UNC Sea Grant

August 1986

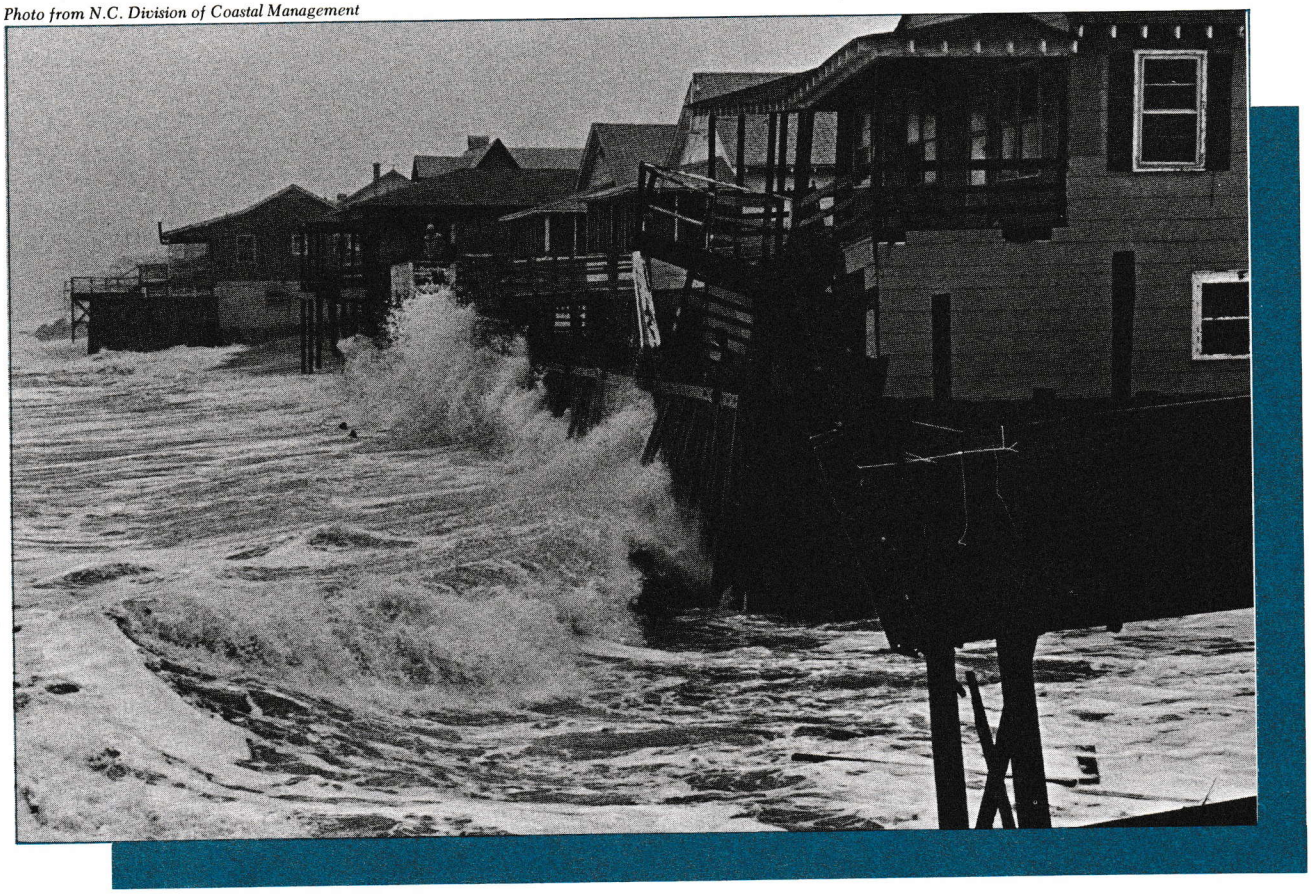
COAST WATCH

A force that can bring down the house

HURRICANE

Layout by Linda Noble; photo by Spencer Rogers

Photo from N.C. Division of Coastal Management



A PROFILE OF Destruction

Hurricanes pose a greater threat to coastal North Carolina today than ever before.

No more intense or more frequent than 20 years ago, hurricanes simply have more homes, condominiums and buildings to slam into.

Billions of dollars in real estate stand vulnerable. Each new house or condominium makes the stakes higher.

Even a mild hurricane such as Diana in 1984 caused over $70 million in damages.

This month, *Coastwatch* wants to help coastal homeowners reduce the risks from hurricanes. This issue examines storm-resistant building techniques and building code standards for coastal construction.

But no home can be made hurricane-proof.

That's why you should heed warnings to evacuate.

Do what you can to reinforce your home. But leave your house to fend for itself when a hurricane approaches.

Here's what your house will be up against.

The winds. The very definition of a hurricane says the winds exceed 74 mph.

Researchers say the ratio of wind speed to damage goes like this: At 50 mph, minor wind damage can occur. When winds exceed 80 mph, expect the loss of windows, shingles and gutters. At velocities over 100 mph, entire roofs and other structural elements are susceptible to damage.

But even more important, hurricane winds can launch a destructive barrage of missiles—lawn chairs, signs, roofing and metal siding.

The storm surge. It is the rise in water level that occurs as the hurricane moves onshore. It does not include the waves that ride atop it.

This dome of water, which can exceed 15 feet, is a hurricane's most destructive force.

The surge can undermine houses by scouring away sand. And it can tug and pull at walls, pilings and foundations, causing them to collapse.

The waves. Hurricane waves can reach 35 to 40 feet in height.

But that's only half of it.

Water weighs about 1,700 pounds per cubic yard. Throw that weight against a building over and over, and you have a nature-made hammer that can demolish any structure not specifically designed to withstand such force.

Add them up—winds, waves and storm surge—for a destructive combination called hurricane.

Diana

The Sound and The Fury

By Sarah Friday

She was no lady. But Marcus Rich will never forget her.

From his home in Wilmington, he watched her run her mighty fingers through the pines; marveled at her wanton power.

Her breath was like a freight train's whistle charging across the land.

He'd never met a lady like this. And it left him scared.

Photo from National Oceanic and Atmospheric Administration

The lady was Diana, the fourth hurricane of 1984. Her visit to the Carolina coast convinced Marcus Rich that homeowners can run from a hurricane, but their homes can't.

When Rich began construction of a new home last year, he used building techniques designed to increase the chances that his home could survive next time.

Hurricanes are inevitable. But the extent of the damage left behind may depend on a few simple, but fortifying building practices, says Spencer Rogers, Sea Grant's coastal engineer.

Rogers helped Rich decide just where those fortifying touches were needed.

"A lot of it's just overlapping—using a little more wood, a few more nails," says Rich. "It didn't make much difference financially, but it did structurally."

The whole idea behind making a house storm-resistant is making sure it's well connected. Houses near the coast should be tightly

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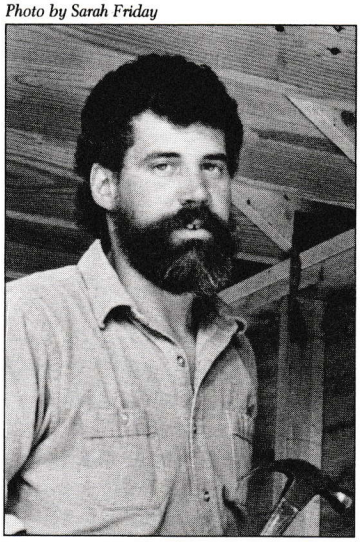
Photo by Sarah Friday



Marcus Rich (above); Hurricane Diana as she swirled landward in 1984 (left)

A CONSTRUCTION CHECKLIST

Any coastal home, new or old, can be made storm-resistant.

A little added effort and a few extra dollars could save you thousands of dollars in repairs after the hurricane.

If you're planning to build a beach house, consider the following tips before choosing a lot.

- Erosion. On the average, 3 feet of the state's shoreline erode each year. In truth, some areas develop 7 or 8 feet of sand; others erode 15 feet or more. To find the erosion rate for a specific area, check with an N.C. Division of Coastal Management permit officer.
- Inlets. Beware of building near inlets. One hefty storm can close or open an inlet, and inlets are always shifting.
- Dunes. Choose a lot that has dunes and vegetation. Natural shoreline protection can reduce the impact of storm waves.
- Storm surge. Know the highest storm surge level recorded for your area. Records are available from local building inspectors. These flood maps show water levels and should not be used to gauge erosion.
- Flood insurance. Check to see if your community qualifies for Federal Flood Insurance. Flood damage is not covered by normal homeowner's insurance. But you may obtain coverage for floods from your insurance agency if your community meets federal standards. Buying flood insurance early may lead to better financing.
- Building regulations. Before designing your home, know the regulations that govern coastal construction. Check with the building inspector in your area for local housing ordinances and state building code requirements. If you're buying beachfront property, see a Division of Coastal Management permit officer for setbacks—the distance the house must be "set back" from the beach.

In addition to the building code requirements, consider the following storm-resistant building techniques. Rogers says these techniques can be used during construction or later to reinforce an older home.

- Roofs. Do not allow roof overhangs to jut more than 2 feet beyond the house. Long overhangs can allow hurricane-force winds to rush underneath and lift the roof.
- Connections. Reinforce connections between the roof and walls and between walls and the foundation with stainless steel straps or wooden wind anchors. "Toenails," or nails driven diagonally through perpendicular boards, are weak connections that can fail in a hurricane.
- Corrosion. Stainless steel straps and wooden wind anchors are corrosion-resistant. Along the beach, corrosion can destroy regular metal straps in three to five years. (For more information about wooden wind anchors, ask for Blueprint UNC-SG-BP-84-3).
- Windows. Install windows that will keep out blowing rains. Add storm shutters to protect the windows from flying debris.
- Roof vents. Cover roof vents, especially in gabled roofs, to keep out blowing waters from high winds.

secured from the pilings to the roof.

Rich's house was on high ground and did not need pilings. So the crew started with the foundation.

They set three layers of concrete blocks for the foundation and poured concrete through all of them. They screwed long bolts down the middle to make the blocks stand firm.

They completed the frame of the house, then sheathed it entirely in plywood. Usually, builders use plywood only at the corners for reinforcement. But the sheets better protect the frame, and it should hold up when Rich's house faces 100 mph winds again.

Inside, Rich used metal straps to connect the roof frame to the second-story walls. Rogers recommends wooden wind anchors or stainless steel straps as sturdy, corrosion-resistant alternatives.

Outside, Rich plans to add functional shutters on all the windows. During Diana, he put plywood over the windows in his old house to keep them from shattering.

"That was a lot of trouble," Rich says. "Shutters will do a better job."

These tips and regulations are the minimum standards for protecting your house, Rogers says. Anything extra you do will increase the chances that your home will survive a hurricane.

The Carolina Code

A better foundation for construction in coastal North Carolina.

By Kathy Hart

A hurricane named Hazel slammed 120 mph winds and a 15-foot wall of water against North Carolina's southern beaches Oct. 15, 1954.

On Long Beach, only five of 357 buildings were left standing.

Five other hurricanes followed in the next six years. Each took its toll on coastal homes, and each delivered a lesson.

Coastal structures weren't built to withstand the fury of hurricanes. Even strong northeasters posed a threat.

After Hurricane Donna in 1960 and the Ash Wednesday northeaster in 1962, the N.C. Building Code Council realized that a different set of standards was needed for coastal construction.

Six years later, North Carolina became one of the first states in the nation to set up guidelines for coastal residential construction. The guidelines were optional and applied only to homes built on the Outer Banks or east of the Intracoastal Waterway.

They called for:

- pilings to be sunk 8 feet in the ground,
- the floor foundation to be 2 feet above the site's highest recorded storm surge, and
- the building to be strongly connected from the top of the roof to the bottom of the pilings.

It would be 18 years before the guidelines would become mandatory. But homeowners and builders began to comply. They mounted their houses on pilings, sunk the pilings deep into the sand and tied roofs to walls and walls to foundations.

"The image of the typical beach house changed," says Spencer Rogers, Sea Grant's coastal engineering specialist.

"People wanted to buy beach houses elevated on pilings with underhouse parking because that was their idea of what a beach house looked like on the North Carolina coast. They probably didn't connect that image with hurricanes. But at least they were making the right choice."

North Carolina building codes were years ahead of the rest of the nation, Rogers says. It was the mid-1970s before the Federal Flood Insurance Program coerced coastal localities nationwide into tougher building requirements.

But Rogers saw ways that the North Carolina code could become even bet-

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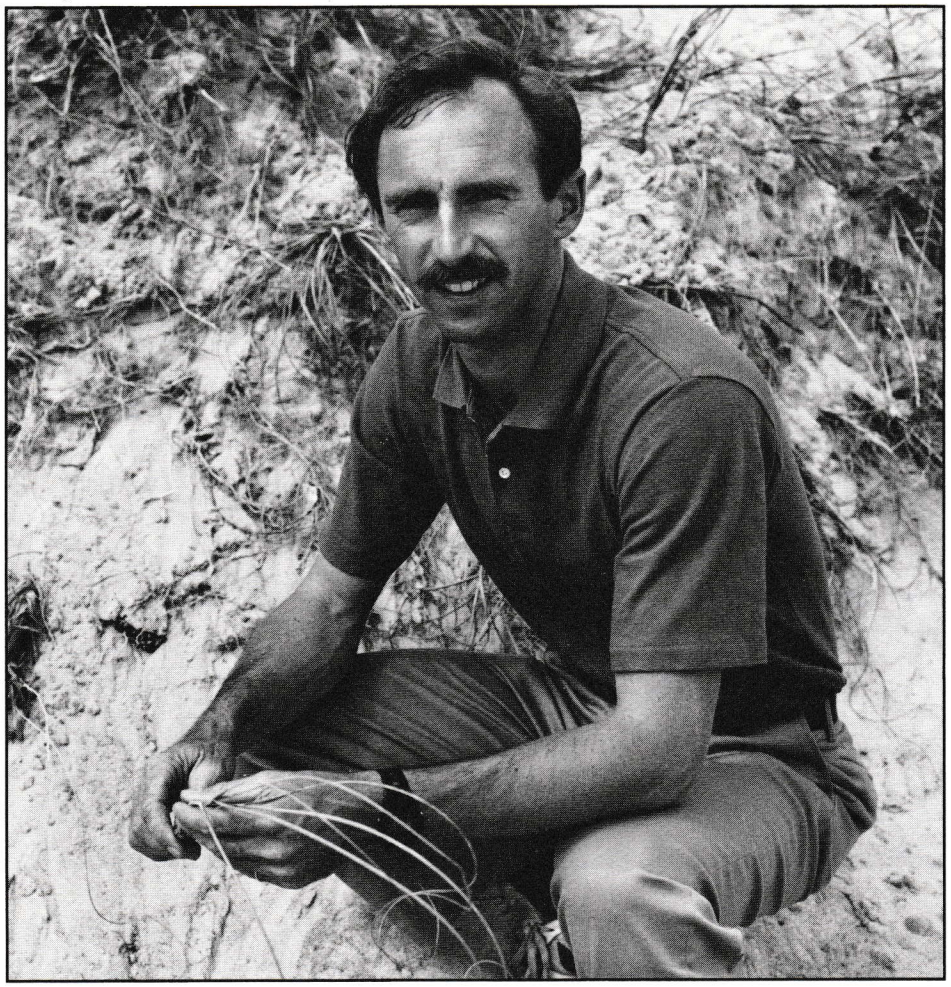
Photo by Allen Weiss



Spencer Rogers

ter. In 1980, he worked with the building code council to remedy a problem he saw frequently in coastal houses—overnotched pilings.

To connect the floor foundation to the piling, builders often sawed out a large section of the piling's top to create a ledge for the floor joists. In strong winds, these notched pilings snapped, and the house fell.

The council changed the code. Now, no more than 50 percent of the piling top can be cut away.

In 1983, the council decided to revise the coastal construction standards.

Rogers helped draw up changes that would make coastal homes stronger. "The old code was pretty good for most buildings," says Rogers. "But it had some weaknesses.

"Sinking pilings 8 feet in the ground is a good standard. But for erosion-prone beachfront areas, 8 feet is not enough."

Other construction techniques, such as bracing buildings with plywood, became standard. But the practice, which resulted in a more secure building, was not part of the building code.

And Rogers opened the council's eyes to the effects of corrosion on coastal construction.

Corrosion can weaken the metal straps and joists hangers used to strengthen building connections against hurricane-force winds.

The day the recommendations were delivered to the council, Hurricane Diana began churning the waters off the North Carolina coast.

The building code was hours away from its first test.

Diana pushed ashore with 100 mph winds but very little storm surge. Afterward, Rogers joined homeowners, building inspectors, insurance adjusters and designers in inspecting the damage.

"Out of several thousand buildings, only 136 were observed and inspected with structural damage," Rogers says.

In contrast, a hurricane of similar intensity, Alicia, made landfall at Galveston Island in Texas in 1983. There, about 35 percent of the 3,000 houses located in the West Beach community were destroyed beyond repair.

Federal flood insurance standards required West Beach buildings to be built above the anticipated storm surge. But few other construction regulations were enforced.

North Carolina's rigorous standards clearly made the difference. But Rogers cautions that Diana was an easy test.

The building standards were designed for 120 mph winds.

"Diana's estimated winds of 90 to 100 mph provided only 70 percent of the actual design conditions," Rogers says. "The extra 30 percent would have undoubtedly caused more severe damages."

Even after the good news from Diana, the council revised the building standards and made them mandatory as of Jan. 1, 1986.

The code now requires beachfront homeowners to sink pilings 5 feet below sea level or 16 feet below ground level, whichever is more shallow.

In addition, the code instructs contractors to frame buildings with plywood and to take into account the effects of corrosion.

"We're pleased with the code as it stands now," says Jess Allred, chief code consultant for the N.C. Department of Insurance. "It's not foolproof. Every house can't stand up to every hurricane, but the majority of them should stand the test."

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, NCSU, Box 8605, Raleigh, N.C. 27695-8605.

It's 95 degrees. The sun shoots its scorching rays down on you like a .44 Magnum. It blazes your skin and burns your eyes.

The laser-like rays have the same effect on your eyes as on your skin, doctors say. To prevent problems, sun-seekers should take similar precautions with their eyes.

A new Sea Grant Blueprint, *The Sun and Your Eyes,* offers practical eye care advice for fishermen, lifeguards or others who spend their days in the sun. It includes methods for soothing sun-strained eyes, tips on buying sunglasses and a list of sun-related problems that can occur.

For a copy of this free, one-page guide, write UNC Sea Grant. Ask for UNC-SG-BP-86-2.

When the first tropical storm was named earlier this year, the telephones at the National Weather Service began ringing. Folks were calling a number set up by the National Weather Service to find out more about Andrew.

For the latest tropical storm and hurricane advisory, you can call 1-900-410-NOAA. A recording by a forecaster from the National Hurricane Center in Coral Gables, Fla., will give you an update on the storm.

Each call will cost 50 cents for the first minute and 35 cents for each additional minute.

The system will only be activated when there is a named tropical storm or hurricane.

It's hurricane season again. And this could be the year when another Hazel strikes our coast.

Will you be prepared?

To make sure, send for *About Hurricanes, what to do and when to leave.* The brochure tells you what to expect when a hurricane strikes, how to plan ahead, what to do if one is forecast, and what to do after the storm.

The brochure also includes a large tracking map that can be used to follow the progress of the season's hurricanes.

For a free copy, write Sea Grant. Ask for *About Hurricanes.*

Sea Grant and the N.C. Bar Association will present a conference on coastal environmental laws and procedures Oct. 3 and 4 at the Crystal Coast Civic Center in Morehead City, N.C.

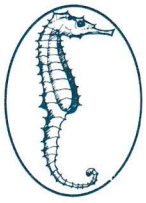
The one-and-a-half day program will focus on laws and regulations controlling development, especially those related to water quality, wetlands and public trust areas.

The first day, participants will discuss a case study representing a major coastal development project. The study raises many issues encountered in coastal development.

The second day's agenda focuses on the administrative process. Topics include how regulations are made, how the public may become involved in rule-making, and what remedies are available to parties affected by enforcement (or lack of enforcement) of regulations.

Hotel accommodations are available at the Holiday Inn in Atlantic Beach, and at the Lord Carteret in Morehead City. Reservations should be made before Sept. 19.

For tuition rates or more information, contact Jim Hatch, Office of Continuing Legal Education, N.C. Bar Association, P.O. Box 12806, Raleigh, NC 27605 (919/838-0561). Or contact Walter Clark at Sea Grant.



Teach a youngster about the marine environment.

Coastal Capers is a booklet written and designed to help teachers, parents and scout leaders educate children 5 to 11 years old about the coast.

Through a series of 20 fun but educational "capers," adults can open a child's eyes to the buoyancy of salt water, the differences in sand and the art in shell shapes.

Written by Sea Grant marine education specialist Lundie Spence and teacher Vivian Barbee Coxe, the capers take complicated concepts and make them easy and fun to learn.

For instance, teach kids about the food web. All it takes is a group of enthusiastic youngsters, several balls of different colored yarn and a little knowledge of what creatures eat.

Or how about teaching 8-year-olds the concept of overfishing and resource management. It takes only a bowl and several bags of goldfish crackers.

Coastal Capers is chocked full of art that can be reproduced with a photocopy machine.

For a copy of the booklet, write Sea Grant. Ask for UNC-SG-84-05. The cost is $3.50.

The National Coastal Resources Research and Development Institute in Newport, Ore., is accepting proposals for research projects. The center funds multi-disciplinary studies of coastal and marine problems.

Research proposals should be national in scope, demonstrate a high potential for success and show that the research will benefit the economies of coastal regions.

Sea Grant Director B.J. Copeland and Sea Grant researcher Mike Orbach are on the institute's 15-member advisory board.

For copies of proposal forms, write Joye Stephenson at Sea Grant.

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Thirty feet beyond the shore, the water turns a deep, dark blue. The waves break haphazardly and send floating objects out to sea. A powerful tugging force lurks beneath the surf, hidden from unsuspecting swimmers.

Rip currents can be deadly. But with a little know-how and a level head, victims can swim to safety.

A new Sea Grant poster describes the currents, how to spot them, and what to do when caught in them.

The poster is free. Write Sea Grant and ask for UNC-SG-86-09.

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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 8605, NCSU, Raleigh, N.C. 27695-8605.

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To help us specialize our services, please answer these questions.

I am in the following line of work:

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__City/County government	__Marine recreation
__Commercial fishing	__Mass media
__Educator	__Seafood processing/marketing
__Farming	__State government
__Homemaker	__University professor/researcher
__Lawyer	__Other _____

Coastal property owner __yes __no Boat owner __yes __no

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