

## CRP 5080: Introduction to Geographic Information Systems for planners

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Semester: Fall 2017

Location: Barclay Gibbs Jones Lab, Sibley Hall (3<sup>rd</sup> floor)

Day/time: Tuesdays and Thursdays, 10 am – 12 pm

**Instructor:** Stephan Schmidt

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**Teaching Assistants:** Nidhi Subramanyam (ns684@cornell.edu), Andrew Varuzzo, Rhea Lopez

**Credit:** 4 hours

**Instructor Office Hours:** Wednesdays 9:30 – 12:30, or during lab session.

**TA Office hours:** TBD

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### COURSE DESCRIPTION

This course is designed to provide students with a conceptual understanding of geographic information systems (GIS) and sciences, practical hands on experience with GIS software, and understanding of how GIS can be applied to planning practice and research. Students will be introduced to the basic concepts, structures, and functions of GIS as well as their applications and limitations. Topics include classification and thematic mapping, visualization and map design; querying and editing attribute information; projections and coordinate systems; geoprocessing; georeferencing; onscreen digitizing and editing; census data manipulation and analysis; database management, data preparation and linkages between Arc and spreadsheets; geodatabases; raster and vector data models; data sources; network analyst; and the use of model builder. In addition, the latter half of the course will include several case studies and spatial analysis techniques applicable to planning practice, including a site suitability analysis, a build out analysis, an environmental justice analysis, and a watershed analysis. During the weekly lab sessions, the students will learn the basic functions of ArcGIS (version 10.4) software. In addition, the course will include a midterm quiz, the purpose being to test basic technical skills and concepts, and a final project, which will involve spatial analysis of a planning related problem. Although there are no prerequisites, it is expected that students have basic computer operating skills and are familiar with the use of spreadsheet software (such as Excel) which assists in processing data for use in GIS. By the end of this course students should be able to:

- Feel comfortable working within the GIS environment and be familiar with a range of available tools and methods to address planning related problems and issues.
- Be able to conceive of and manage a GIS project. This involves a) asking a planning analysis/research problem that requires GIS data and spatial analysis to address/analyze the problem; and b) collecting, processing, and analyzing spatial data to interpret the findings.

## COURSE FORMAT

The class will be conducted as a lecture in conjunction with supplemental computer lab sessions stressing hands-on application and building familiarity with the software. I will spend a portion of the class on Tuesday introducing the material, and then we will begin on that week's lab. Thursday will generally be devoted to in class lab work, with the lab assignment due the following Tuesday. The purpose of the lab session is to encourage peer teaching. In addition, both myself and several TAs will be present and available during the labs to provide assistance. From time to time additional material, guest speakers, or in class demonstrations will take place on Thursdays.

The beginning of the semester will generally be more lecture intensive (lectures will be uploaded weekly to the 'Lecture notes' folder on Course documents in Blackboard). In order to complete the labs, you will need access to the lab on the 3<sup>rd</sup> floor of Sibley Hall, which runs ArcGIS version 10.4. Another option is copying the data and lab materials to your own drive and working on it elsewhere (ie home if you have the software, Mann Library, etc.) If possible, we will make available student copies of the software (1 year student licenses) for PC. Please see Andre Hafner for more information.

**Please note:** *As per College policy, the computer lab will be closed during the thanksgiving break. Please keep this in mind when making plans for completing the labs and working on the final project.*

## READINGS

There is no formal textbook for this course. Instead, readings will come from 2 separate online e-books and a number of research articles. Links to all the readings will be found under the 'Assignments' tab in Blackboard for that week. In addition, all readings (plus some additional ones) can be found in the Course documents folder on Blackboard. The online resources are: GIS Commons by Michael Schmandt (<http://giscommons.org/>) and Geospatial Analysis, 5<sup>th</sup> ed. (2015) by de Smith, Goodchild, and Longley:  
<http://www.spatialanalysisonline.com/HTML/index.html>

### **Other traditional GIS texts:**

Maantay, J. and Ziegler, J. (2006). *GIS for the Urban Environment*, ESRI Press

Mitchell, A. (2012) *The ESRI Guide to GIS Analysis: Volume 3: Modeling Suitability, Movement, and Interaction*, ESRI Press

Longley, P., Goodchild, M., Maguire, D., and Rhind, D. (2010) *Geographic Information Systems and Science*, 3<sup>rd</sup> Edition (John Wiley & Sons).

MacDonald, H. and Peters, A. (2011) *Urban Policy and the Census*, ESRI Press

Ormsby, Tim, et al. Getting to Know ArcGIS Desktop: Basics of ArcView, ArcEditor, and ArcInfo. ESRI Press.

Harvey, F. (2008) *A primer of GIS: Fundamental geographic and cartographic concepts*, The Guilford Press, London and New York

Wood, D. and Krygier, J. (2005) *Making maps: A visual guide to map design for GIS*, The Guilford Press, London and New York – *an over view of cartographic techniques*

Tyner, J. (2010) *Principles of map design*, The Guilford Press, New York and London

Kennedy, M. (2009) *Introducing Geographic Information Systems with ArcGIS: A workbook approach to learning GIS*, Wiley and Sons, 2<sup>nd</sup> ed.

Peters, A. and MacDonald, H. (2004) *Unlocking the census with GIS* (ESRI Press) Redlands, CA.

DeMers, Michael N. 2005. *Fundamentals of geographic information systems*, (John Wiley & Sons).

Nyerges, T. and Jankowski, P. (2010) *Regional and Urban GIS: A decision support approach*, The Guilford Press

## **COURSE GRADING**

### **1. Problem sets (50%)**

Both the lab as well as the associated data are all located on the course folder, to be accessed through the computer lab. There are 12 scheduled lab assignments. These generally (though not exclusively) consist of a scripted lab component followed by a homework assignment, meant to be done “on your own.” Generally, requirements will differ between graduate and undergraduate students (you will note the inclusion of an extra ‘grad question’). Computer skills vary widely, so students should be aware they may have to spend time outside of class working on labs and homework assignments. Labs will be due the following Tuesday after they are handed out by the beginning of class. Students should upload each lab to Blackboard via the ‘Assignments’ link. Labs should be saved as a single word document (with any maps embedded as image files) as last name\_lab #.doc. LATE lab assignments will automatically be downgraded unless there is a medical or family emergency:

3%: if turned in after the start of class on the day they are due

5%: if turned in the following day

10%: if turned in within 1 week

25%: after 1 week

ALL outstanding labs are due, no later than **Tuesday, November 21**. Otherwise, you will receive a 0 for the outstanding lab(s). A weekly help session will be offered outside of lab hours. The date and time for the extra help session will be announced in class. Students must be respectful of the TAs time and only seek assistance when necessary during appropriate times.

2. **Quiz (5%)**

An open book/open notes midterm quiz is scheduled for Thursday, October 12 and will cover the material up until that point. The purpose of the exam is to test student knowledge of concepts and technical material covered through that point in the semester. No make-up will be given, except under extraordinary circumstances.

3. **Final project (30%)**

The purpose of the project is to provide additional experience in collecting, processing and/or analyzing spatial data and should focus on a planning analysis/research problem that requires GIS data and spatial analysis to address/analyze the problem. This project can (and should) be of the students choosing (for instance, it can overlap with outside work, another class, or as part of an exit project). Undergraduates are allowed to work in teams, while graduate students are required to work alone. Requirements and guidelines for the final project will be elaborated on further in class.

There will be a couple lab sessions toward the end of the semester which will be devoted to working on the project. However, students must start thinking about project ideas as soon as possible. You are expected to provide a preliminary project proposal by the date specified in the syllabus. In addition, I will ask all final project teams to schedule a mid semester appointment with me. As an additional resource, previous years' projects will be placed in the 'sample projects' folder under Course documents on Blackboard.

In the past, I have noticed that students (particularly grads) have appreciated the opportunity to work with and for a professional client in completing the final project requirement. For example, students have worked on projects for The Conservation Fund, Policy Link, City of Ithaca, Cooperative extension, and Cornell Campus Planning. You may want to consider soliciting a client. Students who chose this route should note that the requirements of the professional and the class are not necessarily co-terminus! Students should discuss with me if unsure. The mid semester review can be helpful in this respect.

4. **Attendance/Participation/Effort (15%)**

This grade consists of the following components:

*Attendance:* Students must be in class in order to reap the full benefits of the course. Material is presented in a cumulative fashion, so if you miss one week, you will be at a disadvantage the following week. It is extremely important that you keep up!

*Participation:* You are expected to pay attention during the lectures and guest presentations and work on the labs or homework during the appropriate times. Working on the

labs during the lectures will not be tolerated (plus they are already late by that point!) Emailing, googling, twittering, facebooking, surfing the web is not permitted at any time (unless directly applicable to the assignment at hand). A present and engaged student body will contribute greatly to the 'peer-learning' effect that is crucial to learning a complex software package.

*Effort:* Computers are extremely frustrating. However, losing it or taking it out on the TAs or instructor is not an acceptable response! This portion of the grade is not so much to punish students as it is to reward students who are patient, have a good attitude, are entrepreneurial, and use creative and innovative ways to problem solve, particularly when faced with a situation they are unfamiliar with.

As an example of how this grade works, a student who regularly attends class and completes the work will receive a B for this portion of the grade (most students receive a B). A's are given out to reward those that I feel are entrepreneurial with the material and demonstrate intellectual curiosity and superior problem solving techniques. The point of this grade is to reward those that went above what was required of the class over the course of a semester.

## **ACADEMIC INTEGRITY**

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Although I try to foster a social work environment and encourage students to work together on labs, any and all work submitted for credit must be individual! Direct quotations of other work should be enclosed with quotation marks, with a citation afterward that contains the page number of the work where available. When you rely substantially on another person's work without quoting from it directly, please use in text citations at the end of an appropriate section. Failure to provide complete and proper citations may constitute plagiarism, which violates the Cornell Code of Academic Integrity. If detected, plagiarism may result in a failing grade for the course. In compliance with the Cornell University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for students with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances, so arrangements can be made. You can view the Guide online at [newstudentprograms.cornell.edu/AcademicIntegrityPamphlet.pdf](http://newstudentprograms.cornell.edu/AcademicIntegrityPamphlet.pdf)

### **Stress:**

If you are experiencing a lot of personal or academic stress at any time during the semester, I encourage you to seek support early on. I am available to talk with you if you experience stress related to the class. Additionally, I can assist you in reaching out to any one of a wide range of campus resources, including:

Student Services Office, 255-6376

Cornell Learning Strategies Center at 255-6310, <http://lsc.sas.cornell.edu>

Gannett Health Services at 255-5155, [www.gannett.cornell.edu](http://www.gannett.cornell.edu)

Let's Talk Drop-In Consultation and Support [www.gannett.cornell.edu/Let'sTalk](http://www.gannett.cornell.edu/Let'sTalk)

Peer Support provided by Empathy Assistance and Referral Service at 255-EARS

**Class Schedule:** This is a tentative schedule, which is subject to revision by the instructor.

Dates	Lecture Topics	Lab Assignments	Homework Due/Other activities	Readings
Wk of 8/22	Introduction to course and ArcGIS	Lab #1 <b>Introduction to ArcGIS</b> , Creating a unique classification creating a layout		<b>Online:</b> GIS Commons, Ch. 1: Introduction
Wk of 8/29	Thematic mapping	Lab #2 <b>Thematic mapping</b> <ul style="list-style-type: none"> <li>• Creating a shapefile</li> <li>• Querying data</li> <li>• Classification schemes</li> <li>• Uni and Multivariate maps</li> </ul>	Lab #1 due Thursday, 8/31	<b>Online:</b> GIS Commons, Ch. 6: Output
Wk of 9/5	Projections	Lab #3 <b>Map Projection</b> <ul style="list-style-type: none"> <li>• Understanding Map Projections</li> <li>• Project on the fly</li> <li>• Define a projection</li> <li>• Project Data</li> </ul>	Lab #2 due Tuesday, 9/5	<b>Online:</b> GIS Commons, Ch. 3: Map processing
Wk of 9/12	Geoprocessing	Lab #4 <b>Geoprocessing</b> <ul style="list-style-type: none"> <li>• Dissolve</li> <li>• Clip</li> <li>• Intersection/Union</li> <li>• Buffers</li> <li>• Merge</li> </ul>	Lab #3 due Tuesday, 9/12	<b>Online:</b> GIS Commons, Ch. 5: Analysis
Wk of 9/19	Data Models	Lab #5 <b>Georeferencing and Onscreen digitizing and editing</b> <ul style="list-style-type: none"> <li>• Georeferencing images and CAD files</li> <li>• Creating and editing shapefiles.</li> <li>• Creating attribute information</li> <li>• Onscreen digitizing using Bing Maps</li> </ul>	Lab #4 due Tuesday, 9/19 Final project proposal due Thursday (9/21)	
Wk of 9/26	Manipulating census data	Lab #6 <b>Data Selection &amp; Manipulation</b> <ul style="list-style-type: none"> <li>• Downloading census information and boundary files</li> <li>• Creating, Editing Features &amp; Attributes</li> <li>• Joining &amp; relating tables</li> <li>• Selecting features by attributes and location</li> </ul>	Lab # 5 due Tuesday, 9/26	<b>Blackboard:</b> Peters and MacDonald, Chap 1, 2
Wk of 10/3	Census Data Analysis	Lab #7 <b>Census Data Analysis</b> <ul style="list-style-type: none"> <li>• Case study in utilizing census data to conduct environmental justice spatial analysis</li> </ul>	Lab # 6 due Tuesday, 10/3	<b>Blackboard:</b> Schlossberg, M (2003) Fischbeck, et al Mennis, J (2002)

Wk of 10/11	Lab # 7 due Thursday 10/12 <b>Midterm quiz</b> Thursday 10/12 <b>Note:</b> There is no class Tuesday 10/10 (Fall break).			
Wk of 10/17	Database management and Geodatabases	Lab #8 <b>Database Management and data preparation</b> <ul style="list-style-type: none"> <li>Using Excel and Access to prepare data for display in ArcGIS</li> <li>Building and maintaining a Geodatabase</li> </ul>	Guest speaker: <i>Keith Jenkins, 10/29, ArcGIS online</i>	<b>Online:</b> GIS Commons, Ch. 2: Input
Wk of 10/24	Network Analyst	Lab #9 <b>Network Analyst</b> <ul style="list-style-type: none"> <li>shapefile based network</li> <li>Finding the best route</li> <li>Finding the closest facilities</li> <li>Calculating service areas</li> <li>Origin-Destination cost Matrix</li> <li>Location-Allocation model</li> </ul>	Lab #8 due Tuesday, 10/24	<b>Blackboard:</b> Curtin, K (2007)
Wk of 10/31	Suitability analysis using modelbuilder	Lab #10: <b>Site Suitability analysis</b> <ul style="list-style-type: none"> <li>Spatial Analyst extension</li> <li>Reclassification</li> <li>Weighting factors</li> <li>Using Modelbuilder</li> </ul>	Lab #9 due Tuesday, 10/31	<b>Blackboard:</b> Malczewski, J (2004)
Wk of 11/7	Build out analysis	Lab #11: <b>Build out analysis</b> Case study to develop a build out analysis of the Village of Dryden	Lab #10 due Tuesday, 11/7	<b>Blackboard:</b> Town of Phillipstown, Build-out analysis, <i>Estimating the impacts of residential growth</i>
Wk of 11/14	Environmental analysis using raster data	Lab #12: <b>Environmental analysis using raster data</b> <ul style="list-style-type: none"> <li>Delineating watersheds</li> <li>Hydrologic modeling</li> </ul>	Lab #11 due Tuesday, 11/14	<b>Online:</b> Geospatial Analysis, Watersheds and Drainage
Wk of 11/21	<b>We will be working on final projects during class time.</b>		Lab #12 due Tuesday 11/21 <b>Note:</b> No class Thursday 11/23 Thanksgiving	
Wk of 11/28	<b>We will be working on final projects during class time.</b>			
<b>Final projects will be due Wednesday, December 6 by 5 pm via Blackboard.</b>				