



THE MENDEL SCIENCE EXPERIENCE – COURSE PROPOSAL
(for courses that will be taught without Mendel Post-docs or with Mendel post-docs who are currently employed by Villanova)

- 1. Course Title:** Beaches and Coasts
- 2. Instructors:** Dr. Lisa J. Rodrigues and Dr. Francis A. Galgano
- 3. Preferred class meeting schedule for lecture (MWF vs. TR):** MW 1:30-2:45
- 4. Preferred lab meeting schedule:** M 3:00-5:50
- 5. Course Description for NOVASIS (100 word maximum):**

Nearly half of the world’s population lives within a hundred kilometers of a coastline. The coastal zone is an important environment that is relied upon for food, energy, housing, protection, and recreation. Yet, our use of this environment is occurring in tandem with global environmental changes, making it ever more critical that we understand the scientific processes underway at our beaches and coasts. Laboratories will emphasize field techniques and include visits to local coastal sites in New Jersey and Delaware, requiring four weekend field trips that will be exploratory, explanatory, and inquiry-driven.
- 6. Course Description for College website of Core Curriculum courses (250 word maximum):**

Nearly half of the world’s population lives within a hundred kilometers of a coastline. The coastal zone is an important environment that is relied upon for food, energy, housing, protection, and recreation. Yet, our use of this environment is occurring in tandem with global environmental changes that directly impact it, including changing sea level and land-based sources of pollution. It is ever more critical that we understand the scientific processes underway at our beaches and coasts, so that we can better manage and protect these vital environments. Laboratories will emphasize field techniques and include visits to local coastal sites in New Jersey and Delaware, requiring four weekend field trips. The field trips will be exploratory, explanatory, and inquiry-driven, allowing students to experience the coast in an engaging and educational way. This course fulfills one semester of the Natural Science requirement of the Core Curriculum in the College of Liberal Arts and Sciences.
- 7. Please articulate fully and explicitly how you will incorporate, in a meaningful way, each of the following:**
 - a. Problem Solving:** Every laboratory session, including the four off-campus weekend field trips, has been designed around a real-world environmental problem or issue. The field trips will be (1) exploratory, allowing students to experience the coastal environment and develop their own questions about the processes underway; (2) explanatory, allowing students to observe and

measure scientific processes in the real world; and (3) inquiry-driven, allowing students to design and implement a small field study.

- b. Laboratory/Field Experience:** The course will significantly emphasize field experiences through the semester to provide the students with real-world, relevant experiences in an engaging way. Students will learn how to operate field equipment utilized by coastal geomorphologists and oceanographers; gain experience maintaining a field notebook that will include information obtained in trip briefing sessions, scientific observations and data collected during each trip; monitor coastal processes; and plan and carry-out a field study with their peers. To ensure that students get the most academically out of these field experiences, each one will be preceded by a field briefing: a detailed information session that will review the objectives, travel details, and expectations for each trip. Four other laboratory sessions will take place in the classroom and will closely complement the lecture material, providing hands-on examples and simulations of the theoretical processes we will discuss. During a back-to-back lecture and laboratory period we will visit the Independence Seaport Museum for students to gain a more in-depth understanding of the causes and consequences of humans and maritime history on the Delaware Valley coastal zone with a tour led by a naval historian, providing a humanities perspective on the course topics.
- c. Use of Technology and Quantitative Tools:** For the first laboratory session and for all four field trips, students will use field equipment and associated analytical laboratory equipment to map dune profiles, measure current flow, tidal range, among other features of the coast. Students will be instructed on descriptive statistics (means, standard deviations) to better manage the data; comparative statistics (chi-squared, t-test, regression analyses) to better interpret the data; and correct formats for presentation of data (graphs, tables). Excel and the statistical add-in will be used for calculating these statistics and creating graphs and tables. GIS Oceans, an Arcview GIS add-on, will be incorporated into relevant lectures for a more visual explanation of the coastal environment, including plate tectonics, currents, and pollution.
- d. Interdisciplinary Understanding:** The coastal zone is the ideal environment for interdisciplinary study, as it represents the confluence of science (chemistry, physics, geology, ecology) with applied science (engineering), social science (sociology, geography, economics, policy) and humanities (ethics). The occurrence of Superstorm Sandy on the northeast coast in 2012 and the continuing consequences for the population of the region even today, exemplifies the need to study these phenomena from an interdisciplinary perspective. In this way, students can come to a full appreciation of the myriad issues involved. Throughout the course, the scientific aspect of each topic will be discussed within the context of human societies. For example, in the lecture, Coastal Storms, the atmospheric and oceanic conditions that led to Sandy and its ultimate path will be described; ecosystems impacted will be depicted; the influence on human health and development will be outlined; the effectiveness of policies put in place prior to and since then that strive to lessen the impact of storms on the region will be discussed; and the economic costs of clean-up will be addressed. In a similar manner, each lecture and laboratory topic will emphasize the integration amongst the disciplines. Clips from the film “Shored Up” that follows the story of Superstorm Sandy and its impact on the New Jersey coastline will also be used in lectures and in-class laboratories to further impart the real-world relevance of these topics.

8. Provide an overview of how student performance will be assessed (exams, lab reports, written and/or oral assignments).

Students will be assessed with exams, field reports, lab worksheets, press releases, discussions, and participation:

- Four exams given through the semester will test student's knowledge of scientific concepts and theories using multiple choice and fill-in-the blank questions, while short (a few sentences) and long (paragraph-length) answer questions will require critical thinking and integration of learned concepts.
- For field reports, students will be instructed to focus on accurate scientific observation, hypothesis development and testing, the correct presentation of results, and discussion and interpretation of the data. This will give non-science students an appreciation for the methods and techniques involved in environmental science, while understanding the "bigger picture" concepts that the field activities are designed to convey.
- Worksheets completed through the in-class laboratory periods will direct the students through the activity, requiring them to focus on a particular issue and discuss possibilities and outcomes with their partner and/or group.
- Students will attend and participate in guest lectures and write a press release on one lecture that requires them to summarize and interpret the science for a general audience.
- Formally, class discussions will be held at the start and ends of field briefing and laboratory period and during appropriate class lecture periods.
- Collaborative work amongst students will be emphasized (as it is in most science and non-science disciplines). Students will be expected to work together with a partner or a small group to collect data and complete fieldwork. In some cases, the written report will also be submitted as a collaborative assignment.

9. Attach a proposed syllabus, which must include a tentative topic for each lecture and laboratory session. Note that laboratory components of MSE courses are expected to include about 12 lab periods per semester.

See attached. The syllabus has been designed to draw on the complementary expertise of a geomorphologist (Galgano) and an oceanographer (Rodrigues) as these disciplines relate to the coastal environment; as such, this MSE course will be co-taught by both faculty members.

Please note that the four field trips have been planned to take 6-8 hours each and will be held on the weekends outside of regular class time. Therefore, four scheduled laboratory periods in the second half of the semester have been cancelled *a priori*. Instructors will be available during this time to meet with students as needed, but no official course meetings will be held to "make up for" the required field trips schedules for outside of class time.

MSE 2504: BEACHES & COASTS

Overview: Nearly half of the world's population lives within a hundred kilometers of a coastline. The coastal zone is an important environment that is relied upon for food, energy, housing, protection, and recreation. Yet, our use of this environment is occurring in tandem with global environmental changes, making it ever more critical that we understand the scientific processes underway at our beaches and coasts. Laboratories will emphasize field techniques and include visits to local coastal sites in New Jersey and Delaware, requiring four weekend field trips. The field trips will be exploratory, explanatory, and inquiry-driven, allowing students to experience the coast in an engaging and educational way. This course fulfills one semester of the Natural Science requirement of the Core Curriculum in the College of Liberal Arts and Sciences.

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Teaching Assistant: TBD

Location: Lecture: Mon & Wed 1:30-2:45 Mendel G58
Lab: Mon 3:00-5:50 Mendel G58
Field Trips: Four locations in coastal New Jersey and Delaware

Required Text: Davies RA Jr, Fitzgerald DM (2004) Beaches and Coasts. Blackwell Publishing, Malden, MA. 419 pp.

Students are encouraged to purchase the electronic version of the textbook as a more economic and environmentally sustainable option compared to the printed text.

Field Notebook: A write-in-the-rain field notebook is required for the course.

Clickers: Clickers are required for this course; purchase Turning Point Technologies RF clickers. During the first week of class, we will obtain the serial number of your clicker to better assess your understanding of course material and to record your attendance. Therefore, it is important that you bring (and use) your clicker in each class. Clicker responses will not be graded, nor are they a substitute for in-class participation.

Blackboard: Blackboard will be extensively used for posting supplemental readings, handouts, and lecture slides. Download material *before* the lecture or lab, so you can bring them to class and make your notes directly on them. In addition, all grades will be posted on Blackboard; check your grades regularly and notify us about any errors or missing grades.

Grading Scheme: 4 credits

Exams	Unit Exam (3 at 10% each)	30%
	Final Exam	15%
Laboratory Activities	Field Trip Reports (4 at 5% each)	20%
	Field Notebook	5%
	Team Presentation	5%
	Lab Handouts (5 at 2% each)	10%
Press Release on Guest or Mendel Lecture		5%
Attendance and Participation		<u>10%</u>
TOTAL		100%

No extra credit for additional assignments will be provided.

Assignment Submissions: Assignments should be submitted as an e-mailed attachment unless otherwise instructed. Paper submissions will not be accepted. File names should be in the form: Last name_Assignment.xxx for example, Rodrigues_Lab 1.docx. Electronic submissions attached to an e-mail are due by midnight on their due date unless otherwise noted.

Assignment Penalties: Late assignments will have 10% deducted per calendar day that they are late (including weekends), beginning on the first day.

Group/Partner Assignments: Science, as with other areas of professional life, is often collaborative. Therefore, it is imperative that you learn to work as members of a team. Some assignments will require working with one or more partners. Specific instructions will be provided about independently- or collaboratively-submitted assignments.

- 1. Exams (45%):** Three one-hour-long exams (10% each; 30% total) covering the first three units of the course will be taken during class time. A final exam (15%) covering Unit 4 and integrating themes from the whole semester will be taken during the University's December exam period. Exams may include: multiple choice, fill-in-the-blanks, definitions, short answer (phrase to sentence length answers) and long answer (paragraph length answers) questions.
- 2. Field Trips (25%):** This course will include an in-depth study of the local coastal and beach environments in New Jersey and Delaware with four mandatory weekend field trips. Field trips will occur on a Saturday or Sunday depending on the best predicted weather forecast for each weekend. During the first two trips we will explore the local coastal environments, identify features of coasts, and observe coastal processes underway. The third trip will focus on scientific monitoring and measuring data along the coast. During the final field trip, students will design and carry out a small field study to address an interesting question. Prior to each field trip, there will be an in-class briefing to review the objectives, travel details, and expectations for the trip. One week after the field trip, you will submit a report (5% each; 20% total) sometimes independently, with a partner, or with a group; detailed instructions will be provided during each. During the final laboratory period you and your team will present the findings from your field study (5%).
- 3. Field Notebook (5%):** Throughout the semester each student will maintain a complete record of their field activities in a field notebook. The record should include: relevant trip information

obtained during each briefing and scientific observations and data collected during each trip. The notebooks will be reviewed and feedback will be provided at the midterm break; formal evaluation of the notebooks will take place at the end of the semester. Early in the semester a rubric will be provided for guidance in maintaining a field notebook.

4. **In-Class Laboratories (10%):** Five other laboratory periods will take place in the laboratory classroom, involving group activities, hands-on simulations, discussions, and critical thinking; during each of these labs you will complete a directed worksheet that will lead you through the activity (2% each).
5. **Press Release (5%):** During the course of the semester, students are required to write a press release on one of the invited guest lectures or the annual Mendel Lecture (if the latter is topically appropriate). The press release should describe the relevant science for a general audience, conveying the key content, while both informing and engaging the reader. More details about writing a press release will be distributed.
6. **Attendance & Participation (10%)** will be based on in-class discussion throughout lecture periods and classroom/lab/field trip activities. You can participate by asking questions during or after class. Use of your clicker in class is expected, and is not enough by itself to justify a high participation grade. Come and visit us in our offices, one-on-one help can often make all the difference. Lastly, you may share e-mails, website links, and/or articles on relevant topics with us for participation credit. Attendance will be taken at all lectures (based on use of your clicker) and labs.

Academic Integrity: The University's position on academic integrity is clearly stated at http://www.library.villanova.edu/academic_integrity/. All assignments must be original work that is not plagiarized in part or whole. Provide appropriate citations and reference lists to avoid inadvertent plagiarism. Please ask, if you are unsure about when citation is necessary or what is considered plagiarism.

Special Needs: If you have any special needs or are limited from participating in any aspect of the course, please let us know as soon as possible. For example, if you are allergic to anything we might encounter on a field trip, please inform us accordingly. Please also see Learning Support Services (610-519-5636) if your needs relate to the academic environment.

Absences/ Illness: If you miss a lecture, lab, or field trip due to an unexcused absence or illness it is your responsibility to contact us to find out what you missed and what you will need to do to make up any material. Every effort will be made to help you catch up. Acceptable absences must be accompanied by written documentation and include: approved athletic participation, certified serious illness, or death in the immediate family.

Wk	Date	Lecture Topic	Lecturer	Readings	Lab Topic
1	Aug 24	Course Introduction & Overview	Rodrigues	Ch. 1	Fieldwork at the Beach: Equipment and Note-Keeping
	UNIT 1: THE COASTAL ENVIRONMENT				
	26	Plate Tectonics	Galgano	Ch. 2	
2	31	Coastal Geology	Galgano	Ch. 3	Coastal Geology
	Sept 2	Coastal Classification	Galgano	Handouts	
3	7	Labor Day – No classes			Labor Day – No Lab
	9	Coastal Classification	Galgano	Handouts	
4	14	Barrier Island Systems	Galgano	Ch. 8	Field Briefing 1
	16	EXAM 1			
	19 or 20	Weekend Field Trip 1 (Exploratory & Observatory: The Local Coast, Part I)			
UNIT 2: PROCESSES OF COASTAL EROSION					
5	21	Weather & Winds	Galgano	Ch. 5	Properties of Water
	23	Coastal Storms	Galgano	Ch. 5	
6	28	Waves	Rodrigues	Ch. 6	Field Briefing 2
	30	Currents	Rodrigues	Ch. 20.3	
	Oct 3 or 4	Weekend Field Trip 2 (Exploratory & Observatory: The Local Coast, Part II)			
7	5	Tides	Rodrigues	Ch. 11	Wave-Tank Simulations
	7	EXAM 2			
8	Oct 12-16	FALL BREAK			

Wk	Date	Lecture Topic	Lecturer	Readings	Lab Topic
9	UNIT 3: ENVIRONMENTAL CHANGE & THE COAST				Field Briefing 3
	19	Sea Level Change	Galgano	Ch. 4	
	21	Sea Level Change	Galgano	Ch. 4	
	24 or 25	Weekend Field Trip 3 (Explanatory & Monitoring: Beach Profiles & Tides)			
10	26	Dr. Stu Farrell or Army Corps Engineer	Guest	Handouts	<i>No lab due to Weekend Field Trip 1</i>
	28	Pollution	Rodrigues	Handouts	
11	Nov 2	Pollution	Rodrigues	Handouts	Field Briefing 4
	4	Biogeography & Invasions	Rodrigues	Handouts	
	7 or 8	Weekend Field Trip 4 (Hypothesis Testing: Conducting Field Experiments)			
12	9	EXAM 3			<i>No lab due to Weekend Field Trip 2</i>
	UNIT 4: HUMAN INTERACTIONS WITH THE COAST				
	11	Maritime History	Galgano	Ch. 21	
13	16	Ship-Building at the Independence Seaport Museum and Tour of <i>Olympia</i> and <i>Becuna</i>			
	18	Fisheries	Rodrigues	Handouts	
14	23	Energy, Dr. Amy Krakowka	Guest	Handouts	<i>No lab due to Weekend Field Trip 3</i>
	25	Thanksgiving Break – No class			
15	30	Economics	Galgano	Handouts	Student Presentations of Field Experiments Conducted during Field Trip 4
	Dec 2	Coastal Zone Management	Galgano	Handouts	
16	7	Coastal Zone Management	Galgano	Handouts	<i>No lab due to Weekend Field Trip 4</i>
	9	Conservation	Rodrigues	Handouts	
17	TBD	FINAL EXAM (Focus on Unit 4; plus overarching themes from the semester)			

Unit 1: The Coastal Environment

Unit 1 will introduce the concepts that have formed the coastlines of the world from a geological perspective. “Plate Tectonics” drive the underlying physical structure of the continents, creating passive and active coastlines. This, in turn, results in distinctive “Coastal Geology” and different types of coasts that we will describe in “Coastal Classification.” The nearby local coasts of New Jersey and Delaware are dominated by “Barrier Island Systems” and we will focus on the features of these unique coasts as background for all four field trips.

Lab 1: Fieldwork at the Beach – *Field and laboratory experience; Use of technology; Quantitative assessment of data*

Objective: To introduce students to the common methods and techniques used to collect data in the field. In a jigsaw-style case study, students will learn to operate and teach their peers how to operate the equipment and make practice measurements by using the equipment in the West Campus Pond. Students will be instructed on maintaining their field notebook through the semester. Finally, students will be introduced to creating graphs and data analysis using Excel. During the course of the lab period, students will work in different groups (by design of the jigsaw-style case study) and meet several other students in the class. Therefore, this first laboratory will also serve as an icebreaker for the semester.

Assessment: Students will work in small groups to complete a worksheet that will guide them through the operation of equipment, collection of data in the field, creation of graphs, and data analysis.

Lab 2: Coastal Geology – *Problem solving/scientific method; Quantitative assessment of data*

Objective: To identify the typical geological features, rocks, sediments, and stratigraphy found at the coasts. Relevant geologic samples will be available in the laboratory. Students will analyze shoreline data from Delaware; their analyses will illustrate and emphasize the concept of coastal compartments and the role of antecedent geology in building the present-day coastal zone. Students will begin to develop hypotheses that relate to the application of the geologic samples and data. This laboratory activity will also serve as an introduction to the scientific method.

Assessment: Students will work individually to study the samples in the laboratory and write their hypotheses. Then, they will partner with another student to develop a small experiment to test their hypotheses. We will return to this work (and other subsequent activities) in preparation for Field Trip 4 when students will carry out a unique study in the field.

Lab 3: Field Briefing 1 – *Field experience*

Objective: To prepare students for Field Trip 1, including an overview of the objectives and route (with field maps), safe working practices, introduction of working groups, packing of field equipment, and development of data tables.

Assessment: Students will be expected to take notes and create field data tables during the briefing in their field notebook. Notebooks will be reviewed at the midterm and grades will be assigned at the end of the semester.

Lab 4: Field Trip 1: The Local Coast, Part I – *Field experience; Use of technology; Interdisciplinary understanding of society's interactions with the coast*

Objective: To identify the typical features of a barrier island system, including the human impacts to the ecosystem. Field Trip 1 will take place in Brigantine, Atlantic City, and Ventnor, NJ where we will study both the natural and developed areas of the barrier islands. Students will make observations, take photos, collect data related to the natural ecosystem and to human development. We will also take time to discuss the recent economic issues associated with this particular region, and how they relate to the coastal environment.

Assessment: Students will submit a Field Report where they will be required to create graphs and/or tables and discuss the implications of the data collected during the trip.

Unit 2: Processes of Coastal Erosion

Unit 2 will focus on the various processes that shape the coastal environment through erosion, including “Weather & Winds,” “Coastal Storms,” “Waves,” “Currents,” and “Tides.”

Lab 5: Properties of Water – *Problem solving; Laboratory experience; Quantitative assessment of data*

Objective: To observe and manipulate the properties of water to better understand the theoretical concepts that are unique to the water molecule, including: properties of density, thermal expansion, dissolution, and erosion. Students will then be prepared to discuss the various ways that these unique chemical properties apply to and influence the coastal near shore environment.

Assessment: Students will complete a handout that will lead them through the observations, making predications, and assessing the outcome.

Lab 6: Field Briefing 2 – *Field experience*

Objective: To prepare students for Field Trip 2, including an overview of the objectives and route (with field maps), safe working practices, introduction of working groups, packing of field equipment, and development of data tables.

Assessment: Students will be expected to take notes and create field data tables during the briefing in their field notebook. Notebooks will be reviewed at the midterm and grades will be assigned at the end of the semester.

Lab 7: Field Trip 2: The Local Coast, Part II – *Field experience; Use of technology; Quantitative assessment of data; Interdisciplinary understanding of human interactions with the coast*

Objective: To identify the typical features of a beach and dune system, including the human impacts to the ecosystem. Field Trip 2 will take place in Delaware where we will study the extensive preserved dune system at Henlopen State Park with a guided tour from a park ranger. Lastly, we will take the Cape May Ferry to more effectively observe the dunes from the water. Students will make observations, take photos, collect data related to the ecosystem and development. We will also take time to discuss the contrasting conditions between the preserved area in Delaware and the highly developed region visited in Field Trip 1.

Assessment: Students will submit a Field Report where they will be required to create graphs and/or tables and discuss the implications of the data collected during the trip.

Lab 8: Wave-Tank Simulations – *Problem solving/scientific method; Laboratory experience; Quantitative assessment of data*

Objective: To observe and manipulate waves in a tank simulation to better understand the various physical attributes of waves in the ocean and along the coast. Simulations will involve different types of coastal material and will use water of differing densities to accurately mimic the real-world scenarios.

Assessment: Students will complete a handout that will lead them through the observations, making predications, and assessing the outcome.

Unit 3: Environmental Change & the Coast

Unit 3 will focus on the processes of global environmental change occurring at the coast, including “Sea Level Change,” “Pollution,” and “Biogeography & Invasions.” This unit will also be complemented by a

guest lecture from researcher, Dr. Stu Farrell, or an Army Corps Engineer, both of whom were involved in the aftermath of Superstorm Sandy.

Lab 9: Field Briefing 3 – Field experience

Objective: To prepare students for Field Trip 3, including an overview of the objectives and route (with field maps), safe working practices, introduction of working groups, packing of field equipment, and development of data tables.

Assessment: Students will be expected to take notes and create field data tables during the briefing in their field notebook. Notebooks will be reviewed at the midterm and grades will be assigned at the end of the semester.

Lab 10: Field Trip 3: Beach Profiles & Tides – Problem solving/scientific method; Field experience; Use of technology; Quantitative assessment of data

Objective: We will return to New Jersey in Field Trip 3. Students will make measurements of beach profiles at different locations along the coast and monitor tidal flow through the inlets and into the bays throughout the day.

Assessment: Students will submit a Field Report where they will be required to create graphs and/or tables and discuss the implications of the data collected during the trip.

Lab 11: Field Briefing 4 – Field experience

Objective: To prepare students for Field Trip 4, including an overview of the objectives and route (with field maps), safe working practices, introduction of working groups, packing of field equipment, and development of data tables.

Assessment: Students will be expected to take notes and create field data tables during the briefing in their field notebook. Notebooks will be reviewed at the midterm and grades will be assigned at the end of the semester.

Lab 12: Field Trip 4: Conducting Field Experiments – Problem solving/scientific method; Field experience; Use of technology; Quantitative assessment of data

Objective: Students will design and carry out their own small field study during Field Trip 4. These can include any assessment of the coastal ecosystem from the biological, chemical, physical, or geological components. Students will present their project to their peers in a 15-minute in-class presentation during Lab 14.

Assessment: Students will submit a Field Report where they will be required to create graphs and/or tables and discuss the implications of the data collected during the trip.

Unit 4: Human Interactions with the Coast

Unit 4 will focus on how humans use, maintain, and manage coastal resources, starting with an overview of “Maritime History” and continuing with “Fisheries,” “Energy” with guest lecturer Dr. Amy Krakowka from United States Military Academy who has researched alternative energies, “Economics,” “Coastal Zone Management,” and “Conservation.”

Lab 13: Tour of Independence Seaport Museum –Real-world experience; Interdisciplinary understanding of society’s interactions with the coast

Objective: To tour a ship-building facility and two naval vessels, *Olympia* and *Becuna*. Our tour will be led by a naval historian, providing a humanities perspective on the course topics.

Assessment: Students will be evaluated on their participation during the tour.

Lab 14: Student Presentations – *Problem solving/scientific method; Real-world experience; Public speaking*

Objective: To present their completed field studies to peers; to gain public speaking and presentation skills.

Assessment: Students will be assessed on the quality of their speaking, relevance of their content, and ability to answer questions during their presentation; a portion of the assessment will also be based on peer evaluations.