# Introduction to GIS Methods | Spring 2019

**Barnard College Urban Studies UN2200 | Tuesdays & Thursdays: 6:10-8:00pm | Milstein 516**


### Professor:

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### Teaching Assistant:

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### Course Description

This course is an introduction to the analysis of evidence and development of arguments in urban studies, with an emphasis on the use of Geographic Information Systems (GIS) technology. Beyond map production, GIS is a tool that allows you to integrate geography with data, in order to view, manage, and analyze information about the places you want to study. GIS is a central instrument in a number of professional fields, including urban planning, public health, historic preservation, and environmental science. Its usage has seen growing importance due to increased theoretical attention to spatial issues in urban analyses as well as the increasing accessibility of GIS technology. Priority for enrollment is given to Urban Studies majors and upper-level students.

In both geographic and non-geographic analysis, the course will focus on:

- Theory: Spatial Intelligence and Data Acquisition;
- Application: Technical Knowledge and Software Familiarity; and
- Design: Articulation of Concepts and Map Clarity.

### Student Learning Objectives

The course seeks to ensure students develop a basic familiarity with the most commonly-used methods of analysis using GIS, such that the wide range of possibilities of its applications and interpretations is understood at a fundamental level. This will allow students to engage critically and effectively with its growing number of applications.

Thus the objectives of this course are
(1) Providing an understanding of introductory-level skills necessary to work with GIS, predominantly using ESRI's ArcGIS software;
(2) Identifying (and, when necessary, constructing) variables from publicly available data sets that measure spatial variation important to an urban analysis;
(3) Using GIS technology to make **simple** and **convincing** analyses of spatial relationships;
(4) Ensuring an introductory understanding of the ethical questions surrounding data creation, analysis, and representation in urban contexts; and
(5) Critically evaluating maps and map-based arguments on urban topics in both scholarly work and journalism.

### Methods of Instruction

In lieu of a required text, in-class exercises, assignments, and readings will be posted to Canvas for the following week. Given the emphasis on computer-based lab work in this course, care has been

taken to only include necessary readings within this course. Likewise, since much of the core, technical learning comes from repetition and/or trial and error, the first half of the semester will focus on weekly assignments which highlight the key functions of ArcGIS software. The in-class exercises and on-your-own assignments are largely derived from these sources:

- GIS Tutorial 1: Basic Workbook for ArcGIS 10 (Wilpen L. Gorr and Kristen S. Kurland, 2011)
- Getting to Know ArcGIS Desktop, Second Edition, Updated for ArcGIS 10 (Tim Orms, Eileen J. Napoleon, Robert Burke, Carolyn Groessl, and Laura Bowden, 2010)
- The GIS 20: Essential Skills (Gina Clemmer, 2010)

Occasional reading assignments and supplemental readings will be uploaded to Canvas. While there is no required text for this course, the following texts are recommended, as they have been used for this course in previous semesters:

- Mastering ArcGIS (Maribeth Price, 2016)
- GIS for the Urban Environment (Juliana Maantay and John Ziegler, 2006)

## External Hard Drive or Flash Drive

Despite how this technology may seem near-obsolete, it is required that everyone have an external storage device, such as an external hard drive or USB flash drive, for use in this class. The external storage device will enable you to work seamlessly on any computer that runs ArcMap, and help prevent loss or corruption of data. I recommend a minimum of 16 GB of free space. The external storage device must be brought with you to every class, starting week one.

## Grading

5% – Class Participation & Preparation
5% – Group Case Study Presentations
10% – Midterm Exam
50% – On-Your-Own Assignments (8 in total, 4-8% each)
30% – Final Project (Paragraph – 5%; Proposal – 5%; Final Review – 10%; Final Report - 10%)
= 100% (Plus a potential 2% from Extra Credit assignment)

## Attendance (5%)

All students are expected to attend both lecture (Tuesdays) and lab (Thursdays) sessions. Regular attendance, along with participation during pin-ups and other presentations by classmates, factors into the final grade. Students who will miss class due to religious holidays or other appropriate reason should email the professor and TA in the first week of classes with the dates (and reasons) of their foreseen absences and are encouraged to make arrangements with their peers for notes. Students with disabilities who require accommodations or academic adjustments for this course must either enroll in the Program for Academic Access or register with the Office of Disabilities. For any accommodation, the instructor must be presented with either a letter from the Assistant Director of the Program for Academic Access or an Accommodations Card from the Office of Disabilities during the first week of classes.

## Group Case Study Presentations (5%) and Midterm Exam (10%)

Week 8 will consist of short presentations on case studies of GIS-related work of your choosing. These will be given in teams of two -- further details will be discussed during Week 6. The midterm exam will be a take-home exam which tests your understanding of the lectures, readings, and techniques learned in the first half of the semester. It will be uploaded at the end of Week 8 on March 14th and due Thursday, March 28th at 6pm. Unexcused late midterms will not be accepted.

## On-Your-Own Assignments (50%)

For the eight (8) "on-your-own" assignments, all instructions are noted, including what to upload to Canvas. All assignments must be submitted by 6pm (prior to the start of class) on the day the assignment is due. Read the instructions carefully and make sure you upload all required deliverables. Points will be deducted for unexcused lateness or incomplete assignments.

## Final Project (30%)

Your final project should relate in some way to the field of your declared (or planned) major. You can create or collect your own data with the goal of answering a research question using ArcGIS. It is perfectly acceptable (even encouraged) to create a project that will also be helpful for another class or your senior thesis. This project is intentionally broad to allow you to work on a subject that interests you. I recommend thinking about possible projects as soon as possible. A full assignment description will be distributed before the midterm.

*There will be five deliverables for the final project:*
Topic paragraph, detailing scope and data sources for the project (5%) - *Tuesday, April 2nd*
Proposal with revised paragraph and methods summary (5%) - *Thursday, April 11th*
Maps (pin-up, part of your participation grade) - *April 16th and 18th*
Final review (10%) - *April 30th and May 2nd*
Final report deliverable uploaded onto github for sharing (10%) - *due Friday, May 10th by 6pm*

Students are required to submit a topic paragraph with data sources prior to carrying out the project at the start of Week 10 (5% of final grade), and much of the class time toward the end of the semester is reserved for individual guidance with the professor and TA during desk crits, where we can discuss developing the scope, feasibility, and possible/expected results of your project.

Due to the nature of ongoing GIS work being shared between practitioners, and in the spirit of open data, final deliverables include a written and graphical report uploaded onto the course github repository (10% of final grade), along with a presentation or "review" (10% of final grade). Final presentations will be given before a panel of invited guests (TBD) for feedback to be incorporated in the final report. They will be divided into two sessions, April 30th and May 2nd. PDFs of your final presentations must be submitted on Canvas by 5pm before the earlier session on April 30th in order to ensure fairness for all students.

## Professor and TA

The TA will attend the lab sessions on Thursdays and be responsible for providing assistance on in-class and on-your-own assignments throughout the semester, as well as feedback on final projects. In addition to office hours, students may contact the professor or the TA via email, and we will do our best to respond to your emails promptly. However, since time management is a vital skill, please do not rely on the night before due dates to email questions. If you email a technical question to the professor and/or TA, be sure to include enough information for us to best help you, including a detailed description of what you are trying to accomplish and the problem you are encountering, any relevant information regarding the data sets you are using, the steps you have already taken (so we don't tell you to do what you've already done), and any necessary screenshots to help us understand what you are doing when we cannot sit with you in front of a computer.

## Weekly Schedule (subject to minor changes)

Week 1
Tuesday, January 22nd and Thursday, January 24th

**Lecture:** Housekeeping & Introduction to GIS Mapping
**In-Class Exercise:** Getting familiar with ArcMap (ArcMap Tools, Scaling your Map, Identifying Features, Saving .MXDs, Adding & Using Map Layers, Changing Symbology, Saving Layers (.lyr), Auto-Labeling, Exporting to PDF or JPG)
**On-Your-Own Assignment 1:** due Tuesday, January 29th (by 6pm)

Week 2
Tuesday, January 29th and Thursday, January 31st

**Lecture:** Collecting & Assessing Data for GIS
**In-Class Exercise:** Starting a New Map, Managing GIS Files, and Working with Existing GIS Data (Using ArcCatalog, Adding Data, Selecting Features, Querying Data, Working with Attributes - Selecting by Attributes/by Location, Creating New Layers, Creating a Layout & Labeling)
**On-Your-Own Assignment 2:** due Tuesday, February 5th

Week 3
Tuesday, February 5th and Thursday, February 7th

**Lecture:** Qualitative and Quantitative Maps, Classifying Data
**In-Class Exercise:** Creating Thematic Maps (Classifying Data)
**On-Your-Own Assignment 3:** due Tuesday, February 12th
**Reading:** Basic GIS Methods of Analysis and Software Functionality – Chapter 1 (pgs 29-45) – Mapping Global Cities (Ayse Pamuk), answer question on On-Your-Own 3, due Tuesday, February 12th.

Week 4
Tuesday, February 12th and Thursday, February 14th

**Lecture:** Map Projections and Coordinate Systems
**In-Class Exercise:** Modifying Attribute Tables, Joining and Editing GIS Data (by Attributes & Spatially), Creating Centroids from Polygons
**On-Your-Own Assignment 4:** due Tuesday, February 19th

Week 5
Tuesday, February 19th and Thursday, February 21st

**Lecture:** Map Design
**In-Class Exercise:** Editing Metadata, Downloading Data, Prepping an Excel Spreadsheet for Joining and Joining U.S. Census Data
**On-Your-Own Assignment 5:** due Tuesday, February 26th
**Reading:** "Make Maps People Want to Look At," by Aileen Buckley for ArcUser (Winter 2012)

Week 6
Tuesday, February 26th and Thursday, February 28th

**Lecture:** Creating and Editing Shapefiles
**In-Class Exercise:** Editing Vector Data (Points, Polygons & Lines)
**On-Your-Own Assignment 6:** due Tuesday, March 5th
Group Case Study Presentations assignment description distributed - *due March 12th*

Week 7
Tuesday, March 5th and Thursday, March 7th

**Lecture:** Map Projections & Georeferencing
**In-Class Exercise:** Map Projections, Georeferencing Historic Maps and other Raster Images

Week 8
Tuesday, March 12th and Thursday, March 14th

**Group Case Study Presentations by Students**
**Discussion:** Midterm Exam and Final Project descriptions distributed on March 14th
**Take-Home Midterm Exam:** Testing your knowledge of the GIS concepts and techniques discussed during lectures and in-class exercises - *due Thursday, March 28th*

**SPRING BREAK – NO CLASS**

Week 9
Tuesday, March 26th and Thursday, March 28th

**In-Class Exercise:** Geoprocessing Techniques (Merging, Appending, Clipping, Dissolving, Intersections, Buffering, and Spatial Joining)
**Assignments (due next class):**
**On-Your-Own Assignment 7:** due Tuesday, April 2nd
**Final Project Paragraph:** Draft a final project paragraph and upload to Canvas. Based on comments from the professor and TA, you will then have a chance to revise your paragraph and include it as part of your proposal. Deliverable: No more than one single-sided page discussing scope and data sources – *due Tuesday, April 2nd*

**Be prepared to discuss and begin working on your final projects during the next class.**

Week 10
Tuesday, April 2nd and Thursday, April 4th

**Final Project Discussions and Development / In-Class Working Session with Desk Crits**
**Assignments (due next class):**
**On-Your-Own Assignment 8:** Geocoding - due Tuesday, April 9th
**Final Project Proposal:** Based on our in-class discussions, refine your final project paragraph and resubmit next week as part of the proposal and methods summary. Deliverable: No more than two pages – *due Thursday, April 11th*

Week 11
Tuesday, April 9th and Thursday, April 11th

**TBD Guest Lecture: Web Mapping**
**In-Class Exercise:** Web Mapping / KML Files and ArcMap / ArcGIS Online Story Mapping
**Extra Credit:** KML Conversion Map and Story Map – *due April 23rd*
*Open lab time for working on Final Projects*

Week 12
Tuesday, April 16th and Thursday, April 18th

**Final Project Pin-up:** Briefly present progress of final project to class

Week 13
Tuesday, April 23rd and Thursday, April 25th

**Lecture:** Github course repository
**In-Class-Exercise:** Digital Photos as GPS / Hyperlinking in ArcMap / Map Animations / 3D GIS
*Open lab time for working on Final Projects*

Week 14
Tuesday, April 30th and Thursday, May 2nd

**Final Review:** Student presentations will be split evenly between Tuesday and Thursday sections, but all students must upload their slides to Canvas by 5pm on Tuesday, April 30th. Remember, all work presented must match what you submitted or points will be deducted.

****Final Reports to be uploaded to the course github repository by Friday, May 10th at 6pm.****

## Additional Resources

*GIS Tutorials from the Center for Spatial Research* - https://github.com/adamlubitz/gis_tutorials
Created by Juan Saldarriaga, these tutorials cover a comprehensive set of skills involving downloading and exporting GIS data, particularly for use in other software packages.

*Barnard Empirical Reasoning Center (ERC)* - https://erc.barnard.edu
Located in Milstein 102, this should be your go-to for any GIS-related questions outside of class.

*Digital Social Science Center (DSSC)* - http://library.columbia.edu/locations/dssc.html
Located in the Lehman Library basement, DSSC is a great resource for GIS data and technical questions. DSSC collects GIS data that you can use for your final projects or other GIS work beyond this course. They also provide technical consultations for acquiring data and using ArcGIS.

*ESRI User Forum* - https://community.esri.com/community/discussions-lobby
The ESRI user forum is also a great resource for technical GIS software questions.

*American Community Survey (ACS) Dataset References*

US Census Bureau. 2009. "A Compass for Understanding and Using American Community Survey Data: What Researchers Need to Know." US Department of Commerce. Economics and Statistics Administration.

---. 2009. "A Compass for Understanding and Using American Community Survey Data: What State and Local Governments Need to Know." US Department of Commerce. Economics and Statistics Administration.

*Example Research on Planning Topics*

Drewnowski, A, et al. 2014. "Food Environment and Socioeconomic Status Influence Obesity Rates in Seattle and in Paris." In International Journal of Obesity. 38(2): 306-314.

Erenstein, Olaf, Jon Hellin, Parvesh Chandna. 2010. "Poverty Mapping Based on Livelihood Assets: A Meso-level Application in the Indo-Gangetic Plains, India." In Applied Geography. 30(1): 112-125.

Jones, Ken and Tony Hernandez. 2004. "Chapter 2. Retail Applications of Spatial Modelling." In J. Stillwell and G Clarke (eds). Applied GIS and Spatial Analysis. New York: John Wiley & Sons, 11-33.

McEntee, Jesse and Julian Agyeman. 2010. "Towards the Development of a GIS Method for Identifying Rural Food Deserts: Geographic Access in Vermont, USA." In Applied

Geography. 30(1): 165-176.
Rogerson, P and Y Sun. 2001. "Spatial Monitoring of Geographic Patterns: An Application to Crime Analysis." In Computers, Environment and Urban Systems. 25(6): 539-556.
Rylatt, M, S Gadsden, and K Lomas. 2001. "GIS-based Decision Support for Solar Energy Planning in Urban Environments." In Computers, Environment, and Urban Systems. 25(6): 579-603.
Rybarczyk, Greg and Changshan Wu. 2010. "Bicycle Facility Planning Using GIS and Multi-Criteria Decision Analysis." In Applied Geography. 30(2): 282-293.
Sudhira, H S, T V Ramachandra, and K S Jagadish. 2004. "Urban Sprawl: Metrics, Dynamics, and Modelling Using GIS." In International Journal of Applied Earth Observation and Geoinformation. 5(1): 29-39.

*Mapping, GIS, and Data Visualization*

Center for Spatial Research, Columbia University Graduate School of Architecture, Planning, and Preservation. http://c4sr.columbia.edu/
MacEachran, Alan. 1995. How Maps Work: Representation, Visualization, and Design. New York: The Guilford Press.
Slocum, Terry. 1999. Thematic Cartography and Visualization. Upper Saddle River, NJ: Prentice Hall.
Snyder, John. 1982. Map Projections Used by the US Geological Survey: Geological Survey Bulletin 1532. Washington, DC: US Government Printing Office.
Tufte, Edward. 1986. The Visual Display of Quantitative Information. Cheshire, CT: Graphics Press.
---. 1990. Envisioning Information: Narratives of Space and Time. Cheshire, CT: Graphics Press.