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Today

- ◆ Oceans
 - Waves
 - Long-shore drift

Homework: Due by 5 PM on 5/9/2007

Chapter 9 On-Line

- Complete the Multiple Choice, Identification, and Critical Thinking, and

Chapter 10 On-Line

- Multiple Choice and Critical Thinking

http://wpa.pressball.com/esm_lutgens_foundations_4e

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Breaking Waves

Figure 10.11

3

Wave Refraction

When a wave approaches shore at an oblique angle, part of the wave will slowdown sooner than other parts. What will happen to this wave crest as it approaches shore?

Wave Refraction

4

When a wave approaches shore at an oblique angle, part of the wave will slowdown sooner than other parts. What will happen to this wave crest as it approaches shore?

Beach Drift or Longshore Transport

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Figure 10.14

Wave Refraction

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Figure 10.13

Shoreline Features

- Erosional features
 - Wave-cut cliff
 - Wave-cut platform
 - Marine terraces
 - Associated with headlands
 - Sea arch
 - Sea stack

Sea Arch



Sea arch

Sea Stack



Sea stack

Shoreline Features

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▪ Depositional features

- *Spit* —A ridge of sand extending from the land into the mouth of an adjacent bay with an end that often hooks landward
- *Baymouth bar* —A sand bar that completely crosses a bay
- *Tombolo*—A ridge of sand that connects an island to the mainland

Aerial View of a Spit and Baymouth Bar Along the Massachusetts Coastline

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Figure 10.16

Spit

12



Spit

Baymouth Bar

13



Baymouth bar

Tombolo

14



Tombolo

Shoreline Features

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- Depositional features
 - Barrier islands
 - Mainly along the Atlantic and Gulf Coastal Plains
 - Parallel the coast
 - Originate in several ways

Stabilizing the Shore

- Shoreline erosion is influenced by the local factors
 - Proximity to sediment-laden rivers
 - Degree of tectonic activity
 - Topography and composition of the land
 - Prevailing wind and weather patterns
 - Configuration of the coastline

Stabilizing the Shore

- Responses to erosion problems
 - *Hard stabilization*—Building structures
 - Types of structures
 - *Groins* —Barriers built at a right angle to the beach that are designed to trap sand
 - *Breakwaters*—Barriers built offshore and parallel to the coast to protect boats from breaking waves

Stabilizing the Shore

- Responses to erosion problems
 - *Hard stabilization*—Building structures
 - Types of structures
 - *Seawalls*—Armors the coast against the force of breaking waves
 - Often these structures are not effective

Stabilizing the Shore

- Responses to erosion problems
 - Alternatives to hard stabilization
 - *Beach nourishment* by adding sand to the beach system
 - Relocating buildings away from beach
- Erosion problems along U.S. Coasts
 - Shoreline erosion problems are different along the opposite coasts

Miami Beach Before Beach Nourishment

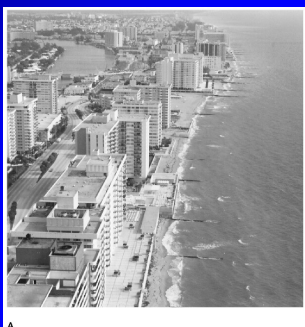


Figure 10.22 A

Miami Beach After Beach Nourishment

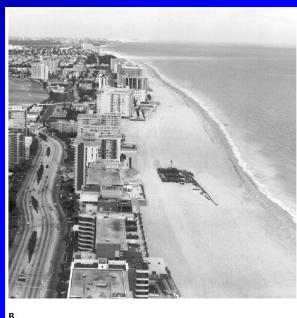


Figure 10.22 B

Stabilizing the Shore

- Erosion problems along U.S. Coasts
 - Atlantic and Gulf Coasts
 - Development occurs mainly on *barrier islands*
 - Face open ocean
 - Receive full force of storms
 - Development has taken place more rapidly than our understanding of barrier island dynamics

Stabilizing the Shore

- Erosion problems along U.S. Coasts
 - Pacific Coast
 - Characterized by relatively narrow beaches backed by steep cliffs and mountain ranges
 - Major problem is the narrowing of the beaches
 - Sediment for beaches is interrupted by dams and reservoirs
 - Rapid erosion occurs along the beaches

The Effect of "Hardened Structures" on Beaches 24

- ◆ Groins used to trap in longshore drift
- ◆ In Pairs...


- What direction is the longshore drift in this picture?



Cape May, New Jersey

25

Jetties & Breakwaters



Santa Barbara

“It would grow corn if you could irrigate it.”

Will Rogers
when observing Santa Barbara Harbor

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The Cape Hatteras Lighthouse



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Coastal Erosion Threatens Lighthouse

- ◆ Groins and jetties have been installed north of Cape Hatteras.
- ◆ Sand is actively being “mined” from offshore for “beach nourishment.”
- ◆ The Cape is located where many hurricanes hit land.
- ◆ When the lighthouse was constructed it was $\frac{3}{4}$ mile from the shoreline.
- ◆ Explain the last observation in terms of the first three observations.



The Fate of Cape Hatteras Lighthouse

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- ◆ What recommendations would you make to the National Park Service to protect the lighthouse?





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<http://www.pilotonline.com/special/lighthouse/index.html>

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<http://www.pilotonline.com/special/lighthouse/index.html>

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Tides

- ◆ Daily changes in elevation of ocean surface



Coastal Classification

- Shoreline classification is difficult
- Classification based on changes with respect to sea level
 - Emergent coast
 - Caused by
 - Uplift of the land, or
 - A drop in sea level

Coastal Classification

- Classification based on changes with respect to sea level
 - Submergent coast
 - Caused by
 - Land adjacent to sea subsides, or
 - Sea level rises
 - Features of a submergent coast
 - Highly irregular shoreline
 - Estuaries —Drowned river mouths



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Tides

- ◆ Caused by gravitational pull of moon
 - And Sun
 - Pull of gravity is greater on side of earth closest to the moon
 - Balanced by centrifugal force from spinning Earth
 - Symmetric bulge in oceans

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Diurnal (twice a day) Tides

- ◆ Position closest to moon changes throughout the day
 - Each location sees 2 high tides
 - One on the near side, one on the far side

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Spring and Neap Tides

- ◆ Spring Tide
 - Sun and Moon aligned
- ◆ Neap Tide
 - Sun and Moon in perpendicular positions

B. Neap tide

A. Spring tide

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Height of Tides Also Depends On the Shape of the Coastline

- ◆ More than 50 feet of tidal variation.

<http://www.scotwalking.co>

Bay of Fundy
Minas Basin
Nova Scotia
Atlantic Ocean

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