Barrier Island Migration

STANDARD COURSE OF STUDY CORRELATIONS:

Earth/Environmental Science, Grades 9-12, Goal 1: The learner will develop abilities necessary to do and understand scientific inquiry in the earth and environmental sciences.

1.02 Design and conduct scientific investigations to answer questions related to earth and environmental science.

Earth/Environmental Science, Grades 9-12, Goal 3: The learner will build an understanding of the origin and evolution of the earth system.

3.02 Evaluate the geologic history of North Carolina.

Earth/Environmental Science, Grades 9-12, Goal 4: The learner will build an understanding of the hydrosphere and its interactions and influences on the lithosphere, the atmosphere, and environmental quality.

4.03 Analyze the mechanisms that produce the various types of shorelines and their resultant landforms:

- Nature of underlying geology.
- Long and short term sea-level history.
- Formation and breaking of waves on adjacent topography.
- Human impact.

Biology, Goal 5: The learner will develop an understanding of the ecological relationships among organisms.

5.03 Assess human population and its impact on local ecosystems and global environments:

- Historic and potential changes in population.
- Factors associated with those changes.
- Climate change.
- Resource use.
- Sustainable practices/stewardship.

MATERIALS

Per group

- Stream table or shallow tray (e.g., aluminum roasting pan)
- Sand
- Modeling clay
- Wood blocks for creating waves
- Fan to create wind
- Craft sticks, wood scraps, rocks, etc., to mimic hard structures
- Water

Per student

- Viewing Guide

PREPARATION

- This activity may require more than one class session. You will be giving each group of students an assortment of material, with which they will devise their own design and investigation of a barrier island. They can use wood blocks to create waves, fans to create wind and craft/building materials to make barriers. This activity may involve a lot of trial and error, so be flexible with time. Because the activity is messy, you may want to work outside. If your school has video cameras, you might have students record their experiments to play back in slow motion to analyze their experiments closely.

INTRODUCTION TO LESSON: Students will increase their understanding of barrier island dynamics by building models of barrier islands and investigating the effects of simulated waves, wind and hard structures on their model islands.

BACKGROUND FOR TEACHER: Barrier islands are dynamic. The geologic record shows that they are short-lived, continuously affected by storms and rising sea level. When humans try to build permanent structures on these dynamic islands, a conflict results: The islands keep trying to "roll over," and humans keep trying to make them stay put. To protect barrier islands as a natural resource, North Carolina lawmakers enacted the Coastal Area Management Act (CAMA) in 1974. The purpose of the law is to protect the islands by managing development. CAMA prohibits "hard stabilization" of beaches, such as through construction of jetties, groins or seawalls.

engage Ask a few questions to introduce the concept of barrier islands: How many of you have visited a North Carolina beach? In North Carolina, beaches are barrier islands. What do you think a barrier island is? How might barrier islands have looked when Europeans first settled North Carolina? Did they appear different than they do today? What forces work to change the islands? Tell students that they are going to watch a video to learn about barrier islands and then design an investigation of barrier island dynamics using models. Show the video and have students answer the Viewing Guide questions. If time is short, show the first 11 minutes.

For a follow-along viewing guide for students, see Viewing Guide 20.

Cape Hatteras photo courtesy of N.C. Division of Tourism, Film and Sports Development.

explore

- Recap with students how barrier islands move.
- Divide class into groups and distribute materials. Tell students that they will design an experiment to investigate the effects of a physical factor on a model island that they build. They are to predict how the factor will affect their island. Before they begin, have them explain their plans for measuring their results and collecting data.
- Each group is to use the materials to build a model barrier island in a stream table or other kind of watertight tray. Students may make simple islands or build more accurate models.

explain

Write the words *jetty*, *groin* and *seawall* on the board and review the definitions (definitions and other information can be found at http://www.nature.nps.gov/geology/coastal/human_impact.cfm#S and http://www.ncsu.edu/coast/shell/terms.html#inlet). You might draw simple illustrations beside the words (e.g., an oval for the island and a line to show a jetty's orientation). Explain that property owners and beach communities sometimes try to control erosion by building protective structures parallel or perpendicular to the beach. Because the presence of hard structures affects the normal movement of sand, it can exacerbate erosion in neighboring areas, disrupting island dynamics. Building new hard-stabilization structures on North Carolina beaches is now prohibited.

elaborate

- Have student groups choose a form of hard stabilization and predict its effect on the island. Have them build the structure on their island and conduct an investigation to see if it changes how the island behaves.
- Have each group demonstrate its structures for the class.

evaluate

- Have each group describe its investigation and results to the class.
- Have students write a lab report that includes their predictions, their data and their conclusions.
- Have students discuss the challenges of measuring the impacts on their model island. Ask them what they would change about their data collection if they were to repeat the activity.

Teacher's Notes:

BEYOND THE CLASSROOM

Plan a field trip to view barrier island processes. The North Carolina Coastal Reserve/National Estuarine Research Reserve offers tours and outreach presentations. It hosts a variety of educational programs for K-12 school groups, including hands-on activities such as seining for fish, conducting shore profiles or testing water quality. For more information, visit http://www.nccoastalreserve.net/Education/7.aspx. To find specific reserve sites to visit, visit http://www.nccoastalreserve.net/.

Additional Resources:

Guide to Coastal North Carolina Barrier Island Dynamics • http://ncnatural.com/Coast/dynamics.html

Engineering Impacts on the Coastal Environment • http://www.nature.nps.gov/geology/coastal/human_impact.cfm#S

Simple beach profile • http://www.cofc.edu/CGOInquiry/hurricanes.htm • http://www.salemstate.edu/~lhanson/gls214/gls214_barrier_isl.htm • Diagrams and detailed explanations of dynamics.

The North Carolina Shore and its Barrier Islands: Restless Ribbons of Sand (Living with the Shore). Pilkey, Orrin, et al. 1998. Durham, N.C.: Duke University Press.

Ribbon of Sand: The Amazing Convergence of the Ocean and the Outer Banks. Alexander, John and James Lazell. 2000. Chapel Hill: UNC Press.