The formation and evolution of barrier islands (cont from website)

The low-lying, flat shorelines of most of the east coast were created by the rising and lowering of sea levels during glacial periods. At various times, the coastline was much farther inland, creating a seashore that ran through today's Philadelphia, PA, Washington, DC, Richmond, VA, Raleigh, NC, and Augusta, GA. All of Florida, Mississippi, Louisiana, and most of Alabama were underwater. At other times, the oceans were so low that the shoreline was many miles farther out on the continental shelf than it is today. These variations were all the result of glacial action.

Glaciers are formed by the accumulation of snow in northern areas that doesn't melt in the warmer months of the year. As the earth's temperatures cooled, glaciers increased in size and spread down from the Arctic, pushing rocks and debris south, carving out valleys and shaping hills. Then they melted and retreated during warmer periods, and they shaped the land and the shorelines of New England as they receded. Although glaciers did not reach South Carolina, they had a profound impact on our shores. Over several million years, the sea levels were rising and falling as the earth's temperatures fluctuated. Wave action acted as a slow broom, sweeping the sands, rocks, and sediment back and forth and flattening the coastal plain and the shoreline. Sand is kept in motion by the waves, and the sweeping motion occurs three to six miles from the beaches, sometimes 60 feet deep. We can think of barrier islands as the remains of the most recent dunes created by the rising seas.

The sand on the beach at Hunting Island was deposited by ancient rivers that brought sediment far out to sea when the oceans were lower. That sand is drawn up by wave action from where it was deposited on the continental shelf at depths of up to 300 feet. The closer it gets to the beach, the stronger the wave action, and the more sand is pushed up onto the beach. A mineral analysis of sand shows that it is primarily comprised of quartz and feldspar, as well as some heavy minerals that originated in the Piedmont. The farther south the beach is, the more it is made of broken shells or calcium carbonate. Miami Beach is about 50% ground up shells that are up to 13,000 years old. Some beaches in the Florida Keys and Puerto Rico are 100% calcium carbonate.

In addition, we find that some of the animal material making up the sand derives from inland water- based oysters. This supports evidence that the seas have moved. When sea levels were lower, oyster beds would have been on the seaward side of today's barrier islands, even though they were on the inland side of ancient islands, dunes, and beaches. Remnants of those beds still can be found in the ocean and in our sand today.
Why barrier islands move

As one of the fastest eroding barrier islands on the east coast, Hunting Island is an example of the dynamic forces at work on barrier islands. The most permanent feature of any sea and shoreline is the presence of waves. Waves are created in three ways: wind, earthquakes, and the gravitational pull of the sun and moon. Waves are not just water moving; they are primarily energy moving. This can be illustrated by a bather in the ocean who ducks under a wave to keep from being swept to shore. Beneath the surface of the water, suspended seaweed, grasses, and sand are not rushed to shore with the wave, but instead they make an orbital motion that the bather's body would have felt also.

As a wave approaches the shore, it touches bottom and when its height is about four fifths of the depth below it, it begins to break. The higher the wave, the more energy it expends on the beach. A steep high wave will create a sudden backwash that sucks the sand off the beach. A flatter, tumbling wave will spread itself out over a greater area on the beach and the sand suspended in the wave is more likely to stay on the beach. In the winter, the beach will seem to be smaller, because the larger waves of the fall and winter storm seasons pull a lot of sand off the beach. But usually the spring waves are not as powerful, and they tend to bring sand back up on the beach, giving us a good wide beach for summer activities.

In addition to waves, there are tides that are created by the pull of the sun and the moon on the earth's seas. The moon has the greatest effect because it is closer. There are two high tides and two low tides every day. Every 27.55 days, or approximately every month, the moon comes its closest to the earth. This is called its "perigree." Tides rise the highest at this time. Twice every 29.53 days, the sun,

moon, and earth align in what is called “syzygy” (siz-i-gee). The tides created by syzygy are called “spring tides” because they seem to spring up. (They occur year-round, not just in the spring.) Once every year and a half, the perigree and syzygy will exactly coincide. This is called “proxigee.” At this time, the tides rise faster and the currents run stronger.

If these higher than normal tides coincide with a hurricane or even a minor storm, significant change can Take place on the barrier islands. Port Royal Sound has the highest tides in the Lowcountry—8-8.5 feet.

In addition to waves and tides, the beach is affected by longshore and littoral currents. Bathers are often carried down the beach by these currents. Currents are created by waves approaching the beach obliquely—at an angle. When large amounts of sand are moved from one section of the beach to another, it is usually the work of the longshore currents. The result is the creation of new sandbars and movement of sand behind barrier islands into the salt marshes. The ideal angle to transport sand is 30 degrees. Sand captured by the currents moves until the current’s energy is depleted by inlets, submarine canyons, bars, and rock outcrops. Humans attempt to control the movement of sand with structures such as sand fences, jetties, and groins. Sand fences allow some sand to sift through, while reducing the wind velocity and trapping most sand on the windward side.

During hurricanes and storms, a lot of sand is moved in and around a barrier island. Waves find the easiest route to move the sand, including places where paths have been opened through the dunes and through inlets or channels. Sometimes new inlets will be cut that connects the sea to a lagoon behind the island, creating a new island. This is what happened in October 2016 when Hurricane Matthew hit Hunting Island. In addition to sweeping away significant portions of the beach (as well as parking lots and bathhouses), a breach occurred between the ocean and the lagoon creating a new island on the south side of Hunting Island. New or larger sandbars emerged from the hurricane at the head of channels. During these events, sand is also washed behind barrier islands adding material to the salt marshes and estuaries. You often can see many sandbars at both ends of Hunting Island; they are identified by waves breaking far outside the beach.

Wind is another important factor in moving islands. Something as tiny as a blade of grass can stop a piece of blowing sand and increase the height of a dune and eventually create an island. A log on the beach will soon accumulate windswept sand. Over time, new dunes or islands will form from the reshaping of the old barrier island. During the reshaping, sand is moved from one area to another in a natural process. Houses built near the shore may be swept away, and sometimes entire towns are wiped out during storms as the beaches are reshaped.

Because Hunting Island is so susceptible to movement, the lighthouse had to be rebuilt a mile and a quarter from its original position. Now the area where it stood has become ocean. At one time, Cabin Road on the south side of Hunting Island extended well beyond its current location and had many more cabins, but it too was relocated by the sea—much of it lost during Hurricane Matthew. Asphalt remnants of the road remain in places south of South Beach.
Ecosystems of a barrier island

Hunting Island is comprised of eight different interdependent ecosystems:

The ocean—Ocean water is very saline—saltier than tears or sweat.
Evaporation continuously removes fresh water but the salt remains in the ocean. The sea off the South Carolina coast is often murky or brown. That is because it is fed by many sounds, bays, and marshes along the coast which greatly increase the nutrients in the ocean. The rich organic "soup" off Hunting Island supports a large variety of sea creatures.

The beach—A beach is the continuously changing point where the land meets the sea. Hunting Island Beach has a history of extreme erosion, and in many places, the remains of trees that were once part of the maritime forest have created a "boneyard" on the beach. Yet the beach is an active place, with shorebirds hunting for smaller creatures, turtles crossing it to nest in the dunes, and crabs burrowing into the sand.

The dunes— Dunes are created through decades or centuries of sand accumulation, and they become more resistant and resilient to storm activity as the plants on them increase in size and root depth. Sea oats are protected by the state of South Carolina because of their importance in securing the dunes. Hunting Island's dunes are constantly under assault from the waves and tides. Most of the dunes were swept away during Hurricane Matthew, but they will rebuild gradually over many years. Hopefully, they are not under assault from beach-goers too.

The lagoon—Hunting Island's lagoon inlet was created in 1968 when sand was dredged and pumped to the nearby beach in a renourishment program. This provided a channel to a deep-water refuge for many species of fish, including spot, croaker, seatrout, and flounder. Since Hurricane Matthew, the lagoon has two openings to the sea.

The marsh islands—Small islands, also called hummocks or hammocks, form at the mouths of creeks from sediment accumulation or from very old dunes. They are surrounded by the salt marsh on the back side of islands such as Hunting Island.

The salt marsh—Located on the west or land-ward side of Hunting Island, on your right as you drive from Beaufort, the salt marsh is a very large nursery for sea creatures. A vast system of tidal creeks interlaces the marshes, transporting nutrients and living organisms with every tide change. The sheer quantity of nutrients in the salt marsh makes it one of the most productive habitats on earth.

The maritime forest—Climax maritime forests, such as Hunting Island's, are established after the early successional landscape has evolved. Mature maritime forests are recognized as essential for the stability and persistence of barrier island ecosystems because they have many mutualistic species that provide extensive root systems to anchor the soil, improve water and nutrient absorption, and help establish future growth. Hunting Island's forest is dominated by oak, palmetto, and pine.

The freshwater wetlands—Although it has diminished in size, a 20-acre fresh water wetland has been part of Hunting Island ecology for several centuries. It's an important environment for migrating and wintering waterfowl.

Ecological importance of barrier islands

The Beaufort Barrier Islands were designated one of the global Important Bird and Biodiversity Areas (IBAs) in 2014 by the Audubon Society and BirdLife International, a worldwide initiative to identify and protect critical sites for bird conservation. Hunting Island is included because of a very large number of shorebirds, seabirds, and wading birds that live, winter, and migrate in the area including some endangered species. The Beaufort Barrier Islands IBA includes 10,000 acres of pristine salt marshes. IBA sites are monitored globally to determine the overall health of the biosphere. Monitors look for bird population declines, threats, and protection plans. Like the canary in the coal mine, birds are one of the first indicators that an ecological area is in trouble. Fortunately, Hunting Island has seen an increase in several threatened or endangered bird species in recent years, including bald eagles and wood storks; whereas least terns and piping plovers seem to be losing habitat on the island as erosion takes more beach.

Conserving IBAs is important for the protection of species diversity on the planet. Much of the US has been converted to monocultures primarily for agricultural use. Forests have been razed, prairies have been plowed, and wetlands have been filled in. In place of bountiful, multi-species ecologies, like Hunting Island, we have corn and soy mono-cultural fields supported by petroleum-based fertilizers and pesticides. Habitat for wildlife has been lost in three primary ways: destruction (bulldozing, mowing, cutting trees, draining wetlands), fragmentation (roads, dams, etc.), and degradation (pollution, and invasive species.)

Biodiversity is important because humans depend on biological resources for food, medicine, wood products, and recreation areas. Healthy, diverse ecosystems can better withstand natural disasters, pest and disease infestation, and climate change than monocultures. They contribute to climate stability, breakdown of pollution, nutrient storage, maintenance of ecosystems, and protection of water resources.

As the only undeveloped, publicly-accessible barrier island in South Carolina, Hunting Island is an important experiment. Here we can discover ways that humans can enjoy and benefit from an ecosystem while protecting it from destructive forces. We can’t do much to stop the waves and the winds from moving the sand

around, but we can help prevent the loss of species through programs like the Turtle Conservation Project and the Christmas Bird Count.