Voyage: Fall 2014  
Discipline: Environmental Science  
EVSC 3559: Geographic Information System (GIS) applications in the marine environment  
Upper Division  
Faculty Name: Falk Huettmann  
Credit Hours: 3; Contact Hours: 38

Pre-requisites:  
This class requires the successful completion of basic ecology, geography, oceanography and mathematic classes. Students must be fluent in written and oral English. Having a basic understanding of global ecosystems, marine ecology, statistics and informatics would be an asset, but is not required.

COURSE DESCRIPTION  
Mapping the sea has been a human pursuit for thousands of years. The advent of modern mapping technology and computing opened up many new opportunities such as the use of Global Positioning Systems (GPS) and GIS. In this class students will learn how to create and manipulate spatial information and using software packages like QGIS, SAGA, IDRISI, GRASS, ArcGIS, Google Earth and R. This class covers the proper use of GPS and navigational equipment, as well as shapefiles, point & polygon editing, raster files, ASCII grids and ISO compliant metadata across open-source GIS platforms. Learning data management and workflows in the field and first-hand presents a unique opportunity in this class. Spatial analysis techniques (krigging, autocorrelation) and predictive modeling (machine learning) will be covered also, leading to training in cumulative impact assessment questions and for complex research project management applications for natural resource management at-sea and beyond.

COURSE OBJECTIVES  
This class has the objective to teach modern open source concepts of marine GIS mapping. Secondly, it uses inquiry-based methods and digital GIS and data opportunities to inform science-based management of the vast ocean resources and to model them in time and space.

REQUIRED TEXTBOOKS  
AUTHOR: Quantum GIS (QGIS)  
TITLE: Learning QGIS  
PUBLISHER: online resource (PDF)  
ISBN #:  
DATE/EDITION:  

1
TOPICAL OUTLINE OF COURSE

Depart Southampton- August 23:

B1- August 26: Lecture 1: Introduction to Geographic Information Systems (GIS)

B2-August 28: Lecture 2: What is Geography

St. Petersburg: August 29- September 2 Lab 1a): Learn to operate QGIS

B3- September 4: Lecture 3: How to do mapping

Gdansk: September 5-7 Lab 1b): Learn to operate a GPS correctly for GIS mapping
Rostock: September 8-9 Lab 1 ongoing

B4- September 11: Lecture 4: GIS mapping formats (shapefile, points and grids)

B5-September 13: Lecture 5: Geographic projections

Antwerp: September 14-16 Lab 2: Mapping introduction in Google Earth, SAGA, R
Le Havre: September 17-19 Lab 2 ongoing

B6- September 21: Lecture 6: Link GIS with Excel and R

B7-September 23: Lecture 7: GIS map layout

Dublin: September 24-27 Lab 3: Overlays of GIS layers

B8- September 28: Lecture 8: World Ocean Atlas (WOA) GIS data layers

B9- September 30: Lecture 9: Bathymetry GIS data layers

Lisbon: October 1-3 Guest Lecture and Oral Presentation
Cadiz: October 4-5 Student-led Discussions (specific technical topics)

B10- October 12: Lecture 10: Climate GIS data layers

Casablanca: October 8-11 Student-led Discussions

Study Day: October 12 Mid-term Exam

B11- October 14: Lecture 11: Biological GIS data layers

B12- October 20: Lecture 12: Home Range and Autocorrelation

Dakar: October 16-19
B13- October 22: Lecture 13: Resource Selection Functions

B14- October 24 Lecture 14: Remote Sensing and GIS
Takoradi October 25-26
Tema October 27-28

B15- October 30 Lecture 15: Predictions (Machine Learning)

B16- November 1 Lecture 16: Metadata in GIS

Study Day: November 2 Lab 4: Applied GIS mapping project

B17- November 4 Lecture 17: Back- and Forecasting in GIS

B18- November 6 Lecture 18: IDRISI GIS: A closer look
Rio de Janeiro: November 7-9 Final field project ongoing
Salvador: November 12-14 Final field project ongoing

B19- November 16: Lecture 19: Batch Processing in GIS

B20- November 18: Lecture 20: FRAGSTATS and Patch Analyst

Study Day- November 19 Final field project ongoing

B21- November 21: Lecture 21: Marxan (Strategic Conservation Planning)
Bridgetown- November 22-24 Final field project ongoing

B22- November 26: Lecture 22: Seascape Ecology with GIS

B23- November 28: Lecture 23: GIS visualizations and fly-throughs
Havana: November 29 December 2 Student-led discussions (GIS science topic)
December 3: study day Presentations of Final field project

B24- December 5 (A Day Finals): Final Exam
FIELD WORK
Field lab attendance is mandatory for all students enrolled in this course. Please do not book individual travel plans or a Semester at Sea sponsored trip on the day of our field lab. This field lab is planned on Friday, 5 September.

This class makes use of ship-based data mapping projects. The field-based project will allow students to compile vessel and oceanography-related GPS data and map and analyze them for a final project presentation. Projects could include the visualization of data collected by the vessel, and in concert with student-collected data referenced in space and time, e.g. weather, ecology, oceanographic or human data.

Port visits can be used to obtain additional GIS data and information on specific or latest online webportal data sources.

FIELD LAB (At least 20 percent of the contact hours for each course, to be led by the instructor.)
- Students will collect vessel-based data (e.g. ship track, ship speed, ocean depth, port locations, wind speed etc) and link it up and GIS map in-time with data they collect themselves (e.g. marine observations or compiled data sources). This class devotes lab time learning to map and analyze such data and in a modern fashion (machine learning, open access and open source GIS etc).

FIELD ASSIGNMENTS
- This class works on a group assignment, where ports get mapped (basic outline and infrastructure with a GPS) and linked with survey observations.

Field Laboratory
The GIS mapping of data is usually based on field survey information. This lab will introduce students hands-on to the use of 12 channel Global Positioning Systems (GPS) for such applications in a real-world field setting. Here we will use a port mapping exercise for students to learn the use and application of GPS abroad, with the correct geographic projection, coordinate system (e.g. decimal degrees, UTM) and data downloads for creation of precise GIS maps. Students are asked to operate a GPS, create valid data, and transfer and map them with GIS. We will map biotic, abiotic and facility features (stationary and non-stationary). That is achieved through specific surveys in the port vicinity and to capture and to describe representative port attributes, and to match and merge them later with already existing GIS maps. As a lab outcome, students are expected to produce a GIS map of their GPS field data of the port and present their findings to the class. This field lab and all techniques get introduced in the regular lectures prior to the lab. Techniques learned in the lab will be essential for subsequent assignments, projects and lectures.

Academic Objectives:
1. To create a GIS map outline of the port visited
2. Map and geo-reference relevant port infrastructures
3. Familiarize with local conditions, data management tasks and for survey field work
These experiences will be evaluated based on a short project presentation (oral PPT) and is part of the participation grade.

METHODS OF EVALUATION / GRADING RUBRIC
Letter grades will be determined from the performance in lectures (60%), labs (20%) and two oral presentations (20% A, B). Lecture performance will be determined from two exams (mid-term 20% and final 30%), participation (10%), reading assignments (15%) and student-led discussions (25%). Labs require 4 lab assignments and one fieldwork outdoors project assignment (20% each). For marking thresholds A = 100-91%, B = 90-81%, C = 80-71%, D = 70-61%, F < 61%. I do offer extra credit opportunities, and follow the latest SAS marking scheme.

RESERVE LIBRARY LIST
AUTHOR: Drew A, Yo, Wiersma, F. Huettmann
TITLE: Predictive Modeling in Landscape Ecology
PUBLISHER: Springer New York
ISBN #:
DATE/EDITION: 2012

ELECTRONIC COURSE MATERIALS

AUTHOR: R project
ARTICLE/CHAPTER TITLE: R manual and packages (online and PDFs)
JOURNAL/BOOK TITLE: http://www.r-project.org/
VOLUME:
DATE:
PAGES:

ADDITIONAL RESOURCES
This class will make use of some online data sets and software (provided by instructor and when in port); usually done via PDFs. See also World Ocean Atlas http://www.nodc.noaa.gov/OC5/WOA09/pr_woa09.html

HONOR CODE
Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University’s honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager’s Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: “On my honor as a student, I pledge that I have neither given nor received aid on this assignment.” The pledge must be signed, or, in the case of an electronic file, signed “[signed].”