GIS FOR ENVIRONMENTAL ANALYSIS AND MODELING
(GIS5035– Fall2012)

Instructor:
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Class Hours:
Mondays: 9:30 a.m. – 12:00 p.m., 0035 Bellamy Building (COSS GIS Lab)

Office Hours:
Fridays: 10:00 a.m. – 12:00 p.m., or by appointment.

Teaching Assistant:
Ting Liu (tl08c@my.fsu.edu)

Computing Lab Manager (any problem related to computer system):
Mr. Shawn Lewers (slewers@fsu.edu)

Course Objective and Description
The purpose of this course is to train students environmental problem solving skills using geographic information systems and related analytic techniques. It focuses on the GIS principles, methods, and techniques that are relevant to and useful for problem solving in environmental science and management. Specifically, this course has four major components: an overview on selected GIS principles including data models, scale and spatial sampling, ecological fallacy and modifiable unit problem, time representation, distance, and spatial autocorrelation; a review on the major techniques or issues for environmental data acquisition and integration; an introduction to environmental analysis and modeling techniques including cell-based modeling, statistical modeling, cartographical modeling, cellular automata, and agent-based modeling; and a discussion on several applied areas of environmental modeling techniques concerning landscape ecology (landscape pattern analysis), hydrology (surface analysis, hydrological feature extraction, soil erosion, and non-point source pollution), natural hazards (flood and wildfire), natural resources management (land cover modeling), and environmental planning (land suitability analysis and urban growth modeling).

This course will be taught at the advanced level, with instructor-led lectures, unsupervised lab assignments, reading and discussions, and an independent research project. The lecture focuses on selected topics concerning GIS principles, techniques and applications. An important component of this course is the computer based lab assignment that involves the use of a leading commercial GIS software packages. A literature survey on a technical or applied topic is required for each participant. Each student needs to complete an independent research project and present the result to the entire class.

Prerequisite
An introductory GIS course or equivalent. In addition to this formal prerequisite, students are expected to have a reasonable background in physical geography, college algebra and univariate and multivariate statistics.

Computing Environment, Software and GIS Lab Policies
Windows based ArcGIS (and some extensions) 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:

- 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 (slewers@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 account username and password to access this site.

Grading Policies

**System:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94-100</td>
</tr>
<tr>
<td>A-</td>
<td>90-93</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
</tr>
<tr>
<td>B</td>
<td>84-86</td>
</tr>
<tr>
<td>B-</td>
<td>80-83</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
</tr>
<tr>
<td>C</td>
<td>72-76</td>
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<tr>
<td>C-</td>
<td>70-71</td>
</tr>
<tr>
<td>D+</td>
<td>66-69</td>
</tr>
<tr>
<td>D</td>
<td>62-65</td>
</tr>
<tr>
<td>D-</td>
<td>60-61</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 59</td>
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</tbody>
</table>

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:**

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab assignments</td>
<td>There are 7 labs to be completed within a fixed time frame.</td>
<td>35%</td>
</tr>
<tr>
<td>Two writing assignments</td>
<td>A set of questions to be answered within a fixed time period.</td>
<td>30%</td>
</tr>
<tr>
<td>Literature review</td>
<td>Review two journal articles on a technical or applied topic, write a report, and discuss your report in the class.</td>
<td>10%</td>
</tr>
<tr>
<td>Research project</td>
<td>Identify a technical or applied topic, write a short proposal, conduct research, present the findings to the entire class, and write a final report</td>
<td>25%</td>
</tr>
</tbody>
</table>
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 (Writing Assignments):
An exam can involve any material covered in lectures, reading or discussion assignments, and labs. There is no provision for extra credit work. A make-up exam might be arranged only when you present an acceptable excuse: documented illness, deaths in the immediate family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. Most other excuses for missing an exam are not acceptable. This policy will be applied strictly.

Lab grading policies:
Lab grade will be combined with other components (exams and article review) to form a single grade for the entire class. Grades of your lab exercises are based on the quality of your answers. Any answer should be concise and 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 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:

Points_get = Points_scored - 0.20*num_days_late*Points_scored

The minimum value of Points_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/visual products if appropriate. Turning in identical or substantially similar assignments will result in significant grade reduction.

Journal article review and discussion:
Each participant is required to review 2-3 major research articles that are related to a single theme (either a specific technique, method or application). The articles must be chosen from a major scholarly journal (check Section Course Materials for details) and must NOT have been reviewed by you in a different course. You are NOT allowed to use any web materials to replace a journal article. Each participant needs to do a 15-minute powerpoint presentation and lead discussion for the set of articles. The leader is expected to prepare a set of questions (5 or so) for that particular set of the articles in one week before the actual discussion. These questions should be posted on the Blackboard site momentarily with the help of the Instructor or TA. Along with a leader (who actually reviews the articles), at least one
“Discussant” will be assigned to each set of the articles. Every student will need to address the review questions when reading through the articles, and the assigned “discussant” should play a critical role in the discussion. The leader should prepare some 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 up to 20 minutes depending upon the topic. All students are expected to participate the discussion.

Research project:
To 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:


There are a few recommended books on GIS fundamentals:

- McMaster, R. B. and Usery, E. L. (eds) 2004. A Research Agenda for Geographic Information Science. CRC Press, 404p. (note that most of the materials included in this book can be accessed from UCGIS website-www.ucgis.org; go to priorities/research)

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


**GIS Journals**

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
- Journal of Geographical Systems
- 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 such as *Environmental Management* and *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.google.com/](http://www.google.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:

Honor Code
The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to “... be honest and truthful and ... [to] strive for personal and institutional integrity at Florida State University.” (Florida State University Academic Honor Policy, found at http://dof.fsu.edu/honorpolicy.htm.)

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 accommodation should:

(1) register with and provide documentation to the Student Disability Resource Center; and

(2) bring a letter to the instructor indicating the need for accommodation and what type. This should be done during the first week of class.

This syllabus and other class materials are available in alternative format upon request. For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center
97 Woodward Avenue, South
108 Student Services Building, FSU
Tallahassee, FL 32306-4167
(850) 644-9566 (voice)
(850) 644-8504 (TDD)
sdr@admin.fsu.edu
http://www.disabilitycenter.fsu.edu/

Free Tutoring from FSU
For tutoring and writing help in any course at Florida State University, visit the Academic Center for Excellence (ACE) Tutoring Services' comprehensive list of tutoring options - see http://ace.fsu.edu/tutoring or contact tutor@fsu.edu for more information. High-quality tutoring is available by appointment and on a walk-in basis. These services are offered by tutors trained to encourage the highest level of individual academic success while upholding personal academic integrity.
## Fall 2012 Tentative Schedule

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Date</th>
<th>Lectures</th>
<th>Labs</th>
<th>Readings</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/27</td>
<td>Syllabus distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9/3</td>
<td>Lab Day/Happy Holiday!</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9/10</td>
<td><strong>Introduction</strong>: Course overview, GIS overview, environment and GIS, and ArcGIS overview</td>
<td>NA or refresh your ArcGIS knowledge</td>
<td></td>
<td>Literature review guidelines/ Project guidelines</td>
</tr>
<tr>
<td>4</td>
<td>9/17</td>
<td><strong>GIS principles I</strong>: Data models, the issue of scale, and spatial sampling</td>
<td>Lab 1: Spatial variability of environmental data</td>
<td>Check the course blackboard</td>
<td>Article review list due</td>
</tr>
<tr>
<td>5</td>
<td>9/24</td>
<td><strong>GIS principles II</strong>: Pitfalls of spatial data (spatial autocorrelation, ecological fallacy, MAUP, and scale)/ time representation</td>
<td>Lab 2: Environmental data acquisition with GPS</td>
<td></td>
<td>Review questions due</td>
</tr>
<tr>
<td>6</td>
<td>10/1</td>
<td><strong>Environmental data acquisition and integration I</strong>: Online databases/GPS/remote sensing/georeferencing/error and uncertainties</td>
<td>Lab 3: Spatial interpolation of environmental data</td>
<td></td>
<td>Proposal due/Review I</td>
</tr>
<tr>
<td>7</td>
<td>10/8</td>
<td><strong>Environmental data acquisition and integration II</strong>: Spatial interpolation</td>
<td>Lab 4: GIS for natural resource management</td>
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<td>Review II</td>
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<tr>
<td>8</td>
<td>10/15</td>
<td><strong>Writing Assignment I</strong></td>
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<tr>
<td>9</td>
<td>10/22</td>
<td><strong>Environmental data analysis and modeling I</strong>: GIS-based spatial analytic and modeling techniques/ Cell-based modeling and geo-hazard analysis</td>
<td>Lab 5: GIS-based geohazard analysis</td>
<td>Check the course blackboard</td>
<td>Review III</td>
</tr>
<tr>
<td>10</td>
<td>10/29</td>
<td><strong>Environmental data analysis and modeling II</strong>: Digital elevation model, surface analysis and wild fire modeling, and hydrological network modeling</td>
<td>Lab 6: GIS-based hydrological network modeling</td>
<td></td>
<td>Review IV</td>
</tr>
<tr>
<td>11</td>
<td>11/05</td>
<td><strong>Environmental data analysis and modeling III</strong>: Soil erosion modeling and non-point source pollution modeling</td>
<td>Lab 7: GIS-based landscape pattern analysis</td>
<td>Check the course blackboard</td>
<td>Review V</td>
</tr>
<tr>
<td>12</td>
<td>11/12</td>
<td>Veteran Day (No Class)</td>
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<tr>
<td>13</td>
<td>11/19</td>
<td><strong>Environmental data analysis and modeling IV</strong>: Landscape metrics, spatial pattern analysis, and land cover change modeling</td>
<td>Lab 8: GIS-based land cover change modeling</td>
<td></td>
<td>Review VI</td>
</tr>
<tr>
<td>14</td>
<td>11/26</td>
<td><strong>Writing Assignment II</strong></td>
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<tr>
<td>15</td>
<td>12/03</td>
<td><strong>Research Presentation I</strong></td>
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<tr>
<td>16</td>
<td>12/10</td>
<td><strong>Research Presentation II/ Report Due Midnight (December 10)</strong></td>
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