Special Projects in Geographical Information Science:
Using GIS for Ecology and Environmental Studies
GEP 350 / GEP 605

Credits: 4 Hours: 6 (2 lecture, 4 lab)
Class Meeting Time: Thursdays, 4:30 - 9:30 pm
Class Location: Gillet Hall, Rm. 315 (GIS Lab)
Instructor: Dr. Juliana Maantay, Dept. of Geology and Geography
Office: Gillet Hall, Rm. 303 Tel: (718) 960-8574
Fax: (718) 960-8584 e-mail: maantay@aol.com
Office Hours: Mondays and Wednesdays, 4:30 pm - 5:30 pm, and by appointment

Course Description:

"Special Projects in GIS" has been developed to meet the needs of students using Geographic Information Systems to conduct research in any of the natural and social science disciplines, and who wish to apply more advanced GIS techniques to their analyses. This course will enable the intermediate GIS users to expand their knowledge of current methodologies, and to prepare them to conduct more complex and meaningful analyses involving modeling and simulation.

This term, the course will explore in depth the topic of "GIS for Ecology and Environmental Studies," and will give students the opportunity to design and develop a major GIS project. Through a series of lectures, GIS laboratory work, and the design of a GIS project, students will learn more advanced GIS spatial techniques and their applications to environmental management, urban planning, economic development, risk and hazard assessment, and other arenas of public policy and decision-making.

Course Requirements:

· Lab Assignments (40%)
· Project Proposal Paper and In-Class Presentation (25%)
· Class Discussion Participation (10%)
· Final Exam (25%)

Required Texts:

· Spatial Reasoning for Effective GIS, by Joseph Berry, 1995, John Wiley, NY, NY

Additional readings assigned from selected chapters of: (on reserve at Lehman Library)
CLASS 1 (8/30)
Discussion Topic: Introduction to the Course, and Review of Basic Mapping and GIS Principles
Lab Work: Case Study Analysis and Map Interpretation Problems.

CLASS 2 (9/6)
Discussion Topic: Statistical Mapping
Lab Work: Assignment #1: "Refresher Lab - Creating Choropleth and Proportional Symbol Maps"
Reading Assignment: Kraak, Chapter 7; Johnston, Chapter 1; Fotheringham, Chapter 3.

CLASS 3 (9/13)
Discussion Topic: Cartographic Modeling and Spatial Analysis
Lab Work: Assignment #2: "Generating Buffers and Using Theme-on-Theme Selection for Proximity Analysis"
Reading Assignment: Berry, Topic #7; Goodchild, Chapter 7; Johnston, Chapter 3.

CLASS 4 (9/20)
Discussion Topic: Integrating Vector and Raster Data - Working with Remotely-Sensed Imagery
Lab Work: Assignment #3: "Re-projecting and Editing Spatial Data for Integration with Remotely-Sensed Images"
Reading Assignment: Turner, Chapter 3; Berry, Chapter 28, and Topic 6; Johnston, Chapter 9; Alexander and Millington, Chapter 11.

NO CLASS (9/27 - Yom Kippur)
CLASS 5 (10/4)
Discussion Topic: Environmental Spatial Databases and Mapping
Lab Work: Assignment #4: "Working with a Global Environmental Database"
Reading Assignment: Johnston, Chapter 2; Goodchild, Chapter 35.
Written Assignment: Project Proposal Concept due today.

CLASS 6 (10/11)
Discussion Topic: Topographic, Linear, and Temporal Operations
Lab Work: Complete Lab Assignments #1 - 4.
Reading Assignment: Johnston, Chapters 4, 5, and 6.

CLASS 7 (10/18)
Discussion Topic: Methods of Interpolation, Spatial Simulation, and the Use of Geostatistics
Lab Work: Assignment #5: Interpolating to Create a Continuous Surface From Points Using Inverse Distance Weighting"
Reading Assignment: Berry, Topics #2 and 10; and Johnston, Chapter 7.

CLASS 8 (10/25)
Discussion Topic: Modeling in GIS
Lab Work: Assignment #6: "Developing and Implementing a Simple Environmental Model"
Reading Assignment: Berry, Topics #5 and 8; Goodchild, Chapter 31; & Johnston, Chapter 10.
Written Assignment: Draft Project Proposal Paper due today.

CLASS 9 (11/1)
Discussion Topic: Global Positioning Systems (GPS) and GIS
Lab Work: GPS in the field; and Complete Lab Assignments #5 and 6.
Reading Assignment: Johnston, Chapter 8; Berry, Chapters 27 and 29.
CLASS 10 (11/8)
Discussion Topic: Spatial Decision Support, Expert Systems, and Rule-Based Reasoning
Lab Work: Assignment #7: "Predictive Modeling for Habitat Suitability: Using a Logistic Regression Model"
Reading Assignment: Turner, Chapter 7; Goodchild, Chapters 24 and 29.

CLASS 11 (11/15)
Discussion Topic: Error Analysis, Data Uncertainty, and Model Calibration
Lab Work: Assignment #8: "Mapping Nearest Neighbors"
Reading Assignment: Berry, Topic #4; Heywood, Chapter 10 (from GEP 205/505); Alexander and Millington, Chapter 7.

NO CLASS (11/22 - Thanksgiving Day)

CLASS 12
Discussion Topic: Modeling and Public Policy
Lab Work: Assignment #9: "Mapping and Analyzing Patterns in Point Data (Cluster Analysis with K-function statistics)"
Reading Assignment: Goodchild, Chapter 30; and Case Study #5.

CLASS 13 (12/6)
Discussion Topic: Student Case Study Presentations and Course Review
Lab Work: Complete Lab Assignments #7 - 9
Reading Assignment: Course reading material review.
Written Assignment: Final Project Proposal Paper due Today

CLASS 14 (12/13)
Discussion Topic: Student Case Study Presentations
Lab Work: Complete Lab Assignments #7 - 9.
Written Assignment: Take-home Final (written) Exam
NOTE: Students in GEP 350/GEP 605 have varying levels of GIS skills and background knowledge. To ensure as far as possible that everyone is "on the same page," and to minimize the effort required to understand the topics of spatial analysis, simulation, and modeling to be covered in this course, students are urged to review the following material, especially as necessary to supplement any known or potential area of deficiency.

All students will be expected to have a grasp of the rudiments of map composition and chart design, a familiarity with general GIS theory, a reasonable understanding of basic statistics, and a working knowledge of ArcView GIS software and Windows.

For general information on thematic mapping, map composition, and chart design, review Cartography: Thematic Map Design, by Borden Dent, 1999, McGraw Hill, New York, NY. See especially Chapters 13, 14, 15 and 18, regarding map composition, use of color, typeface selection, and graphing, and Chapters 4, 5, and 7, regarding thematic mapping. Chapter 6 is an excellent overview of GIS. This book is available on reserve at the Lehman Library.


STUDENT PROJECT PROPOSAL PRESENTATION:

Each student will individually prepare and make an oral presentation to the class of his/her project proposal research and resulting paper. The presentations will be made in Classes 13 and 14, and are to be 15-20 minutes in length. The presentations should cover the following topics: the title of the project; the purpose of the project (hypothesis, problem to be solved, etc.); brief background of the issues; the data sets required; the methodology to be used; the flow chart of operations; the data sets that have been acquired or located; any preliminary mapping carried out; and what further research may stem from this project.

PROJECT PROPOSAL PAPER:

Each student will individually develop a term paper detailing a GISc project proposal for independent research. This is to be a realistic project, one feasible of being carried out by you for an independent study course, such as GEH 490/GEP 690, Workshop in GISc Research. In Class 5, you will submit a brief (one or two paragraphs) synopsis of your project concept, which I will comment on and return to you. This should be developed further in the next few weeks into a full draft, which should include the same topics as the oral presentation (see above) as well as a literature review of related projects done previously; an outline of your search for relevant data; and a rough draft of a project flow chart. This first draft of your paper is due in Class 8, and will
be returned with comments. The final project proposal paper is due in Class 13, and should contain about 3,000-5,000 words.
**SAMPLE SYLLABUS  GEH 490 / GEP 690**

Independent Research in Geography GEH 490  
Workshop in GISc Research GEP 690  
4 credits;  
Instructor: Dr. Juliana Maantay; tel: (718) 960-8574  
begin_of_the_skype_highlighting (718) 960-8574 end_of_the_skype_highlighting; e-mail: maantay@aol.com  
Class Meeting Place: Gillet, Room 315 (Cartography Lab);  
Class Meeting Times: TBA; Class participants will meet at least four scheduled times, and as needed.

**Course Description:**  
This course is intended to provide the student with a solid grounding in research design and methodology by designing and conducting a GIS research project. Projects are to be substantive and original research efforts conforming to generally acceptable professional geographical practices and techniques.

**Required Reading:**  

**Course Timetable:**

**Week 1 - Meet to discuss course requirements, reading materials, and preliminary research concepts**

**Weeks 1-4:**  
Read Chapters 1, 2, and 3 ("The Nature of Scientific Research," "Defining Geographic Problems," and "Formation of the Research Design");  
· Select research topic, and conduct literature review on topic, examine other research on topic;  
· Prepare written Initial Research Design, including hypothesis or questions to be answered;  
· Conduct a Preliminary Data Needs Assessment and Data Acquisition;

**Week 5 - Presentation of Preliminary Research Design and literature review**

**Weeks 5-8:**  
Read Chapters 4 and 6 ("Acquisition of Relevant Data," and "Analysis of Data");  
· Refine research methodology;  
· Capture and input necessary data;  
· Preliminary data analysis;

**Week 9 - Interim Progress Report on research projects**
Weeks 9-12:
Read Chapter 7 ("Automation in Geographic Research: Searching Sources, Information Capture, Mapping, and GIS");
· Analysis of data;
· Preliminary map and charts production;
· Prepare preliminary findings;

Week 13 - Presentation of Research Results

Week 13-15:
Read Chapter 8 ("Writing Geographic Research Reports");
· Prepare final maps and charts and written report of findings;

Week 15 - Final Project Due (all materials to be submitted no later than December 19, 2001)