

UP 506: Introduction to Geographic Information Systems Fall 2016

Course Staff and Schedule

Instructor: Prof. Robert Goodspeed (rgoodspe@umich.edu)
Office: 2223C Art & Architecture Building
Office Hours: T/Th 2:30 – 4PM (sign up via Canvas link)

GSI: Taylor LaFave (tlafave@umich.edu)
Office Hours: By Appointment

Lectures: T&Th 4:00 – 5:00 PM, Room 2108, Art & Architecture Building
Labs: 004 Th 5:30–8:00 PM
002 Fr 8:30–11:00 AM *All labs in Advanced Training Lab 1, Duderstadt Center*
003 Fr 1–3:30 PM

Summary and Learning Objectives

This course is designed to introduce students to the dynamic field of geographic information systems (GIS). The course has three interrelated objectives: (1) provide a foundation in concepts from cartography, spatial analysis, and computer science used in GIS applications, (2) develop specific skills using ESRI's ArcMap, QGIS, and other software applications through a set of hands-on exercises, and (3) allow students to apply these skills through a mapping project on a topic of their choosing. Although urban planning topics will be emphasized, the course is intended to serve as a general introduction to GIS. Students will learn the basic principles of GIS, practice mapping spatial data, study examples GIS analysis, and develop and implement simple analysis models.

Note on Labs: Students should enroll in one of the three lab sessions, which will meet in Advanced Training Lab 1 located on the second floor of the Duderstadt Center. If for some reason a student cannot attend their own session for a given week, please ask the GSI to assign you to another session.

Materials

Textbooks

- Law, Michael and Amy Collins. 2015. *Getting to Know ArcGIS*. 4th ed. Redlands, Calif.: ESRI Press. ISBN: 9781589483828 (Referred to below as "GTK")
Available at the North Campus Bookstore. It is important ensure your copy is the correct edition, and is accompanied by the data CD.
- Chang, Kang-Tsung. 2013. *Introduction to Geographic Information Systems*. 7th Ed. New York: McGraw-Hill Science/Engineering. ISBN: 978-0077805401
Available at the North Campus Bookstore. This textbook also has a data CD, which will be useful but is not needed for class assignments. Note that there is an 8th edition available we are not using.

Additional Texts (Available from the Art, Architecture & Engineering Library)

- Maantay, Juliana, and John Ziegler. 2006. *GIS for the Urban Environment*. Redlands, Calif.: ESRI Press.
Textbook with useful cases on environmental, health, crime, and other planning topics.
- Monmonier, Mark S. 1996. *How to Lie With Maps*. 2nd ed. Chicago: University of Chicago Press.
Assigned chapters are posted to Canvas, however the entire book is recommended to interested students.
- Pickles, J, and S Didunyk. 1995. *Ground Truth: The Social Implications of Geographic Information Systems*. New York: Guilford Press.
Social critique of GIS use.

Readings

- All required readings not from the course textbooks will be posted to Canvas. Many of the “Additional Readings” are also available online. While not required, they are recommended for doctoral students, or students interested in exploring the topics further.

Other

- USB Drive, minimum 2 GB
- See *Canvas website for links to a variety of GIS resources.*

Assignments

- Class Participation and Discussion (lecture and lab) (5%)
- Lab Assignments (30%)
- Midterm Exam (15%)
- Module 2 & 3 Reading Response Posts (15%)
- Final Project Paragraph (5%), Proposal (10%), Poster (20%)

Class Participation – Attendance to the first 1 hour of lab is required, and the GSI will keep attendance that will be used to compute the participation grade. Lecture attendance will be taken occasionally.

Lab Assignments – Lab assignments are due at the beginning of the lab session the following week. The course content is cumulative and there are weekly assignments, so it is particularly important for students to keep up with the pace of the course. Late labs will be penalized 10% for each day late.

Midterm Exam – The midterm is based on the lecture presentations and readings. It will be a bluebook exam completed in-class. Students should provide their own bluebook, a blank exam booklet available from all campus bookstores.

Module 2 & 3 Reading Response Posts – After the midterm exam, students should post a 300-500 word reading responses to the class website each week before the Monday lecture. Instructions are posted to Canvas for each week, but typically the responses should address the article(s) assigned for that week and optionally also respond to other students’ posts. **Responses are due for a minimum of 4 of the 6 weeks.** Weeks 14 and 15 will be considered as one week. The grade is the percent of required posts completed (maximum of 100%).

Final Project – Additional details on the final project will be provided separately. A short paragraph is due at the start of class on **Tues., Oct. 25th**, and a detailed project proposal is due **Tues., Nov. 15th**. Posters will be displayed at fairs held on **Thurs., Dec. 8th** (draft, class only), and **Wed., Dec. 15th** (public).

Resources

Getting Help

GIS is professional software, meaning it is used by a community of expert users who are already familiar with its interface, specialized functions, and underlying concepts. This makes it different than most of the software applications you have used before, which are designed for use by broad audiences of general users with limited shared knowledge. **As a consequence, you may find GIS software to be buggy, confusing, and frustrating.** When you encounter problems, there are several resources available to you. In general, students are encouraged to use them in the following order:

- Classmates
- Class Canvas help forum
- Online help files, FAQs, listservs, and other resources (get started at <http://resources.arcgis.com/en/help/> or <http://gis.stackexchange.com/>)
- Course instructors
- SAND Lab Librarians

Corrupted files, error messages, missing menus, and other challenges you may encounter are not simply problems, but learning opportunities for students as they progress along the path of becoming a skilled professional GIS user.

Spatial and Numeric Data Services (SAND) Lab

The University Library's Spatial and Numeric Data Services (SAND) provides assistance with spatial data, numeric data, and statistics for the University of Michigan community. One of the two UM SAND labs is located at Taubman College in room 2207A of the Art & Architecture Building. This lab is generally open during business hours (9AM – 5PM, M-F), and is staffed by a GIS consultant during regular hours which will be announced to the class. The lab supports students from Taubman College, in addition to those from other North Campus programs including the Schools of Engineering and Information. SAND provides advanced computers and software to help students and researchers work with spatial and numeric data and access to data only available from within our labs. These labs are equipped with ArcGIS, ArcView, ERDAS, SAS, SPSS, StatTransfer, Stata, Adobe Creative Suite (Photoshop, Illustrator, InDesign, Dreamweaver), and other software. SAND also provides access to and assistance with data from the Inter-university Consortium for Political and Social Research (ICPSR), Roper Center for Public Opinion Research, Europa World Plus, Global Insight, Geolytics, the U.S. Census Bureau, the U.S. Geological Survey, and other sources.

UP 506 Sand Lab Use Guidelines: Students with questions arising *from course assignments* should inquire with classmates and course instructors before visiting the SAND Lab. After reviewing the provided Canvas links and conducting preliminary explorations, students are encouraged to consult with the SAND Lab librarians about data sources for the final project. There are two ways to utilize the SAND Lab:

- For smaller issues or general questions, consult with the graduate student during drop-in hours;
- For more complex requests, set up an appointment with one of the data librarians.

For more information or to book an appointment, see: <https://taubmancollege.umich.edu/labs-workshops/spatial-and-numeric-data-services-sand-lab>

Course Policies

In addition to those specified here, policies which apply to students in this class include those of the Urban and Regional Planning Program, Taubman College, students' home academic units, and the University.

Academic Integrity

Taubman College Policy on Plagiarism:

"Plagiarism is knowingly presenting another person's ideas, findings, images or written work as one's own by copying or reproducing without acknowledgement of the source. It is intellectual theft that violates basic academic standards. In order to uphold an equal evaluation for all work submitted, cases of plagiarism will be reviewed by the individual faculty member and/or the Program Chair. Punitive measures will range from failure of an assignment to expulsion from the University."

Students will be provided guidance in class about academic integrity norms in GIS, including how to appropriately cite data sources and document analyses. Students with additional questions should contact the course instructor.

Accommodations for Students with Disabilities

It is Taubman College policy to "meet the educational needs of all persons, including those with physical or perceptual limitations, who are interested in the study of architecture, urban planning and/or urban design." If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; <http://ssd.umich.edu>) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

Grading

The following scale will be used for grading in this course.

Grade	Minimum %
A+	100
A	95
A-	90
B+	87
B	83
B-	80
C+	77
C	73
C-	70
D+	67
D	63
D-	60
E	50
F	40

Schedule

Module 1: Introduction to GIS

Week 1 - Introduction and Course Overview

Tues., Sept. 6: Introduction & Geographic Orientation

Thurs., Sept. 8: Geographic Orientation & GIS Applications in Urban and Regional Planning

Lab 1: GTK 3

Readings:

1. Chang, Ch. 1

Additional Readings:

1. Söderström, Ola. 1996. "Paper Cities: Visual Thinking in Urban Planning." *Cultural Geographies* 3 (3):249-281.
2. Harvey, F., and N. Chrisman. 1998. "Boundary Objects and the Social Construction of GIS Technology." *Environment and Planning A* 30:1683-1694.

Week 2 - Geographic Concepts: Coordinate Systems & Projections

Tues., Sept. 13: Concepts 1

Thurs., Sept. 15: Concepts 2

Lab 2: GTK 4 & 6

Readings:

1. Chang, Ch. 2
2. Monmonier, Ch. 2

Week 3 - Spatial Data Formats

Tues., Sept. 20: Overview and Vector Data

Thurs., Sept. 22: Raster Data

Lab 3: GTK 7-10

Reading:

1. Chang, Ch. 3 & 4

Week 4 - Thematic Mapping, Measurement & Cartography

Tues., Sept. 27: Levels of Measurement & Cartography

Thurs., Sept. 29: Thematic Mapping

Lab 4: Cartography Assignment

Readings:

1. Chang, Ch. 9
2. Monmonier, Ch. 10 & 11
3. Kent, Robert B., and Klosterman, Richard E. (2000). "GIS and Mapping: Pitfalls for Planners." *Journal of the American Planning Association*, 66 (2), 189-198.

Week 5 – U.S. Census

Tues., Oct. 4: U.S. Census – Introduction, Census Geography & Data Products

Thurs., Oct. 6: U.S. Census – Neighborhood Scale Analysis & Examples

Lab 5: Census Assignment

Reading:

1. MacDonald, Heather. 2006. "The American Community Survey: Warmer (More Current), but Fuzzier (Less Precise) than the Decennial Census." *Journal of the American Planning Association* 72 (4): 491-502.
2. Schlossberg, M. 2003. "GIS, the US Census and Neighborhood Scale Analysis." *Planning, Practice & Research* 18 (2-3):213.
3. U.S. Census Bureau. 2009. *A Compass for Understanding and Using American Community Survey Data: What Researchers Need to Know*. (Read pp 1-10, skim remainder including appendices)
4. U.S. Census Bureau. 2012. *2010 Census Summary File 1 Technical Documentation*. (skim)
5. Hodges, K. and E. Christopher. Webinar: "Using the ACS to Measure Trends Over Time." American Community Survey Data Users Group. Available online at: <https://www.youtube.com/watch?v=Bvl2sZo1PNY#t=5>

Additional Reading:

1. Peters, Alan and Heather MacDonald. 2004. *Unlocking the Census with GIS*. Chapter 1, "The Census: An Introduction," Chapter 2, "Downloading the Data and the Maps." Redlands: ESRI Press.

Week 6 – Database Concepts

Tues., Oct. 11: Database Concepts

Thurs., Oct. 13: GIS Ethics

Lab 6: GTK 15a, 15b, 16 & 17

Reading:

1. Chang, Ch. 8 & 10
2. Ferreira, Joseph. 1990. "Database Management Tools for Planning." *Journal of the American Planning Association* 56 (1):78-84.
3. GISP Code of Ethics and Rules of Conduct.

Additional Reading:

1. Chapter 2 in Worboys, Michael, and Matt Duckham. 2004. *GIS: a computing perspective*. 2nd ed. Boca Raton: CRC Press.

Week 7 – Midterm Exam

Tues., Oct 18: No Class - Fall Study Break

Thurs., Oct. 20: Midterm Exam

Module 2: Analysis in GIS

Week 8 – Creating Data

Tues., Oct. 25: Creating Data

- Project Paragraph Due

Thurs., Oct. 27: Spatial Analysis 1: Queries, Measurements, Transformations

Lab 7: GTK 12, 13 & Geocoding Assignment

Reading:

1. Chang, Ch. 5, 7, & 16
2. Drummond, William J. 1995. "Address Matching: GIS Technology for Mapping Human Activity Patterns." *Journal of the American Planning Association*, 61 (2), 240-251.

Week 9 – Spatial Analysis

Tues., Nov. 1: Spatial Analysis 2: Model Builder and Examples

Thurs., Nov. 3: SAND Lab Librarian

Lab 8: GTK 18-19

Reading:

1. Chang, Ch. 11
2. Corburn, Jason, Jeffrey Osleeb, and Michael Porter. 2006. "Urban Asthma and the Neighborhood Environment in New York City." *Health & Place* 12 (2):167-179.
3. New Yorkers for Parks. 2008. Manhattan's East Side Open Space Index. (skim)

Week 10: Spatial Analysis, Cont.

Tues., Nov. 8: Spatial Analysis 3: Equity Mapping

Thurs., Nov. 10: Spatial Analysis 4: Data Quality, Opportunity Mapping

Lab 9: Washtenaw County Equity Analysis

Reading:

1. Chang, Ch. 17
2. Talen, Emily. 1998. "Visualizing Fairness: Equity Maps for Planners." *Journal of the American*

Planning Association, 64 (1), 22-38. (Tues.)

3. Ackerson, Kristopher. "In the Right Place: Iowa City uses GIS to Site Affordable Housing." *Planning*, March 2013: 33-35. (Thurs.)

Additional Reading:

1. Ewing, Reid, Shima Hamidi, James B. Grace, and Yehua Dennis Wei. 2016. "Does urban sprawl hold down upward mobility?" *Landscape and Urban Planning* 148:80-88.
2. Talen, Emily. 2011. "Sprawl Retrofit: Sustainable Urban Form in Unsustainable Places." *Environment and Planning B: Planning and Design*, 38 (6), 952-978.
3. Knaap, Eli, Gerrit-Jan Knaap, and Chao Liu. 2012. "Mapping Opportunity: A Critical Assessment." Presented at the Association of Collegiate Schools of Planning, Philadelphia, PA. Draft date: 30 October 2014.
4. Knaap, Gerrit-Jan. 2014. "OppMap: A New Tool for Exploring Access to Opportunity."
5. Reardon, Tim and Holly St. Clair. 2012. "The Opportunity mapping Framework-Limitations and New Directions." Metropolitan Area Planning Council Working Paper.
6. Tegeler, Philip and Salimah Hankins. 2012. "Prescription for a New Neighborhood." *Shelterforce*.

Week 11: Raster Analysis

Tues., Nov. 15: Raster Analysis Techniques & Example

- Project Proposal Due

Wed., Nov. 16: GIS Day! (<http://www.gisday.com>)

Thurs., Nov. 17: Special Topics in Spatial Analysis (3D & Time)

Lab 10: GTK 20

Reading:

1. Chang, Ch. 12
2. Winters, Meghan, Michael Brauer, Eleanor M Setton, and Kay Teschke. 2013. "Mapping Bikeability: A Spatial Tool to Support Sustainable Travel." *Environment and Planning B: Planning and Design* 40, 865-883. (Tues.)

Additional Reading:

1. Chang, Ch. 13 (Terrain Mapping), Ch. 14 (Viewshed and Watershed Analysis), Ch. 18 (GIS Models).
2. Example of using GIS to measure urban form: Purciel, Marnie, Kathryn M. Neckerman, Gina S. Lovasi, James W. Quinn, Christopher Weiss, Michael D. M. Bader, Reid Ewing, and Andrew Rundle. 2009. "Creating and Validating GIS Measures of Urban Design for Health Research." *Journal of Environmental Psychology* 29 (4):457-466.

Week 12: Working Session

This week we will meet in a computer lab for a short "desk crit" to see your work so far and answer any questions. Each individual or group should check in with the instructor during the session.

Tues., Nov. 22, 4:00 - 6:00 PM: Working Session (PC Classroom/Room 2054, Shapiro Undergraduate Library)

Thurs., Nov. 24: Thanksgiving (No Class)

Module 3: Emerging Applications and Final Projects

Week 13: Open Source GIS, Web Mapping, and Participatory GIS

Tues., Nov. 29: Open Source GIS, Web Mapping, PPGIS & Volunteered Geographic Information

Thurs., Dec. 1: Guest Speaker: "Growing Resilience in Detroit: A Spatial Planning Model and Approach for Multifunctional Green Infrastructure," Sara Meerow, SNRE PhD Student

Lab 11: Web Mapping Assignment

Readings:

1. Brown, Greg, Morgan Faith Schebella, and Delene Weber. 2014. "Using Participatory GIS to Measure Physical Activity and Urban Park Benefits." *Landscape and Urban Planning* 121 (0), 34-44.
2. Goodchild, M.F. 2007. "Citizens as Sensors: The World of Volunteered Geography." *GeoJournal* 69 (4), 211-221.
3. Adams, David. 2012. "Volunteered Geographic Information: Potential Implications for Participatory Planning." *Planning Practice & Research* 28 (4), 464-469.

Additional Resources (Tues.):

1. Sieber, Renee. 2006. "Public Participation Geographic Information Systems: A Literature Review and Framework." *Annals of the Association of American Geographers* 96 (3):491-507.
2. Tulloch, David L. 2008. "Is VGI Participation? From Vernal Pools to Video Games." *GeoJournal* 72 (3-4), 161-171.
3. Fisher, Adam. 2013. "Google's Road Map to Global Domination." *New York Times*. Magazine Section, December 11, 2013.
4. Schuurman, N. 2000. "Trouble in the Heartland: GIS and its Critics in the 1990s." *Progress in Human Geography* 24 (4):569-590.
5. Elwood, Sarah. 2008. "Volunteered Geographic Information: Future Research Directions Motivated by Critical, Participatory, and Feminist GIS." *GeoJournal* 72 (3-4):173-183.

Additional Resources (Thurs.):

1. Malczewski, Jacek, & Rinner, Claus. (2015). *Multicriteria Decision Analysis in Geographic Information Science*. New York, NY, USA: Springer. <http://doi.org/10.1007/978-3-540-74757-4>

Week 14: Final Project Working Sessions

Tues., Dec. 6: Planning Support Systems (PSS) and the Future of GIS in Planning

Thurs., Dec. 8: Draft Poster Fair (class only)

Reading:

1. Klosterman, Richard E. 1997. "Planning Support Systems: A New Perspective on Computer-Aided Planning." *Journal of Planning Education and Research* 17 (1):45-54.
2. Ch. 2 and Ch. 3 in Holway, Jim, C.J. Gabbe, Frank Hebbert, Jason Lally, Robert Matthews, and Ray Quay. 2012. *Opening Access to Scenario Planning Tools*. Cambridge, Mass.: Lincoln Institute of Land Policy.
3. Goodspeed, Robert, Peter Pelzer, and Chris Pettit. "Planning our Future Cities: The Role

Computer Technologies can Play.” Draft manuscript.

Additional Resources:

- Drummond, William J. and Steve P. French. 2008. “The Future of GIS in Planning: Converging Technologies and Diverging Interests.” *Journal of the American Planning Association* 74 (2):161-74.
- Ferreira, Joseph. 2008. “Comment on Drummond and French: GIS Evolution: Are We Messed Up by Mashups?” *Journal of the American Planning Association* 74 (2):177 - 179.
- Brail, Richard K. 2008. *Planning Support Systems for Cities and Regions*. Cambridge, Mass.: Lincoln Institute of Land Policy. (Examples of GIS-based planning support systems)
- Carton, L. J., and W. A. H. Thissen. 2009. "Emerging conflict in collaborative mapping: Towards a deeper understanding?" *Journal of Environmental Management* 90 (6):1991-2001.

Week 15:

Tues., Dec. 13: Big Data & Frontiers of Urban GIS Research

Reading:

1. Boeing, G. and P. Waddell. 2016. “New Insights into Rental Housing Markets across the United States: Web Scraping and Analyzing Craigslist Rental Listings.” *Journal of Planning Education and Research*, forthcoming.
2. Griffin, Greg Phillip, and Junfeng Jiao. 2014. "Crowdsourcing Bicycle Volumes: Exploring the Role of Volunteered Geographic Information and Established Monitoring Methods." *URISA Journal* 27 (1).

Thurs., Dec. 15, 10:30 am - 12:30 PM: Final Poster Fair