

## GLY 4734 Changing Coastlines

**This is a discipline-specific global learning course that counts towards your FIU Global Learning graduation requirement.**

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**Class Schedule:** Mondays, 5-7:40 PM; PC-438

**Textbook:** Beaches and Coasts, 2004, Blackwell Publishers--available at <https://fiu.catalog.fcla.edu/fi.jsp?search=beaches%20and%20coast&ix=kw&V=D&S=0211478029901174&l=2#top>.

**Reference Text on Reserve at Green Library:**

- Coastal Erosion and Protection in Europe, 2013, Routledge Publishers
- Hurricanes: Causes, Effects and the Future, 2008, Voyager Press

**Discussion Papers (Available in Canvas):**

- The Beach Book, excerpt "All Beaches Are Not the Same." 14p.
- Australia Beaches: Exotic Destinations, Gulfscope, 2010.
- Seascape: Beach Erosion Control, P. Morris, 1988.
- Coastal Erosion and the United States Flood Insurance Program, 2017, Journal of Ocean and Coastal Management, <http://dx.doi.org/10.1016/j.ocecoaman.2017.04.004>.
- Surfside Sand Controversy, 2017, Shore & Beach, V. 85, p. 41-44.
- From Coast to Toast, 2013, Vanity Fair, 16p.

### Literature Review:

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

### Course Description:

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 collision course.

In coastal regions worldwide, settlement, 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.

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 (causes 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 of 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 hotspot in the United States with loss rates as high as 50 feet per year. Elsewhere erosion rates are fairly low, such as Calvert Cliffs in Chesapeake Bay, Maryland where rates average less than a foot per year. 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 in 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.

A more recent development that has diminished sand supplies on some beaches is mining. This illegal exploitation of beach sand has been documented in 60 countries by Coastal Care. On the Moroccan beaches near Tangier, the sand has been scraped away, making the area look like a lunar landscape. The pillaging of sand is a growing practice worldwide as sand is the second most important natural resource after water. While sand is used to make many products, including glass and microprocessors, it is because sand represents 80% of the composition of concrete that makes it an object of such greed and illegal mining. The beaches of Barbuda are being mined to supply sand to other areas in the Caribbean and elsewhere. Sand mining is widespread in Asia where smugglers have taken over the market. Dubai is seeking new sand supplies to continue their building boom; ironically their plentiful desert sand is too well rounded (e.g., smooth) to make suitable concrete.

Coastlines are also changing for biological reasons, especially the blighting of beaches by harmful algal blooms and sargassum seaweed invasion. Red tide has long been a concern for some Chinese and Japanese beaches, but now it is becoming an increasing problem for the Florida Southwest coast. Sargassum seaweed, while natural like red tide, has recently become problematic for Caribbean and South Florida beaches, which may be related to climate change and/or deforestation of Amazon forests and the use of fertilizer to promote agricultural crops on these vast barren areas.

### **Global Learning Course Objectives and 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, meteorological and oceanographic factors as well as socioeconomic, technological and cultural conditions. Short-answer exams and weekly written assignments will serve as an assessment of your global awareness.

**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. Role-playing exercise will help serve as an assessment of your global perspective.

**Global Engagement**—Students will collaborate in groups to devise solutions to problems of mitigating coastal erosion, which are appropriate within the framework of technological, economic, legal and societal norms at local, regional, national and global levels. A student survey will serve as an assessment of your global engagement.

### **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 Debates
- Powerpoint Presentations
- Field Trip
- Co-Curricular Activities (extra credit)

### Co-Curricular Activities:

Students will be able to participate in various on and off-campus co-curricular activities, which are available at [goglobal.fiu.edu](http://goglobal.fiu.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:

- Class discussions, presentations and debates 25%
- Weekly write-ups of assigned readings and literature review (use bullet points for main points and three thought-provoking comments 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) 25%
- 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		

## Class Schedule

<u>Date</u>	<u>Topic</u>	<u>Reading</u>
<b>Week 1</b>	<b>Ground Rules and Introduction to Course</b>	<b>Syllabus</b>

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 excerpt from The Beach Book (see Canvas)

<b>Week 2</b>	<b>Beaches: Not All Beaches Are Alike</b>
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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.

**Assignment for next class:** One-page summary of Chapter 7

In Beaches and Coasts textbook and review Australia Beaches article (see Canvas).

**Week 3 No Class (Holiday)**

**Week 4 Beach Environments and Processes**

Engaging Question: Beaches have many common elements, but differences in geologic history, tidal range, wave energy and sediment type make each beach unique.

Learning Activity: Power Point Presentation

**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 is the role of waves and currents 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)

**Assignment for next class:** One-page summary of Coastal Erosion & National Flood Insurance Program article (see Canvas) and review of article on Seascape (see Canvas).

**Week 6 Causes of Beach Erosion: Waves and Currents II**

Learning Activity: Power Point Presentation

Beach and dune erosion are a major problem for the Federal Emergency Management Agency (FEMA) in its administration of the National Flood Insurance Program (NFIP). This is especially true for coastal areas where hurricanes and winter storms can cause considerable land loss, unlike riverine floods. Seascapes, which was the terminology assigned to artificial seaweed, has been used in North Carolina and several Caribbean countries.

**Assignment for next class:** Write three short answer questions (with answers) for possible use in Mid-Term Exam.

**Week 7 No Class —Saturday Class field trip**

**Week 8 Spring break**

**Week 9 Mid-Term Exam**

**Assignment for next class:** One-page summary on hurricane modification by billionaire Bill Gates (literature review); review book on Hurricanes on reserve in Green Library. Hurricanes, which are called cyclones in the Indian Ocean and typhoons in Pacific Ocean, impact many nations worldwide, especially the Philippines.

**Week 10 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)

Learning Activity: Power Point Presentation

**Assignment for next class:** One-page summary of Chapter 4 in Beaches and Coasts textbook and view “Vanishing Lands” documentary on YouTube.

**Week 11 Causes of Beach Erosion: Sea Level Rise**

Engaging Question: Is rising sea level the “dipstick” of climate change?

Learning Activity: Power Point Presentation & Vanishing Lands documentary.

Group discussion on 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 (see Canvas).

**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 worthwhile, 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 socio-economic conditions in European countries and the Bahamas (Socratic Circles).

**Assignment for next class:** One page summary based on review of the French 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 13 Beaches: Here Today, Gone Tomorrow?**

Engaging Question: Are beaches in peril because of human activities that include sand thievery and other causes?

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 Surfside Sand Controversy and review article From Coast to Toast (see Canvas).

**Week 14 Politics of Shore Erosion**

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

Learning Activity: Power Point Presentation

Class discussion of case studies of beach erosion and quality considerations and public access (Socratic Circles).

**Assignment for next class:** Literature review regarding Florida's red tide problem and prepare a one-page summary.

**Week 15 Red Tide—Harmful Algal Blooms**

Engaging Question: Is red tide natural or human-induced because of pollution?

Florida has experienced many harmful algal blooms in recent years, especially along the southwest coast with Ft. Myers often being the epicenter. Many other countries suffer from toxic red tide, including Japan and China. An additional problem in Florida involves the release of polluted water from Lake Okeechobee, which has caused massive blue-green algae blooms that has mire lagoons and oceanic beaches in St. Lucie, Martin and Palm Beach Counties.

Class Discussion: What can be done to eliminate or at least minimize harmful Algal blooms in fresh, brackish and saline waters?

**Assignment for next class:** Prepare for Final Exam

**Week 16 Final Exam:** The schedule will be announced when available from FIU; there will be no other activities except the Final Exam during final examination week. The Final Exam will consist of 10 multiple-part, short-answer questions as was the case for the Mid-Term Exam.

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