Hubert H. Humphrey School of Public Affairs

PA5271: GIS IN PLANNING AND POLICY ANALYSIS

Section 2, Fall 2011
Time: 6:00-8:45PM Wednesdays
Classroom: HHH Center 85

Instructor: Yingling Fan
E-mail: yingling@umn.edu
Phone: 612-626-2930
Office: HHH Center 295E
Office Hours: Wednesdays from 12:30-1:30PM or by appointment

INTRODUCTION

Geographic Information Systems (GIS) is an increasingly growing field, providing spatial data management and analysis services to a broad range of business and public organizations. US News identified the GIS occupation as one of the "21 hot jobs for the 21st century", claiming that the number of GIS positions in local governments alone will increase 6% per year.

The use of GIS is inevitable in urban planning and public policy as both fields involve exploring location-related trends and issues. For instance, planners routinely conduct geo-spatial analyses to study residential clustering, to explore the spatial mismatch between jobs and workers, and to identify suitable land for urban transition, infill development, or environmental conservation. To public policy professionals, GIS facilitates spatial visualization of poverty, crime, pollution, and health patterns, allowing those who on the front line of public services to distribute tax money more fairly and to protect life and property more effectively. In simple words, GIS skills are a valuable asset in today's competitive job market.

This course covers GIS basics (e.g., map projections, coordinate systems, spatial data manipulation & visualization, and geodatabase management) as well as advanced GIS applications (e.g., network analysis, raster & TIN models, socio-demographic analysis, 3-D analysis, hot-spot analysis, spatial interpolation, and other spatial statistics). It gives special attention to making GIS useful to urban planners and policy analysts. It is not intended to make students into GIS coding, spatial modeling or spatial statistics experts – those interested in a GIS-based career path should continue to take programming and database courses in Computer Science and advanced GIS offerings in the Department of Geography.

STUDENT LEARNING OUTCOMES

Although the course is literally about mastering GIS, the overarching goal is to improve students' *problem solving* and *spatial thinking* skills. Upon completion of this course, the student will be able to

1. solve an diverse array of planning and pubic policy problems using GIS theory and methods;
2. sharpen spatial thinking skills by placing problems and objects within the space dimension, by recognizing the importance of space surrounding those problems and objects, and by reflecting on the relationships that occur within the whole system; and
3. develop analytical skills for addressing real-world problems within the GIS framework.

APPROACH

To achieve student learning outcomes above, the course features hands-on learning in classroom, laboratory, and homework exercises. The class time will be divided into lecture and laboratory sessions that cover both theory and practice of topics of interest. Lab and homework exercises comprise of real-world tasks faced by planning and public policy practitioners.

Students will be using a Geographic Information System software package known as ArcGIS 10.0, published by Environmental Systems Research Institute (ESRI). There are many competitors, but ArcGIS (and ESRI's older software ArcView) is the most commonly used. In addition, students will be using various ArcGIS extensions (e.g., Spatial Analyst, 3D Analyst, Geostatistical Analyst, Network Analyst) and a variety of smaller 3rd party extensions (e.g., XTools Pro and CrimeStat).

Note that you will never learn to use GIS unless you put time in learning how to use the software! Just like sports, GIS is learned through practice and repetition. In this course, you are expected to spend 4-6 hours every week to 'practice' GIS skills. I will also try to reduce lecture length so that you have more in-class time to work with the GIS software.

TEXTS

Maribeth H. Price. 2012. *Mastering GIS*. **Fifth Edition**. McGraw-Hill, New York.

Each chapter in the textbook has two sections: "Mastering the Concepts" and "Mastering the Skills". Students should read the "Mastering the Concepts" section before each class. Additional readings will be assigned during the semester and will be uploaded to the course folder on the T Drive.

LOGISTICS

Access to the computer lab (Room 85) requires only your U of M student ID card. There are also computers with the software loaded in Rooms 80 and 40 (which also require your student ID card for access). You can access all HHH computers by using the same user name and password for e-mail.

In the computer lab we will be working from the courses drive T:\. There are two sub-directories that contain data and workspaces for the course. The general course materials (e.g., syllabus, readings, handouts, assignments, and datasets) will be found in subdirectory "PA5271.002Data." Workspace will be found in subdirectory "PA5271.002Students." In this latter subdirectory you will find a group of sub-folders and one of these will have your name. This will be your private workspace. Only you (and I) can access the folder with your name on it. You will notice that from time to time I will have copied some of the data you will be using to save you time.

For those who want to work on your home or laptop computers, ESRI makes available a full copy of the software for no charge but with a one-year time limit. Please check with your instructor should you need such a copy.

Food and drink are not permitted at the workstations! There are shelves at the back of the room where food and drink can be stored while you are working.

EVALUATION

Students are evaluated based upon performance on a series of small assignments and a larger final project. All the assignments should be done independently. For the final project, I strongly encourage you to select a planning or policy analysis problem that is the closest to your area of interest. Attendance as well as active participation and contribution to class discussion is required and counts in the final grade. Missing three classes will result in an at least 10-point deduction from your final grade. The relative weights for grading purposes are as follows:

- Final Project (26%)
- Eight Assignments (64% - each 8%)
- Class Participation (10%)

STUDENT ACADEMIC INTEGRITY AND SCHOLASTIC DISHONESTY

Academic integrity is essential to a positive teaching and learning environment. All students enrolled in University courses are expected to complete coursework responsibilities with fairness and honesty. Failure to do so by seeking unfair advantage over others or misrepresenting someone else's work as your own, can result in disciplinary action. The University Student Conduct Code defines scholastic dishonesty as follows:

Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering forging , or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis.

Within this course, a student responsible for scholastic dishonesty can be assigned a penalty up to and including an "F" for the course. If you have any questions regarding the expectations for a specific assignment or exam, ask me directly.

CLASS SCHEDULE, READINGS, AND ASSIGNMENTS

1. GIS Basics
2. Advanced GIS Applications

PART 1. GIS BASICS

9/7 Course overview; GIS Mapping; ArcGIS
- Readings: /Mastering the Concepts/ in Chapters 1 & 2
- Lab: Using ArcCatalog and working with ArcMap

9/14 Basic Cartography: Coordinate Systems, Projections, and Metadata
- Readings: /Mastering the Concepts/ in Chapters 11 & 15
- Lab: Managing coordinate systems and working with map projections
- Assignment #1: Finding blockgroup IDs for single family units in northern Oregon

9/21 Spatial Data Structure: Maps, Tables, and Queries

- Readings: /Mastering the Concepts/ in Chapters 3, 4, & 5
- In-class lab: Working with tables and queries
- Assignment #2: Measuring urban-suburban health disparities in US large metropolitan areas

9/28 Geoprocessing: Multi-layer Spatial Analyses
- Readings: /Mastering the Concepts/ in Chapters 6 & 7
- Lab: Clipping, intersecting, dissolving, and working with buffers
- Assignment #3: Examining land development patterns around the Hiawatha LRT stations

10/5 Geocoding
- Readings: /Mastering the Concepts/ in Chapter 10
- Lab: Working with map elements and geocoding street addresses
- Assignment #4: Mapping single-family parcels in Washington County, Oregon

10/12 Editing in ArcMAP
- Readings: /Mastering the Concepts/ in Chapters 12 & 13
- Lab: Creating and editing features
- Assignment #5: Editing building footprints in subdivisions

10/19 Geodatabase
- Readings: /Mastering the Concepts/ in Chapter 14
- Lab: Creating and editing a geodatabase
- Assignment #6: Using a geodatabase to define logical relationships

PART 2. ADVANCED GIS APPLICATIONS

10/26 Transportation Network Analysis
- Readings: /Mastering the Concepts/ in Chapter 9
- Lab: Network tracing, routing, and allocation
- Assignment #7: Mapping transit accessibility in the City of Chicago

11/2 Raster Analysis
- Readings: /Mastering the Concepts/ in Chapter 8
- Lab: Working with the ArcGIS Spatial Analyst
- Assignment #8: Finding a suitable site for a new school in Stowe, Vermont

11/9 TIN Analysis; 3-D Analysis
- Readings: *Using ArcGIS 3D Analyst*, ESRI
- Lab: Comparing actual and zoned density in Montgomery County, Maryland (identifying suitable locations for infill development)

11/16 Socio-Demographic Analysis Using Census Data
- Readings: Browse through the Census Bureau Geography website: http://www.census.gov/geo/www/index.html
- Lab: Mapping racial distribution in the Twin Cities Metropolitan Area

11/23 Spatial Statistics I: Hot-Spot Analysis
- Readings: Chapter 6, 7, & 8 in the CrimStat III Manual
- Lab: Identifying pedestrian crash concentration zones in Miami-Dade County, Florida

11/30 Spatial Statistics II: Spatial Interpolation

- Readings:
  1. Konstantin Krivoruchko. 2001. Introduction to Modeling Spatial Processes Using Geostatistical Analyst, ESRI.
  2. *ArcGIS Geostatistical Analyst: Statistical Tools for Data Exploration, Modeling, and Advanced Surface Generation,* ESRI.
- Lab: Mapping the probability of ozone exceeding a critical threshold in California

12/7 Student Presentations

12/14 Student Presentations

SUMMARY SCHEDULE OF SESSIONS

Week	*Part I : GIS Basics*			
1	9/7	Course overview; GIS Mapping; ArcGIS	Ch. 1-2	
2	9/14	Basic Cartography: Coordinate, Projections, & Metadata	Ch. 11&15	
3	9/21	Spatial Data Structure: Maps, Tables, and Queries	Ch. 3-5	HW#1 Due
4	9/28	Geoprocessing: Multi-layer Spatial Analyses	Ch. 6-7	HW#2 Due
5	10/5	Geocoding	Ch. 10	HW#3 Due
6	10/12	Editing in ArcMAP	Ch. 12-13	HW#4 Due
7	10/19	Geodatabase	Ch. 14	HW#5 Due
	Part II: Advanced GIS Applications		Final Project Guideline Out	
8	10/26	Transportation Network Analysis	Ch. 9	HW#6 Due
9	11/2	Raster Analysis	Ch. 8	HW#7 Due
10	11/9	TIN Analysis; 3-D Analysis	CF	HW#8 Due
11	11/16	Socio-Demographic Analysis Using Census Data	CF	
12	11/23	Spatial Statistics I: Hot-Spot Analysis	CF	
13	11/30	Spatial Statistics II: Spatial Interpolation	CF	
14	12/7	Student Presentations		
15	12/14	Student Presentations	Final Paper Due Dec 14	

Note: CF: Course Folder