the female carries the resulting eggs during the summer and releases them near the inlets in the early fall.

But some crabs don't adhere to the schedule. They mate later during the summer. Then, the female often carries the eggs throughout the fall and winter until the next spring before releasing them.

Although May is usually the month when shedding is at its peak, Mother Nature can rush the schedule if the weather warms earlier. And molting usually peaks a week to 10 days earlier in the southern and central coastal areas, says Wayne Wescott, a Sea Grant Marine Advisory Service agent.

But no matter when North Carolina crabs shed, they are always ahead of their northern neighbors in the Chesapeake. And this affords crabbers a top-dollar value for their soft crabs.

North Carolina crabbers also get the jump on another soft crab market—the one for "roaches." Small soft-shell crabs from 1½ to 3 inches wide are called roaches, and they are used in an exclusive hors d'oeuvres market in the North.

Crabbers find these roaches, also called "walk-ins," in their unbaited peeler pots during the very first days of spring. After crabbers shed the small crabs, they ship

continued on next page

them to New York, Baltimore and Boston, where they are the first fresh, live soft crabs on the market. Consequently, the crabs can bring up to $28 a dozen.

Sea Grant has computerized its mailing lists and publications inventory. The new system should help us process your requests more efficiently.

You can help us by providing your customer identification number when you order publications. The number appears just above your name on your *Coastwatch* mailing label.

Coastwatch is published monthly except July and December by the University of North Carolina Sea Grant College Program, 105 1911 Building, Box 8605, North Carolina State University, Raleigh, N.C. 27695-8605. Vol. 16, No. 5, May 1989. Dr. B.J. Copeland, director. Kathy Hart, editor. Nancy Davis and Sarah Friday Peters, staff writers.

Browsing the Sea Grant Bookshelves

What would summertime be without seafood? This month, the Sea Grant bookshelves feature a few of our most popular seafood selections.

To order, write Sea Grant, Box 8605, NCSU, Raleigh, N.C. 27695-8605. Make checks payable to UNC Sea Grant. Indicate the publication numbers and include your customer identification number located above your name on your *Coastwatch* mailing label.

Seafood Poster colorfully charts the availability by month of the state's most popular fish and shellfish. UNC-SG-84-04; $2.

Recipes with a New Catch includes recipes for cooking 16 species of nontraditional fish—shark, triggerfish, bluefish, amberjack and more. UNC-SG-86-06; 40 pages; $2.

Hooked on Fresh Fish and Shellfish describes methods for determining seafood freshness. UNC-SG-85-08; 50 cents.

Bringing the Catch Home describes how to handle, prepare, transport and store fresh fish. UNC-SG-86-26; 50 cents.

Dressing Finfish illustrates methods for cleaning the catch. UNC-SG-86-10; 50 cents.

Flaking Fish shows how to flake fish for use in seafood dishes. UNC-SG-87-05; 50 cents.

Cracking into Crustaceans provides illlustrated instructions for cleaning shrimp and hard and soft crabs. UNC-SG-88-01; 50 cents.

Breaking into Bivalves provides illustrated methods for shucking oysters, clams and scallops. UNC-SG-88-02; 50 cents.

Coastwatch

105 1911 Building
Box 8605
North Carolina State University
Raleigh, NC 27695-8605

Nonprofit Organization
U.S. Postage
P A I D
Raleigh, NC
Permit No. 896

ADDRESS CORRECTION REQUESTED