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GLY 4734 Changing Coastlines

Florida International University

Department of Earth and Environment

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Classroom:

Required Textbook: Beaches and Coasts, 2004, Blackwell Publishers (available at FIU Reserve Desk, Green Library)

Reference Text on Reserve at Green Library:

- Coastal Erosion and Protection in Europe, 2013, Routledge Publishers
- Barrier Island Handbook, 1988, Coastal Publications

Discussion Papers (Available in DropBox):

- D1: Beach Renourishment as a Soft Engineering Solution to Coastal Erosion, 1997, Journal of Coastal Research, V. 13, p. 1050-1063.
- D2: North Carolina's Coast in Crisis: A Vision for the Future, 2008, Institute for Coastal Science & Policy, 26p.
- D3: Time Frames for Barrier Island Migration, 1987, Shore and Beach, V. 55, p. 82-86.
- D4: Sand Thieves of Long Island's South Shore, 1997, Shore and Beach, V. 65, p. 4-12.
- D5: Beach Erosion, Tidal Inlets and Politics, 1999, Shore and Beach, V. 67, p. 26-32.
- D6: Beach Wars, 2015, Saturday Evening Post, 8p.

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Literature Review:

- Wave-Generated Energy in Israel and Micronesia
- Hurricane Modification Proposal by Billionaire Bill Gates
- Project Stormfury in Caribbean Sea and Atlantic Ocean
- Case Study of Sylt Island, German Bight
- Vanishing Seaside Town of Dunwich, England

Course Justification:

Eighty percent of the world's population resides in the coastal zone, and beachfront property is some of the most desirable and expensive real estate in the United States and indeed worldwide. This course involves the evolution of coastal landscapes with emphasis on shoreline changes and development patterns. About 70 percent of the world's beaches are presently eroding; the number approaches 90 percent for the better studied United States sandy coastlines. At the same time there is a shoreward migration of the population and increased development—this is the classic definition of a mission course.

In coastal regions worldwide, settlements, agriculture, industry, transportation, and tourism thrive. Human impact via utilization of the coastal zone for land reclamation, extraction of natural resources, construction of structures such as river dams and inlet jetties, can impact natural processes and limit sediment supply, resulting in profound impacts on the shore, such as accelerating coastal erosion and land loss. Minimizing human impacts depends upon a clear understanding of natural and anthropogenic processes as well as social norms, economic constraints and pressures for continued urbanization.

Coastal development in South Florida has been booming in the past few decades as mid- and high-rise buildings replace residential houses and small motels because of the tremendous demand and high value of this property. Such rapid growth in South Florida is being replicated along much of the developed world's shorelines, such the Mediterranean coast of Spain and France, and indeed in many developing countries, including Brazil, China, and Malaysia. The response to coastal erosion as driven by storm impacts, sea level rise and other factors has often been to harden the shore with coastal engineering structures, especially seawalls, groins and jetties. Such attempts to protect beachfront development and infrastructure, especially roads and utilities, have sometimes led to the loss of the beach itself. In the United States, the trend is away from these massive concrete structures and toward a soft solution—beach nourishment.

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Beach nourishment is considered by many coastal communities as their salvation to the onslaught of storms and progressive coastal erosion. Generally, sand is pumped from offshore areas to nourish the beach at a cost of millions of dollars per mile of shore with 65 percent of the cost borne by taxpayers through these massive U.S. Army Corps of Engineers projects. While some projects have been very successful, especially the Miami Beach project that cost \$65 million to restore 10 miles of beach in the early 1980s, others have lasted only a few years or until the advent of the next coastal storm. What is not realized by the general public and many government officials is that the artificially-built beach is sacrificial—beach nourishment only treats the symptom (e.g., beach retreat); it does not cure the disease (cause of erosion). Therefore, beach nourishment merely sets back the erosion clock and buys beachfront areas some time that varies greatly according to local, regional and global factors.

Understanding the causes of coastal erosion and various strategies for mitigation and their impacts on human development and the natural environment requires an understanding of their inter-disciplinary dimensions. The nature of this problem spans the technical aspects to the economic, political and legal challenges. This course examines coastal erosion and development patterns on a worldwide basis and assesses the global and site-specific susceptibilities and differing approaches for mitigation. Some areas are especially prone to erosion, such as Louisiana--the erosion hot spot in the United States with loss rates as high as 50 feet per year. Elsewhere erosion rates are fairly low, such as East Hampton, New York where rates average about a foot per year, probably because of the onshore flow of sediments left behind from the last Ice Age that formed Long Island itself. The cost to maintain sandy beaches, which are the world's most popular recreational areas and some of the most expensive real estate, is high and likely to increase in future years in response to global warming and attendant rising sea levels.

The United States is the world leader in coastal science and engineering--we are on the forefront of the issues involving coastal erosion and mitigation as well as litigation that are now problematic in other developed countries and under-developed countries.

Global Learning Course Outcomes:

Global Awareness—Students will be able to demonstrate an understanding of the interconnection of coastal erosion and protection strategies on a global basis, that these problems have no national borders, and that these problems are affected by geological,

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meteorological and oceanographic factors as well as socioeconomic, technological and cultural conditions.

Global Perspective—Students will be able to conduct analyses of the impact and mitigation of coastal erosion in a site-specific and global context, and the extent to which multiple factors, such as technical approaches, economics, and social norms, contribute to or help solve the problem.

Global Engagement—Students will collaborate in groups to devise solutions to problems of mitigating coastal erosion, which are appropriate within the framework of technical, economic, legal and societal factors at local, regional, national and global levels.

Active Learning Strategies (please bring your laptop computer to class):

Students will participate in a number of activities including

- Class Discussions
- Discussion Groups
- Socratic Circles
- Class Debate
- Field Trip
- Co-Curricular Activities (extra credit)

Co-Curricular Activities:

Students will be encouraged to participate in various on and off-campus co-curricular activities, which are available at goglobal.tu.edu. Documented attendance of at least three of these activities and submission of a three-page summary of the activities (one page per activity) will count as extra credit in the course.

Grading Policy:

Grades will be based on the following scores:

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| • Class discussions, presentations and debates | 20% |
| • Weekly write-ups of assigned readings and | 20% |

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literature review (use bullet points for main points and three thought-provoking questions and/or **pro-active mitigation approaches**; limit one page per assignment with second page for at least three references except for assigned chapters to be reviewed)

- Pop Quizzes 10%
- Mid-Term Exam 25%
- Final Exam 25%

Grading Scale:

A 93-100	B 83-86	C 70-76	D 60-69	F <60
A- 90-92	B- 80-82			
	B+ 87-89	C+ 77-79		

Early Alert:

In an effort to help you succeed in your academic courses, FIU utilizes an Early Alert system. Instructors are now able to notify students' academic advisors if there are concerns about class performance. If an alert is submitted, your academic advisor will send you a message via your Student Dashboard (accessed via your MYFIU page) to discuss ways to improve your performance. Please respond to any communication you receive from your academic advisor about an early alert. Our goal with this program is to help you to be successful by identifying any issues as early on as possible and working to address them.

Class Schedule

Date	Topic	Reading
Week 1	Ground Rules and Introduction to Course Engaging Question: Is conflict at the shore inevitable in response to coastal erosion and continued development? Learning Activity: Power Point Presentation Class discussion of beaches—the most dynamic developed landscape on earth and the socioeconomic implications of continued urbanization and global change (Global Awareness and Perspective) Assignment for next class: One page summary of Chapter 7 In Beaches and Coasts textbook	Syllabus

Week 2 **No Class (Holiday)**

Week 3 **Beaches: Not All Beaches Are Alike**

Engaging Question: What factors differentiate beaches both physically and culturally (e.g., development scheme) considering world-famous beaches such as Copacabana Beach in Rio de Janeiro, Brazil, Bondi Beach, Sydney, Australia, South Beach, Miami, Florida and Brighton Beach, England?

Learning Activity: Power Point Presentation

Class discussion of beach dynamics and implications for sustainable development.

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Assignment for next class: One-page summary based on on-line review of the documentary “Sand Wars” (available on-line from FIU Green Library) that vividly portrays contractors and smugglers who are defaming and destroying some of the most pristine beaches worldwide.

Week 4 Beaches: Here Today, Gone Tomorrow?

Engaging Question: Are beaches in peril because of human activities that include sand thievery and climate change-induced sea level rise?

Learning Activity: Power Point Presentation

Class Debate: What pro-active approaches can be taken to maintain the most cherished recreational areas in the world—sandy beaches? (Global Engagement).

Assignment for next class: One-page summary of Chapter 6 in Beaches and Coasts textbook and review literature on energy generation from waves in Israel and Micronesia.

Week 5 Causes of Beach Erosion: Waves and Currents I

Engaging Question: What role do waves and currents play in coastal erosion and how do these processes vary on a global basis?

Learning Activity: Power Point Presentation

Class discussion of how waves act like light by bending and focusing energy in shallow water and how these properties could possibly be used to reduce coastal erosion and even generate electricity. (Global Awareness and Perspective)

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Assignment for next class: One-page summary of D1 (Beach Dewatering) article (see DropBox).

Week 6 Causes of Beach Erosion: Waves and Currents II

Learning Activity: Power Point Presentation

Beach dewatering is designed to work with nature to make sandy beaches more stable. This technology was developed in Denmark and is now being employed at many beaches worldwide. Seascape, which is a type of artificial seaweed, has been used in North Carolina and several Caribbean countries.

Assignment for next class: One-page literature review on hurricane modification by billionaire Bill Gates. Hurricanes, which are called cyclones in Indian Ocean and typhoons in Pacific Ocean, impact many nations worldwide, especially the Caribbean. Write three short-answer questions (with answers) for possible use in Mid-Term Exam.

Week 7 No Class on February 22—Saturday (February 27) Class field trip to beaches in Miami-Dade County: Haulover Beach Park and Crandon Park on Virginia Key.

Week 8 Causes of Beach Erosion: Coastal Storms

Engaging Question: Can hurricanes be tamed, and if so, what are the environmental, political and legal ramifications?

Group discussion of the pros and cons of storm modification projects, such as Project Stormfury by NOAA. (Global Awareness and Perspective)

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Learning Activity: Power Point Presentation

Assignment for next class: Prepare for mid-term exam.

Week 9 Mid-Term Exam

Assignment for next class: One-page summary of Chapter 4 in Beaches and Coasts textbook.

Week 10 Spring Break

Week 11 Causes of Beach Erosion: Sea Level Rise

Engaging Question: Is rising sea level the “drip, tick” of climate change?

Learning Activity: Power Point Presentation & Vanishing Lands documentary.

Group discussion of what causes ocean levels to rise worldwide in response to global warming and how it is “hard wired” to coastal erosion (Global Awareness and Perspective)

Engaging Question: What can be done to stem the rising tide and prevent wholesale losses of beaches worldwide?

(Global Engagement)

Assignment for next class: One-page summary of Chapter 21 in Beaches and Coasts textbook.

Week 12 Causes of Beach Erosion: Human Modification and Stabilization

Engaging Question: Consider the benefits vs. the economic and environmental costs of coastal stabilization: is it worth-

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while, and, if so, at different spatial scales—regionally, nationally or globally? Consider that the mainland US has more than 100,000 miles of shoreline and one million miles of shoreline worldwide.

Learning Activity: Power Point Presentation

Class discussion of cost and benefits of various coastal engineering projects and viability based on differing oceanographic and socioeconomic conditions in European countries and the Bahamas (Socratic Circles).

Assignment for next class: One-page summary of Barrier Islands Handbook (Green Library Reserve).

Week 13 **Barrier Islands—A Dynamic Landform**

Engaging Question: Barrier islands are one of the most dynamic and vulnerable landforms on earth, yet these “strings of sand” are highly developed real estate. Coastal storms can generate overwash and even cause inlet breaching, cutting highways, electrical lines and water/sewage mains. Barrier beaches are some of the best in the world, and coastal engineering projects are often employed in efforts to stabilize the shore and protect valuable beachfront development, such as Miami Beach, Florida and Banjul, the capital of the Gambia.

Learning Activity: Class discussion of “how to live with an unstable island.”

Assignment for next class: One-page summary comparing articles D2 and D3, and review of literature on Sylt--a barrier island in Germany.

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Week 14 Barrier Island Migration or Disintegration?

Engaging Question: Will the Outer Banks of North Carolina, consisting of a world-class foreland of three capes and barriers, break apart into relative small island segments during the next category 5 hurricane that strikes this area as proposed by some coastal scientists? Should savvy property owners sell their houses now, considering that their property may be the new “Atlantis” and ocean bottom is not developable?

Learning Activity: Power Point Presentation

Group discussion of the fundamental considerations for the preservation of barrier islands, which have persisted for thousands of years (albeit not in the same location), which may now be vulnerable to demise. What islands have already been lost or may disappear in the coming decades, such as the Chandelier Islands in Louisiana, and under what conditions does this wholesale loss of a coastal landscape occur for barrier islands worldwide, such as the island of Sylt, Germany? (Global Perspective)

Assignment for next class: One-page summary comparing the findings and conclusions of articles D4 and D5. What are the facts?

Week 15 Politics of Shore Erosion

Engaging Question: Is it possible to make maps lie so that beaches can appear wider than they naturally are?

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Learning Activity: Power Point Presentation

Class discussion of the case of Fire Island and Village of Westhampton

Dunes along the South Shore of Long Island, New York regarding

the placement of responsibility for erosion problems that

resulted in tens of millions of dollars committed by the Federal

Government in one case and the hopes of a similar decision by an

adjacent beach community. (Socratic Circles).

Assignment for next class: One-page literature review of a fishing town—
Dunwich, England and Beach Wars article (D6 in Discussion Paper).

Week 16 Beach Access and Public Usage

Engaging Question: When is it proper to take or deny the highest
economic use of private property for the public good?

Learning Activity: Power Point Presentation

Class discussion of beach access to such areas as the Malibu Colony
where movie moguls and actors/actresses have beachfront houses.

In other countries, there are different problems such as the usage
of the best beaches in The Bahamas for resorts, such as Atlantis

on Paradise Island, Nassau. In Costa Rica, there can be squatters

on large tracks of land because of weak land ownership laws. Still

elsewhere, some of the most magnificent coastlines, such as Nash Point,

Glamorgan Heritage Coast in Wales, are located on private lands. While

access points and trails through the pastures are provided, there is scant to

no parking along the narrow lanes (e.g., trivet-bounded roads) that date

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back to Medieval times. In Constanta, Romania, construction of bars and restaurants on the public beach is unlawfully permitted by the city mayor.

Assignment for next class: Prepare for Final Exam.

Week 17 Final Exam

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