Environmental Applications of Geographic Information Systems
Geography 59 / Earth Sciences 77: Winter 2013

Instructor	**James Dietrich, 009B Steele**
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Office Hours:	Mon, Wed, and Fri 12:30 – 1:00 pm (or by appointment)
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Office Hours:	Tues 11:00 – 1:00 pm (or by appointment)

Lecture	Mon, Wed, and Fri 11:15 am – 12:20 pm (008 Fairchild) X-hour Tue 12:00 – 12:50 pm (Optional unless otherwise noted in the schedule)
Lab	Mon or Tue 2:00 – 4:00 pm (RAHR Lab, 013 Fairchild)
Course/Lab Website	canvas.dartmouth.edu
Prerequisites	Geography 50; or Earth Sciences 65 / Geography 51; or permission of instructor.
Reading materials	There is no required textbook for this course. Individual reading materials will be posted on the class website. Students who would benefit from reviewing a basic GIS text are encouraged to obtain and read the following work: Bolstad, P. 2012. GIS Fundamentals, 4th edition. Eider Press, White Bear Lake, MN.

Course description and objectives:

This course focuses on the uses of *geographic information systems (GIS)* as a method for understanding environmental systems and solving environmental problems. Students will learn advanced principles of GIS analysis and will investigate ways that these methods can be used to better understand environmental processes. Among the major topics to be discussed are topographic analysis, spatial modeling, spatial statistics, geographic visualization, integration of remote sensing and GIS, and web-based mapping. These methods will be explored through a wide variety of applications, including examples focused on watershed hydrology, water quality, vegetation, land use/land cover, climate, landscape ecology, and natural hazards. In lectures, weekly laboratory exercises, and class projects, students will gain experience in designing and implementing GIS-based solutions to environmental problems.

This course is included among the *Quantitative Analysis of Earth Systems* group of courses in the Earth Sciences curriculum. Concepts and skills common to all courses in the group include:

(1) Simplification/modeling of complex systems for quantitative analysis;
(2) Quantitative analysis of earth systems;
(3) Limits of data/knowledge.

Expected learning outcomes from this course include the following:

(1) Understanding of the principles and concepts used in environmental applications of GIS, as demonstrated by the student's ability to discuss those principles and concepts clearly.
(2) Familiarity with the processes of spatial modeling and quantitative analysis of spatial data. These skills will be practiced and evaluated in weekly laboratory assignments.
(3) Experience in designing and implementing a research project involving the use of GIS and spatial analysis to address a real-world problem.

Course requirements and grading:

Class preparation and participation (10%): Students are expected to prepare for each class session and to participate actively in the course. It will be important to read thoroughly and reflect on reading assignments before class. This will be evaluated by periodic brief in-class activities and assignments.

Labs (30%): There will be six weekly labs, beginning in the first week of the course. Lab reports are due one week after each lab session, at the beginning of the following week's lab. All lab submissions should be printed (hardcopy) prior to your lab time.

Final project (60%): Students will design and conduct research projects. (*See Final Project Description at the end of this document*). Some in-class time will be made available for work on the project, and students will have access to the Rahr Lab outside class hours.

Project Proposal (25%): A brief project proposal and oral presentation will be submitted early in the course, and updates on progress will be expected as the term progresses.
Final Project (35%): Students will report on their project via a scientific poster presentation

Grades will be earned on the following scale: A (100-90%), B (89-80), C (79-70), D (69-60), E (<60)

Late Work: If you have circumstances that will make it difficult to turn in an assignment on time please contact the instructor or teaching assistant *in advance*. Without this advance permission, assignments handed in late will receive no credit.

Accommodations for students with disabilities:

Students with disabilities, including "invisible" disabilities (such as chronic illnesses or learning disabilities) are encouraged to contact the Student Accessibility Service office and the instructor to discuss appropriate accommodations. Please do so before the end of the second week of the term. All inquiries and discussions about accommodations will remain confidential.

Religious observances:

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with the instructor before the end of the second week of the term to discuss appropriate accommodations.

Academic honor principle:

You should be aware of, and follow, the Dartmouth Honor Code. In terms of this course, the academic honor principle means that:

- All work on the exam must be your own. You should not give or receive assistance during the exam. No books, notes, or other materials are permitted during the exam without permission from the instructor.
- You are encouraged to discuss lab assignments with others, but all work handed in must be your own. Your written report should be expressed in your own words, and any quotations, figures, graphs, or other materials based on another's work must be explicitly identified with a source citation.
- Final projects may involve collaboration among students and/or with individuals from outside the course. Such collaborations are strongly encouraged; however, the results of the project must be your own work. In the written proposal, the two presentations, and the final paper, any materials (graphics or text) that are based on another's work must be explicitly identified with a source citation.

If you have questions about how the academic honor principle applies to this course, please contact the instructor.

Course Schedule

The following schedule should be regarded as tentative. Changes may be made as the term progresses.

Week	Date	Topic	Deadlines
1	Mon, 05-Jan	Introductions, Review of GIS / RS concepts	
	Lab	Lab #1: Topo Analysis and Watershed Modeling	
	~~x Tue, 06-Jan~~	-	
	Wed, 07-Jan	GIS/RS Data Sources	
	Fri, 09-Jan	Remote Sensing / Image Interpretation	
2	Mon, 12-Jan	Remote Sensing / Image Interpretation	
	Lab	Lab #2: Remote Sensing of Lake Water Clarity	Lab #1 Due
	x Tue, 13-Jan	*EE Lunch Talk, Rm. 200 Life Sci. Center, 12:00pm*	
	Wed, 14-Jan	Topographic Data	
	Fri, 16-Jan	Spatial Statistics	Project Group / Topic Selection
3	Mon, 19-Jan	MLK Day - No lecture, ***Labs will meet	
	Lab	Lab #3: Habitat Suitability Modeling	Lab #2 Due
	x Tue, 20-Jan	*REQUIRED: Spatial Statistics*	
	Wed, 21-Jan	Spatial Modelling	
	Fri, 23-Jan	Temporal GIS	
4	Mon, 26-Jan	3D GIS	
	Lab	Lab #4: Spatial Interpolation	Lab #3 Due
	x Tue, 27-Jan	*Tech Tuesday: GPS*	
	Wed, 28-Jan	Historical GIS	
	Fri, 30-Jan	Volunteered Geographic Data	
5	Mon, 02-Feb	Cartography / Geovisualization	
	Lab	Lab #5: Lidar Remote Sensing	Lab #4 Due
	x Tue, 03-Feb	*Tech Tuesday: TLS*	
	Wed, 04-Feb	Proposal Presentations	
	Fri, 06-Feb	Winter Carnival - No Class	
6	Mon, 09-Feb	Web Mapping	Proposals Due @ 2:00pm
	Lab	Lab #6: Web Mapping	Lab #5 Due
	x Tue, 10-Feb	*Tech Tuesday: SfM*	
	Wed, 11-Feb	Ethics in GIS and RS	
	Fri, 13-Feb	Poster workshop	

Week	Date	Topic	Deadlines
7	Mon, 16-Feb	Weekly Project Status Meeting	
	Lab		Lab #6 Due
	x Tue, 17-Feb	*Tech Tuesday: TBD*	
	Wed, 18-Feb		
	Fri, 20-Feb		
8	Mon, 23-Feb	Weekly Project Status Meeting	
	Lab	Project Work	
	x Tue, 24-Feb		
	Wed, 25-Feb		
	Fri, 27-Feb		
9	Mon, 02-Mar	Weekly Project Status Meeting	
	Lab	Project Work	
	x Tue, 03-Mar		
	Wed, 04-Mar		Poster Drafts Due @ Noon
	Fri, 06-Mar	Poster Revisions	Poster Revisions @ Noon
10	Mon, 09-Mar	Final Project Presentations	
	Sat, 14-Mar	Finals - Nothing!!!	

Final Project

Scope:

- Your final projects should be on a topic of interest to you and should be centered on a basic science question or methodological test.
- The research question should have an "environmental" focus

Individual / Group Work:

- I will support both individual and group projects; however, I encourage you to work in groups build teamwork skills that will help you succeed in your post-university careers.
- Groups should be limited to three people
    - Keep in mind that projects should be of sufficient scope to warrant multiple people's time.

Proposal:

- Both an oral presentation and written proposal of your project will be due during Weeks 5-6
- The written proposal will be a 5 – 6 page (double-spaced) document outlining the "problem", research questions, data / methods, and the deliverables for the project.
- The oral presentation will be an 8 – 10 minute "PowerPoint" presentation of your project.
    - After each presentation, we will have a class discussion period to help refine some of the details of the proposal.

Final Project Poster:

- The final product of your project will be a scientific conference poster with a short 3 – 4 minute oral presentation.
- Details on the poster format will be given in class
- Deadlines:
    - January 16th (Fri) – Group / Topic Selections Due
    - March 4th (Wed) – Poster drafts are due (digital copies to Canvas) by noon
    - March 6th (Fri) – Poster revisions are due by noon for printing
    - March 9th (Mon) – Poster presentations

Peer Review / Group Accountability:

- You will be required to provide feedback on your classmate's presentations throughout the term
- For group projects:
    - To gauge each student's participation in a project I require that each group member submit a confidential memo outlining his or her contributions to the project and "grading" their other group member's contributions.

Negative Results:

- Negative results and failed methodologies are an undervalued, but extremely important aspect of science. If your project is starts to fall apart or you do not think it will answer your research question, I implore you to talk to me about it before giving up. We can refocus the work you have put into it to explore why it did not work and explore how you might improve it "next time".

For Graduate Students (enrolled in EARS 177): An additional short, letters-style (4000 – 5000 words) scientific article will be due by March 14th (Sat) by 5pm.