

GEO5157 GIS For Environmental Analysis And Modeling
(Spring 2006)

Instructor:

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Class Hours:

Mondays: 2:30 - 5:00 p.m., 320 Bellamy Building

Office Hours:

Wednesdays and Fridays: 1:00 – 2:30 p.m., or by appointment.

Teaching Assistant:

TBA

Computing Lab Manager (any problem related to computer system):

Mr. Shawn Lewers (SWL2727@mailers.fsu.edu)

Course Objectives and Description

The goal of this course is to teach students problem-solving skills for environmental management in a GIS framework. Specifically, this course will identify GIS principles, methods and techniques that are particularly relevant to environmental problem solving. It will also examine and review specific application areas where GIS can be useful.

This course covers a range of technical topics such as the nature of environmental data, environmental data acquisition and integration, interpolating environmental data, and environmental modeling techniques. Applications include a combination of the following aspects: geohazard analysis, hydrological modeling and watershed analysis, terrain modeling and landform analysis, landscape metrics and landscape pattern analysis, cartographic modeling and land suitability analysis, non-point pollutant modeling, soil erosion modeling, wildfire modeling, and landscape dynamic modeling.

The course consists of lectures, lab assignments, reading and discussions, and an independent research project. The lecture focuses on a number of selected topics related to GIS principles, techniques and applications. A substantial component of this course is comprised of computer-based lab assignments that involve the use of several software packages. Weekly discussion of selected journal articles or book chapters is required for each participant. Each student needs to complete an independent research project and present his/her result to the entire class.

Prerequisite

GEO4151/5159 Geographic Information Systems or equivalent.

Computing Environment, Software and GIS Lab Policies

Windows based ArcGIS (and extensions), IMAGINE or/ and IDRISI software packages will be used for class assignments. ***However, you must be aware that this is not a software training course. If you are looking for such a course (learning a specific software package), you should visit the homepages for***

specific software packages. These vendors may provide short training courses or more software-specific training materials.

You will be given a temporary account in order to log on a computer in COSS GIS Lab. This account may expire by the end of the semester. When you are at the computer lab, you must observe the COSS GIS lab and FSU's related policies. The GIS lab rules include (on the following page):

- *No food or drink in the lab.*
- *Lab computers are for GIS work only. Your other class work is to be done in other labs.*
- *Lab printers are for GIS work only.*
- *DO NOT install software without permission from your instructor or the lab manager. If you need software, ask!*
- *DO NOT save your work on the local machines. Use your Z:\ drive. If you use the local machine or temp directory, others will be able to see your work and it may not be there later.*
- *DO NOT waste color prints, as they are expensive. Use the black and white printer whenever possible.*
- *Be courteous of others in the lab and stay quiet.*
- *Clean up after yourself. Lab attendants will throw out things that are left behind.*
- *DO NOT remove equipment that belongs in the lab from the lab. You will be criminally prosecuted if you are caught.*
- *DO NOT download MP3 or movie files. Most of these websites are compromised by viruses.*
- *Always log-off the computers when you are done, but DO Not shut them down.*
- *No instant messaging is allowed.*
- *Follow the FSU Honor Code and Code of Conduct rules and behave in an adult-like manner.*

It is your responsibility to check and observe these rules. Any violation of these rules can result in the loss of privileges to use this facility. If that happens, it is your responsibility to find an alternative so that you could work on your lab assignments. If you are unsure about a rule or rules, ask a lab employee or Shawn Lewers (swl2727@fsu.edu).

Course Blackboard Site

The Blackboard will be used to host the course lecture and lab materials. You may find the lecture slides there, but there is no guarantee that these lecture materials will be available on time. You will still need to take notes during a lecture session. You are required to check that site from time to time because some important announcements may be posted there. The Blackboard address is: <http://campus.fsu.edu>. You will need to use your FSU email account username and password to access this site.

Grading Polices

System:

A	94-100	C	72-76
A-	90-93	C-	70-71
B+	87-89	D+	66-69
B	84-86	D	62-65
B-	80-83	D-	60-61
C+	77-79	F	< 59

In qualitative terms, the grade standards are: **A**, Outstanding, few errors or omissions (if any); **B**, Good, only minor errors/omissions; **C**, Satisfactory, at least one major error/omission; **D**, Poor, several major errors/omissions; and **F**, Fail: many major errors/omissions.

Components:

<i>Components</i>	<i>Description</i>	<i>Share</i>
Lab assignments	There are about 10 lab assignments	30%
Reading and discussion assignments	A selection of journal articles or book chapters; leading and summarizing the discussion (60%); participating the discussion (40%)	20%
Exam 1	Open book; need to be completed within 24 hours	15%
Exam 2	Open book; need to be completed within 24 hours	15%
Research project (presentation and report)	Identifying a topic, writing a short proposal (one page or so), conducting research, presenting the findings to the entire class, and preparing a final report	20%

Attendance:

Students are required to attend all classes and be punctual. Missing even one lecture can affect your grade substantially. Announcements regarding the course outline and the schedule of the lectures, labs and exam (including changes of these) may be made in class. All organizational/administrative announcements made during the class period are assumed to be known by all students. **Cell phones, pagers, alarms, laptops, calculators, and other electronic devices must be turned off in class at all times. In a lecture session, please do not log on any lab computer!**

Exams:

The exam can involve any material covered in lectures, reading or discussion assignments, and labs. There is no provision for extra credit work. No make-up exam is allowed. If you miss the exam, you must present a signed physician's excuse or, if the exam is missed due to a family funeral, a dated newspaper obituary. Most other excuses for missing the exam are not acceptable. This policy will be applied stickily.

Lab grading policies:

Grades of your lab exercises are based on the quality of your answers. Any answer should be concise and be well organized. They must be **in print**. The grade for each of the exercises is reported as *points_scored/total_points_of_exercise*. For example, if an assignment is worth 20 points and your answers score 16 points then you should see 16/20 on your marked assignment.

Each of the assignments will have a due day clearly written on the first page of your lab assignment. The due time is 5:00 p.m. on the due day. Any assignment that is turned in after the due time on the due day is considered late, which will receive penalty strictly.

The penalty for a late assignment is based on the number of days late (including weekends). If an

assignment is late less than 24 hours, it is considered 1 day late. If an assignment is late less than 48 hours but more than 24 hours, it is considered 2 days late, and so on. Late assignments are penalized **20%** per day. Here is the formula for calculating the points of a late assignment:

$$\text{Points}_{\text{get}} = \text{Points}_{\text{scored}} - 0.20 * \text{num}_{\text{days}_{\text{late}}} * \text{Points}_{\text{scored}}$$

The minimum value of $\text{Points}_{\text{get}}$ is 0. Assignments handed in after I have returned the graded assignment to class (usually one week after the due date) will receive no points. Again, you must provide acceptable excuse (see exam section) in order to receive more time for you to complete lab exercises without penalty applied. You should discuss with your lab instructor about your situation no later than the due day. This policy will be applied stickily.

Note that every person must hand in his or her own lab assignments. Working together is permitted and encouraged, BUT each person will be graded separately, must answer "creative response" questions independently, and must create his or her OWN maps. Turning in identical or substantially similar assignments will result in significant grade reduction.

Reading assignment and discussion:

A set of journal articles or book chapters will be used for reading purpose. Each student is expected to lead discussion for two articles. One will be assigned by the instructor and the other will be selected by the student. The leader is expected to prepare a set of questions (5~10 or so) for that particular article in one week before the actual discussion. These questions should be posted on the Blackboard site momentarily (with the help of the instructor), and each student will need to address these questions when reading through that article. The leader should prepare several slides to initiate the discussion, and summarize the major findings resulting from the classroom discussion. The summary report is due one week after the discussion. Each discussion session could last 15~30 minutes depending upon the topic. All students are expected to participate the discussion. The list of assigned articles will be posted on the blackboard later.

Research project:

Will be discussed in a separate document.

Course Materials

There is no required text for this class. However, you should have at least two books on hand for reference: one book on environmental or physical geography and the other on GIS fundamentals.

Here are two recommended books on environmental or physical geography:

- Marsh, W. M. and Grossa, J. M., 2002. *Environmental Geography: Science, Land Use, and Earth Systems* (2nd edition). New York: Wiley and Sons: 440p.
- Strahler, A. and Strahler, A., 2006. *Introducing Physical Geography* (4th edition). New York: Wiley and Sons: 728p.

There are a few recommended books on GIS fundamentals:

- Burrough, P.A. and R. A. McDonnell, 1998. *Principles of Geographic Information Systems*. New York: Oxford University Press, 333 p.

- Lo, C. P. and A. K. W. Yeung, 2002. *Concepts and Techniques of Geographic Information Systems*. Prentice Hall, New Jersey, 492p.
- Longley, P. A., Goodchild, M. F., Maguire, D. J. and Rhind, D. 2005. *Geographical Information Systems and Science*. New York: Wiley and Sons. 454p.
- Zeiler, M., 1999. *Modeling Our World: The ESRI Guide to Geodatabase Design*. ESRI Press, Redlands, California, 199p.

Here is a list of useful GIS books concerning environmental applications :

- Bartlett, D., 2004. *GIS for Coastal Zone Management*. Taylor & Francis. 328p.
- Bourgeron, P. S., Jensen, M, and Lessard, G., 2001. *A Guidebook for Integrated Ecological Assessments*. Springer, 552p.
- Clarke, K. C., Parks, B. O. And Crane, M. P., 2002. *Geographic Information Systems and Environmental Modeling*. New Jersey: Prentice Hall. 306p.
- Convis, C. (eds.), 2001. *Conservation Geography: Case Studies in GIS, Computer Mapping, and Activism*. Redlands, CA: ESRI.
- Costanza, R., Constanza, Voinov, A., 2003. *Landscape Simulation Modeling*. Springer, 330p.
- DeMers, M. N., 2002, *GIS Modeling in Raster*. New York: John Wiley & Sons. 203p.
- Goodchild, M. F. et al. (eds), 1993. *Environmental modeling with GIS*. New York: Oxford University Press. 520p.
- Goodchild, M. F., Steyaert, L. T., Parks, B. O, Johnston, C., Maidment, D., Crane, M., and Glendinning, S. (eds), 1996. *GIS and Environmental Modeling: Progress and Research Issues*. Wiley and Sons, 504p.
- Gurnell, A. M.and D.R. Montgomery (edited), 2000. *Hydrological Applications of GIS*. John Wiley, New York, 176 p.
- Halls, P. J., 2001. *Spatial Information and the Environment*. Taylor & Francis, 328p.
- Heuvelink, G. and Goodchild, M. F., 1998. *Error Propagation in Environmental Modelling With GIS*. Taylor & Francis, 127p.
- Johnston, C. A., 1998. *Geographic Information Systems in Ecology*. Blackwell Publishing, 239p.
- Lang, L., 1998. *Managing Natural Resources with GIS*, Redlands, Redlands, CA: ESRI.
- Long, E. T., 2003. *Coastal and Marine Geo-Information Systems*. Springer, 620p.
- Longley, P.A., Goodchild, M.F., Maguire, D., and Rhind, D.W., 2005. *Geographical Information Systems* (2nd Edition) (Abridged), New York: John Wiley & Sons. 358p.
- Lyon, J. G., 1995. *Wetlands and Environmental Applications of GIS*. CRC Press, 400p.
- Maidment,D. and Djokic, D., 2001. *Hydrologic and Hydraulic Modeling Support W Geographic Information Systems*. Relands, California: ESRI. 216p.
- Maidment, D. and Morehouse, S., 2002. *ArchHydro: GIS for Water Resources*. Redlands: ESRI. 220p.
- Malczewski, Jacek, 1999. *GIS and Multicriteria Decision Analysis*. John Wiley, New York, 392 p.
- Millington, A., Walsh, S. J., and Osborne, P.E., 2001. *GIS and Remote Sensing Applications in Biogeography and Ecology*. New York: Springer. 344p.
- Mladenoff, M. G.and Baker, W.L., 1999. *Spatial Modeling of Forest Landscapes*. Cambridge University Press, 364p.
- Shamsi, U.M., 2002. *GIS Tools for Water, Wastewater, and Stormwater Systems*. ASCE

- Publications, 375p.
- Skidmore, A. (ed), 2002. *Environmental Modelling With GIS and Remote Sensing*. Taylor and Francis.
- Wilson, J. P. And Gallant, J.C., 2000. *Terrain Analysis: Principles and Applications*. New York: John Wiley, 479p.
- Wright, D. J. (ed), 2001. *Undersea with GIS*. Redlands: ESRI Press. 253p.

Journal articles:

In this course, journal articles will be recommended to students to read. Students should constantly check the following journals for useful articles on GIS theories and applications:

- *International Journal of Geographic Information Science*
- *Transaction in GIS*
- *Computer, Environment and Urban Systems*

Because students in GIS classes come from different disciplines, they can refer to professional journals in their own fields to find useful GIS application papers, e.g. for landscape architects, a journal such as *Environmental Planning and Landscape and Urban Planning* will be useful. Two other geography journals are also useful: *Applied Geography* and *The Professional Geographer*. Also environmental management and natural resources journals contain more and more GIS papers (e.g. *Landscape Ecology*, *Ecological Modeling* or *Journal of Environmental Management*)

Electronic discussion groups and internet for GIS:

Students with an electronic mail account can sign up for an electronic discussion group on GIS. The most important group is called GIS-L. There are many discussion groups for individual software, e.g., there is one for ARC/INFO, one for IDRISI.

Another trend in GIS is the use of Internet to deliver GIS data and maps. Some GIS analyses can also be done through the Internet. You should constantly check the websites. There are many websites on GIS. You can use a search engine, such as <http://www.yahoo.com/> to search for them. If you are reading this syllabus in our GIS class website, you will be directed to link to a number of important websites for information on programs and data. The following websites (URL) are a must for you to explore:

- <http://www.usgs.gov/> [USGS WEBSITE]
- <http://www.esri.com/> [ARC/INFO WEBSITE]
- <http://www.idrisi.com/> [IDRISI WEBSITE]
- <http://www.census.gov/> [US CENSUS BUREAU WEBSITE]

Honor Code

Students are expected to uphold the Academic Honor Code. The Academic Honor System of The Florida State University is based on the premise that each student has the responsibility to:

- Uphold the highest standards of academic integrity in the student's own work,
- Refuse to tolerate violations of academic integrity in the University community, and
- Foster a high sense of integrity and social responsibility on the part of the University community.

PLAGIARISM: All submitted assignments must be your own original, independent work. All sources must be properly cited, (especially in the graduate student paper). Ask the instructor if you are unsure

what to do. Plagiarism will result in significant grade reduction.

ADA Requirements

Students with disabilities needing academic accommodations should:

- Register with and provide documentation to the Student Disability Resource Center (SDRC).
- Bring a letter to the instructor from the SDRC indicating you need academic accommodations.

This should be done within the first week of class.

For more information about services available to FSU students with disabilities, contact the Assistant Dean of Students: sdrc@admin.fsu.edu, Disabled Student Services, 08 Kellum Hall, Florida State University, Tallahassee, FL 32306-4066, (850) 644-9566.

Spring 2006 Tentative Schedule

Weeks	Dates	Lecture	Lab	Reading	Discussion/ Comments
1	1/9	Course overview; environmental science and GIS; GIS principles (I)-data modeling	Lab 1: Exploring the structure of geodatabase	Zeiler (1) Longley (2&3)	Guidelines assignments
2	1/16	Martin Luther King Jr. Day (no class)			
3	1/23	GIS principles (II): scale, resolution, and MAUP problem; representing time	Lab 2: Spatial variability in environmental data	Longley (4) Peuquet (8)	Discussion (1): Scale/MAUP
4	1/30	GIS principles (III): spatial autocorrelation; spatial sampling and distance decay	Lab 3: Temporal data representation	Longley (4)	Discussion (2): Sampling scheme
5	2/6	Environmental data acquisition (web search/ GPS/ Remote Sensing) and integration (georeferencing and issues of errors)	Lab 4: Georeferencing raster data	Lang (33) Barnsley (32) Fisher(13) Guptill (49) Longey (5)	Discussion (3): Data sources and errors
6	2/13	Interpolating environmental data	Lab 5: Interpolation environmental data	Mitas (34) Yang	Discussion (4): Spatial interpolation
7	2/20	Exam One	Midterm Feedback		
8	2/27	Cell-based modeling and geohazard analysis	Lab 6:Geohazard analysis	Zeiler (9)	Discussion (5): geohazrd analysis
9	3/6	Spring Break (enjoy!!)			
10	3/13	Terrain analysis and wildfire modeling	Lab 7:Wildfire modeling	Zeiler (10)	Discussion (6): terrain analysis

11	3/20	Hydrological modeling	Lab 8: Hydrological modeling	Band (37)	Discussion (7): hydrological modeling
12	3/27	Land suitability modeling	Lab 9: Land suitability modeling	Eastman (35)	Discussion (8): land suitability modeling
13	4/3	Landscape fragmentation analysis	Lab 10: Landscape pattern analysis	Turner (2000)	Discussion (9) From pattern to process
14	4/10	Exam Two	Research Project		
15	4/17	Short (30 minutes) Mandatory Class Meeting/Research Project			
16	4/24	Project Presentation/Report is due on April 24 (midnight)			