

EVR 4930: Environmental Modeling with GIS
Department of Environmental Science, Policy and Geography
University of South Florida St. Petersburg
Fall 2007

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Office Hours	Monday 10:00 – 10:45 Wednesday 10:00 – 12:00 Or by appointment	Monday – 2:00 – 3:00 Thursday 10:00 – 12:00 Friday 1:30 – 3:00 Or by appointment

Prerequisites: GEO 4151C and GEO 3180C
Or Consent of the instructor

Course Description

This is an upper-division undergraduate course. The objective of this course is to examine the use of geographic information systems (GIS) for the environmental modeling. An important goal of this course is to provide students with an overview of the power and application of GIS to computer-based spatial models for the environment. Students will be exposed to a range of spatial analytic and modeling tools and applications intrinsic to GIS in applied formats through seminar style presentations and discussions of assigned articles and reports.

The focus of the course will be applied and analytical aspects of GIS on environmental modeling, with some treatment of technical issues related to data sources, data types, data analysis and modeling techniques specific to environmental data. Students will not only learn the basic concepts of GIS-based environmental modeling and data interpolation techniques, they will also be exposed to the current state of spatial models/techniques to manage our environment.

Upon completion of this course, students will be familiar with the scope of GIS application in environmental modeling; they will also have hands-on experience with GIS application for environmental modeling.

They will also be exposed to the environmental models such as RUSLE, Basins (Better assessment of Source and Non-point Source pollution by the EPA) either through class projects or in-depth discussion/lecture of case studies.

¹ Ring the doorbell if the main door is locked

Required Text

1. Required: GIS and Environmental Modeling by (Eds.) Clarke,
2. Required: Exploring the Water Resources
3. Required(**available via blackboard in pdf**) Modeling our world by Michael Zeiler

Suggested Text

4. *Suggested*: Exploring the Ocean Environment
5. *Suggested*: Exploring the Dynamic Earth
6. *Suggested*: Exploring the Tropical Cyclones
7. *Suggested*: Spatial Reasoning by J. K. Berry

Course Components

1. Introduction to fundamental concepts of GIS and Environmental Modeling
2. Hands-on experience: working on different module to learn about GIS application for Environmental Modeling.
3. Exposure to different environmental models with GIS
4. Calculation of parameters for RUSLE
5. Understanding and/or applications of the critical concepts of watershed scale models
6. Working on class projects and lab exercises
7. Seminar style discussion and participation
8. Term project/paper

Course Requirements

In addition to regular lecture/discussion in class, seminar style **presentation** and **discussion** is a critical component of this class. This facilitates learning. **All students are expected to complete the required readings and to participate in the seminars.** This course requires you to complete 1 Term Project and multiple lab exercises/assignments and/or class projects. There will be 1 midterm and 1 final.

Exercises/Homework and class projects

Exercise/lab work will be assigned (almost every week) over the course of the term which will comprise 40% of your grade. We will use Blackboard to assign the exercises/homework and announce due dates. You will learn skills necessary to complete your Term Project.

Seminar Presentation

Each week a seminar style presentation will be led by one student in which we will discuss a specific paper. **All students are expected to complete the required readings and to participate in the seminars.** Note that **20% of** your final grade will be allocated to the seminar presentation/participation (To encourage dialogue, 5% of your final grade will also be allocated to seminar participation and 15% for leading the discussion). Grading for the seminar presentations will be based upon four criteria: (1)

statement of the paper objectives, (2) the main points and conclusions of the paper, (3) issues of interest or concern raised by the seminar leaders, and (4) organization.

Exams

There will be 1 midterm (take home) and 1 final for this course. Exams may comprise of lab exercises as well as theory.

Term Project/Paper

During the semester 1 term project/paper will be assigned. You will have about 5 weeks to complete. This will comprise 15% of your final grade.

Class Grading

Lab Exercise/Class Projects	40%
Term project/paper	15%
Midterm1	15%
Seminar Presentation	15%
Seminar Participation	5%
Final	10%
Total	100%

Grading Scale

>= 96%	A+
90 - 95%	A
85 - 89%	B+
80 - 84%	B
75 - 79%	C+
70 - 74%	C
65 - 69%	D+
60 - 64%	D
<60%	F

Attendance Policy

If you miss your scheduled seminar discussion (you as the leader) your grade will be affected. If you miss a class due to circumstance beyond your control you are required to notify me in your earliest convenience. You will not loose point if you miss a class for reasons beyond your control (you as the participant). You must inform me at your earliest convenience and you are highly encouraged to weigh the opportunity costs of missing a class as lectures will greatly aid in understanding of the material. Please arrange to get notes from other students. Please note that notes or tapes from this class are not for sale. Students who anticipate the necessity of being absent from class due to the major observation of a major religious observance must inform me.

Academic Dishonesty

While class projects and term projects may usually be worked on in groups, each student is expected to turn in his/her own copy of report written in his /her own words. Blatant copying will result in zeros on all involved reports. No exception or excuses. Please refer to 2007 – 2008 student handbook for detailed discussion.

Make Up Exams

Make up exams may be permitted and must be arranged prior to the exam unless it is an emergency. However, you should inform me at the earliest opportunity.

Other Notes

Students taking this course come from a variety of backgrounds. It is hoped that all students will share thoughts and experience in order to make this a very enjoyable class for everyone. **This course requires more time commitment (outside of class) than most courses. This time investment is necessary to acquire mastery of the tasks assigned.**

Week #	Date	Topics
Week 1	8/27/2007	What is environmental modeling with GIS Introduction Course outline Course requirements Grades
Week2	9/3/2007	No class Labor Day
Week 3	9/10/2007	Modeling the environment with GIS History of GIS and environmental modeling The evolution of GIS The coupling debate How maps inform Utility of maps Raster data and vector data Reading: Chapter 1, Clarke et al. Article by: Goodchild (page 8) Article by Karimi and Houston Class Project: Water Resources Module Exercises: Measuring Global Water Finding the suitable location for reservoir
Week 4	9/17/2007	Fundamentals of GIS GIS Data Representation Fundamentals of GIS

Diverse Application of GIS
Representation of the world
Modeling surfaces
Modeling imaged or sampled data
Modeling discrete features
Comparing Spatial data representation

Reading: Chapter 3, Zieler

Class Project/Exercises: Edge effect analys (landuse)
Surface Water Flow
Water Harvesting

Week 5 **9/24/2007**

Modeling with GIS

Linear modeling with lines
Cell-based modeling with raster
Surface modeling with TINs

Reading: Chapters 2 (pages 41 – 43), 9, and 10 Zieler
Article by Goodchild (page 94)

Class Project: Working with Topology

Exercises: Network Analysis
Watershed Topolgy

Week 6 **10/1/2007**

Environmental Modeling Frameworks, Paradigms and Approaches

Typology of environmental Modeling
The nature of environmental modeling
Complex environmental systems
Environmental phenomena and complex systems
Modeling with computer

Reading: Chapter 2, Clarke et al.

Class Project: Assessment of Wild Fire Risk

Exercise/homework: Assessment of Wild Fire Risk I
Assessment of Wild Fire Risk II

Week 7 **10/8/2007**

Spatial Decision Support Systems and Environmental

Modeling: An application approach

A flexible, multiuse spatial decision support system
Applications of SDSS using Environmental Models

Reading: Chapter 3, Clarke et al.
Article by Gogu et al

Class Project: Exploring Environment

Exercises: Assessing the Hurricane Risk I
Assessing Hurricane Risk II

MIDTERM I - Assign

Week 8	10/15/2007	GIS Data Sources and Measurement Technologies a. Environmental modeling, data and GIS b. Data types, sources and issues c. Remotely sensed data and data capture d. GPS data accuracy and precision e. Data access and data distribution Reading: Chapter 4, Clarke et al. Article by Burrough et al. (page 29) Class Project/Exercises: Habitat Suitability Models(s)
Week 9	10/22/2007	Development, calibration and validation of models a. From the real world to abstract models b. Modeling goals c. Model Structure d. Calibration of models e. Validation of models f. Case Study: <u>SWAT</u> Reading: Chapter 5, Clarke et al. Article by Jayakrishnan et al. Class Project/Exercises: Global Precipitation Pattern Seasonal Temperature Variation
Week 10	10/29/2007	Dynamic systems modeling and four dimensional GIS

- a. Space-time modeling in a GIS context
- b. Models and modeling
- c. Time dimension and the GIS
- d. Modeling space-time systems

Reading: Chapters 6 and 7, Clarke et al.

Class Project/Exercises: What if the Ice Sheet Melted
Hurricane risk III

MIDTERM I - Due

Week 11 11/5/2007

Modeling Physical Systems

- a. Physical processes in Environmental Modeling
- b. Models and GIS
- c. Case study: RUSLE

Reading: Chapter 8, Clarke et al.
Article by: Van Remortel

Class Project: Work with Software: ArcGIS9 RUSLE

Week 12 11/12/2007

No Class Veterans Day

Week 13 11/19/2007

Modeling Physical systems

GUEST Lecture: Dr. Karlin: Introduction to ArcHydro

Class Project/Exercises: Time series in ArcHydro
RUSLE continues

Reading: Article by: Shi et al.

Week 14 11/26/2007

**Integrative Environmental Modeling and Visualization
of Environmental data**

- a. Interaction between models
- b. Uncertainty analysis and model integration
- c. Approaches to model integration
- d. User Interface Issues

Reading: Chapters 9 and 11, Clarke et al.
Article by: Burrough et. al

Class Project/Exercise: RUSLE

Week 15 **12/03/2006** **GIS and Environmental modeling where next?**
Introduction to Basins
Class Project/ Exercises: Distance Analysis
Cost Surface Analysis

Reading: Chapter 12, Clarke et al.
Articles by: Corwin et. al

Week 16 **12/10/2007** **FINAL**

I reserve the right to modify the schedule if necessary. In that unlikely case, postings on the Black Board website will take precedence over this schedule.