

Resource Economics and Policy Applications of GIS

REP 475 Fall 2004

Time: Tuesday and Thursday; 9:30-10:45 AM; Thursday 3:30-5:00 PM

Location: Winslow 201 Classroom (Tuesday) / Winslow 301 Computer Lab (Thursday)

Prerequisites: COS 102, 103, and 104 or equivalent; MAT 215 or MAT 232 or equivalent.

Instructor:

Dr. Kathleen P. Bell, Assistant Professor
Department of Resource Economics and Policy
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kathleen.p.bell@umit.maine.edu (first class)

Office Hours:

Tuesday 11AM - 1 PM
Additional times are available subject to request.

Course Objectives:

The course has three objectives: (1) introduce basic geographic information system (GIS) and spatial analysis skills; (2) emphasize the significance of spatial data, GIS, and spatial statistics to the study of natural resource and environmental policy issues; and (3) provide students with applied spatial research skills.

Course Description: The course is intended for undergraduate and graduate students who wish to develop GIS and spatial analysis skills in an applied, research-based learning environment. The course will emphasize social science applications of GIS, focusing largely on the interactions between humans and the natural environment. Students will learn basic data management and spatial analysis skills and be introduced to basic spatial statistics concepts. Students will become familiar with resource economics and policy applications of spatial data and will acquire experience working with spatially explicit datasets. Policy-makers are increasingly using spatial data and spatial statistical methods to study policy issues and to design and evaluate public policies. Moreover, government agencies and other organizations are increasingly using GIS to share information with stakeholders and the general public. This course is intended to provide students with knowledge and skills applicable to this modern research environment.

The course meets twice a week for 75 minutes. Lectures will be given during the Tuesday class session. Hands-on computer labs will be held during the Thursday class sessions. Students will be divided into 2 lab sections. One section will meet from 9:30 to 10:45 AM; the second section will run from 3:30 to 5:00 PM. Students will be regularly asked to complete homework/lab assignments demonstrating their spatial analysis skills. The completion of these assignments will require students to work independently in the computer lab outside of these class sessions.

Pre-requisites: The course assumes satisfactory completion of an introductory statistics course (MAT 215 or MAT 232) and an introductory computer course (COS 102-104 series or equivalent). Basic computer skills will be assumed. Students are expected to understand Windows-based operating systems and to manage files and disk space responsibly. Experience working with Microsoft Word and Excel is not required but is helpful.

Texts:

Ormsby, T., Napoleon, E., Burke, R., Groessl, C., and L. Feaster. 2001. *Getting to Know ArcGIS Desktop*. Redlands, CA: ESRI Press; Book and CD-ROM edition.

Bolstad, P. 2001. *GIS Fundamentals: A First Text on Geographic Information Systems*. White Bear Lake, MN: Eider Press.

Additional Reading Materials: Additional, non-text reading materials will be assigned. Access to these materials will vary. The majority of additional readings are accessible through the electronic reserves collection maintained by Fogler Library. Additional materials will be distributed in class or made accessible via the instructor's web page. Refer to the detailed course schedule for more information on these readings.

Grading: Letter grades will be assigned based on the following class work:
Homework/Lab Assignments (40%)
Research Project (40%) (Paper (30%); Presentation (10%))
Final Exam (20%.)

Homework/Lab Assignments: There will be several homework/lab assignments during the semester. Typically, you will be given a week to work on the assignments. Assignments will be graded. Late homework will not be accepted unless its tardiness is authorized.

Research Project:

The research project serves as the opportunity for students to demonstrate their fulfillment of the course objectives. Students are required to complete an applied spatial analysis project by applying the techniques covered in class. A project may involve posing and testing a research hypothesis related to an environmental or natural resource policy question using spatial data or creating spatial data to support environmental or natural resource policy decisions. Additional materials will be distributed in class to assist students with topic selection and project design.

Research project topics will require approval by the instructor. The "tentative" deadline for project approval is September 30, 2004.

The final paper summarizing the project may not exceed 10 pages in length, including text, maps, and references (double-space; 11 type font). The "tentative" deadline for the paper is November 23, 2004. All students will give a brief (15 minute) presentation outlining the methods and findings of their project in the final weeks of the course.

Final Exam: The "tentative" date of the final examination is December 14, 2004 (8 to 10 AM). Please make note of this date, for students who miss the examination will receive a failing grade unless their absence is authorized. No make up exam will be offered. Please alert your instructor of any conflicts prior to the exam date.

Class Attendance Policy: You are expected to attend all class sessions.

Absence/Tardiness Policy: If a student needs to reschedule an examination, he or she must have an authorized excuse. Similarly, if a student wishes to receive credit for a late homework, its tardiness must be authorized. If illness is the reason for a missed exam or late homework, please submit written documentation of this illness from the health center or a doctor to the instructor.

Disability Policy:

If you have a disability for which you may be requesting an accommodation, please contact either Professor Bell or Ann Smith, Director of Disability Services at their new location in East Annex, 581-2319, as early as possible in the term.

Course Schedule and Reading Assignments:

Week 1 Course Introduction (August 31 & September 2)

- Lecture: Thinking Spatially - Spatial Data, GIS, and Resource Economics and Policy
Bolstad, Chapter 1
Ormsby, Chapter 1
*Bateman, I.J., Jones, A.P., Lovett, A.A., Lake, I.R., and B.H. Day. "Applying Geographical Information Systems to Environmental and Resource Economics." *Environmental and Resource Economics* 22: 219-269.
- Lab: 8 Minute Dating with ESRI products. ArcCatalogue, ArcMap, and ArcTools.
Ormsby, Chapters 2, 3, and 4

Week 2 Spatial Data: Data Management, Data Features, and Basic Analysis (September 7 & 9)

- Lecture: Management and Structure of Spatial Data
Bolstad, Chapter 2
Ormsby, Chapters 5, 6, 7, and 8
- Lab: Get Spacey. Visualization and Attribute Queries using Arc Map (Policy Application – Elections - Are there spatial patterns in voting behavior? ; 2000 U.S. Presidential Election Data)

Week 3 Spatial Data: Projections and Data Acquisition and Integration (September 14 & 16)

- Lecture: Properties of Spatial Data
Bolstad, Chapters 3 and 4
Ormsby, Chapters 11 and 13
- Lab: Time in the Trenches. Managing Spatial Data: Importing and Exporting Data, Re-projecting Data, Clipping Data, and Joining Tables (Policy Application – Water Quality; USGS Data Resources)
Ormsby, Chapter 9

Week 4 Communicating with Maps (September 21 & 23)

- Lecture – Spatial Display of Quantitative and Qualitative Information
Bolstad, Chapter 9, pp. 230-243
Tufte, E.R. 1983. *The Visual Display of Quantitative Information.* Graphics Press: Cheshire, Connecticut, pp. 1-51 (Chapters 1 and 2).
Ormsby, Chapters 18-19
- Lab: A Picture is Worth a 1000 Words. Using Layout to Create High Quality Maps (Policy Applications – Public Health - CDC Data on Cancer Mortality)
Tufte, E.R. 1983. *The Visual Display of Quantitative Information.* Graphics Press: Cheshire, Connecticut, pp. 107-121 (Chapter 5).

Week 5 Spatial Analysis: Proximity and Neighbors (September 28 & September 30)

- Lecture: Proximity – Distance and Neighborhood Measures
Ormsby, Chapters 10
Bolstad, Chapter 10, pp. 268-280
- Lab: Close to you ? Location Queries, Spatial Joins, and Neighborhood Functions (Policy Application - Environmental Justice, Risk, and Superfund Sites; US EPA NPL Site data and US EPA Toxic Release Inventory Data)

Maantay, J. 2002. "Mapping Environmental Injustices: Pitfalls and Potential of Geographic Information Systems in Assessing Environmental Health and Equity," *Environmental Health Perspectives* 110 (suppl 2): 161-171.

Arora, S. and T.N. Cason. 1999. "Do Community Characteristics Influence Environmental Outcomes? Evidence from the Toxics Release Inventory." *Southern Economic Journal* 65(4): 691-716.

Research Project Topic Approval Deadline (September 30, 2004)

Week 6 Spatial Analysis – Buffers and Overlay (October 5 & 7)

- Lecture : Buffers and Overlay Analysis
Ormsby, Chapter 12
Bolstad, Chapter 9, pp. 246-266
- Lab: Relationships in Space: Union, Dissolve, and Intersect. Buffer and Overlay Analysis (Policy Application – Describing Land Use Patterns)
Irwin, E.G., Bell, K.P. and J. Geoghegan. 2003. "Modeling and Managing Urban Growth at the Rural-Urban Fringe: Evidence from a Model of Residential Land Use Change," *Agricultural and Resource Economics Review* 32(1):83-102.

Week 7 Creating Spatial Data and Basic Editing (October 14)

- Lab: Into the Woods. Importing GPS Data into ARCGIS (Policy Application – Mapping a Section of the Orono Land Trust Trail Network)
Bolstad, Chapter 5
Ormsby, Chapter 15

Week 8 Spatial Analysis - Trends and Routing (October 19 and October 21)

- Lecture: Space and Time; Space and Travel
Bolstad, Chapter 12
Ormsby, Chapter 12
- Lab: By the sea. Spatial Analyst (Policy Application - Detecting coastal land-cover and land-use change; Describing human and animal routes.)

Week 9 Location, Location, Location - Siting and Reserve Design (October 26 & 28)

- Lecture: Optimizing Over Space
Dobson, A.P., Rodriguez, J.P., Roberts, W.M., and D.S. Wilcove. 1997. "Geographic Distribution of Endangered Species in the United States," *Science* 275: 550-553.
Ando, A., Camm, J., Polasky, S., and A. Solow. 1998. "Species Distributions, Land Values, and Efficient Conservation," *Science* 279: 2126-2128.
- Lab: Research Project.

Week 10 Spatial Resource Management (November 2 & 4)

- Lecture: Spatial Resource Management (Marine Protected Areas; Zoning; Smart Growth)
Sanchirico, J.N., Cochran, K.A., and P. M. Emerson. 2002. *Marine Protected Areas: Economic and Social Implications*. Washington, DC: Resources for the Future. Discussion Paper 02-26.
Fischel, W. 1985. *The Economics of Zoning Laws*. Johns Hopkins University Press: Baltimore. Pp. 207-271 and 293-340
- Lab: Research Project.

Week 11 Spatial Statistics – An Introduction (November 9 & 11)

- Lecture: Basic Spatial Statistics - Patterns and Processes
Bolstad, Chapter 12.
Bailey, T.C. and A.C. Gatrell. 1995. *Interactive Spatial Data Analysis*. Harlow, England: Prentice Hall. Chapter 1.
*Fotheringham, A.S., Brundson, C., and M. Charlton. 2000. *Quantitative Geography: Perspectives on Spatial Data Analysis*. London: Sage Publications. Subset of Material Drawn from Chapters 5-8.
- Lab: Fun with Kriging. Geostatistics and Interpolation (Policy Application – Air Pollution Monitoring - Ozone)
Bolstad, Chapters 13 and 14.
*Fotheringham, A.S., Brundson, C., and M. Charlton. 2000. *Quantitative Geography: Perspectives on Spatial Data Analysis*. London: Sage Publications. Chapter 7.

Week 12 Spatial Statistics – Spatial Dependence (November 16 & 18)

- Lectures: Econometrics and Spatial Data
Anselin, L. 2003. "Under the Hood: Issues in the Specification and Interpretation of Spatial Regression Models," *Agricultural Economics* 17 (3), 2002: 247-267.
*Fotheringham, A.S., Brundson, C., and M. Charlton. 2000. *Quantitative Geography: Perspectives on Spatial Data Analysis*. London: Sage Publications. Chapter 7.
- Lab: Shades of Green. Spatial Dependence (Policy Application - Environmental Consumerism - Evidence of Copy-Cat Behavior?)

Week 13 Student Presentations (November 23)

- Group A (November 23)

Week 14 Student Presentations (November 30 & December 2)

- Group B (November 30)
- Group C (December 2)

Week 15 Student Presentations (December 7 & December 9)

- Group D (December 7)
- Group E (December 9)

Final Examination December 14 8 to 10 AM