SSCI 301, Maps and Spatial Reasoning

Syllabus

Units: 4

Term: Spring 2023
Lecture: Tuesdays and Thursdays, 2:00 to 3:20 p.m.
Labs: Tuesdays, 4:00 to 5:50 p.m. (35650R) and Thursdays, 12:00 to 1:50 p.m. (35647R)

Locations: THH 118 (Class), THH 106 (35650R Lab), and WPH 201 (35647R Lab)

Instructor: John P. Wilson, Ph.D.
Office: AHF B55F
Office Hours: Mondays, 3 to 4 p.m. and Fridays, 4 to 5 p.m. PT. Also available by appointment via email.
Contact Info: jpwilson@usc.edu

Lab Instructor: Andrew Kampfschulte
Office: AHF B57A
Office Hours: Tuesdays and Fridays, 12:00 to 1:00 p.m.
Contact Info: kampfsch@usc.edu

Library Help: Andy Rutkowski
Office: LIPA B40-A
Office Hours: Thursdays, 10 a.m. to 12 p.m. or by appointment
Contact Info: arutkows@usc.edu

IT Help: Myron Medalla, Dornsife Technology Services
Office: AHF B56A
Contact Info: spatial_support@usc.edu, 213-740-2775

Course Scope and Purpose

Maps have long played a role in the production and use of geographic information. They support many different kinds and levels of spatial reasoning, from simple queries (route finding, proximity analysis) to more advanced forms of spatial analysis and modeling. An explosion in geographic information technologies over the past two decades has enabled the development of quick visualization tools such as Google Maps, sophisticated geographic information systems (GIS) such as ArcGIS and TerrSet, and many kinds of GPS-enabled sensors. Users can be found across society: social workers use GIS to track where clients live and where more social services are needed, urban planners use GIS to analyze the transformation of city spaces, landscape architects use GIS to design and track the status of their individual project sites, anthropologists use GIS to map the changing cultural patterns of a neighborhood, historians use GIS to map historical transformations across space, environmental scientists use GIS to track how natural disasters and groundwater flows interact with human-environment systems, and emergency responders use GIS to track where earthquake or hurricane survivors need assistance – to name a few.

Taken as a whole, this course provides a broad understanding (theoretical and technical) for later work with geographic information, regardless of background and/or academic interests. It introduces the geographic information technologies and spatial skills needed to map, model, and predict how physical and social phenomena develop and change. In these ways, the spatial sciences can significantly affect the way research is conducted, profoundly impact the way we understand the world, and help us to prepare plans and designs that will dramatically improve the quality of life for those whose life experiences and prospects are shaped by spatial processes.

This course is designed to serve several different student audiences given its role as a required course in the B.S. in Geodesign, B.S. in Global Geodesign, B.S. in Environmental Studies, and the GIS and Sustainability Science, Human Security and Geospatial Intelligence, and Spatial Sciences Minors. Each student is encouraged to utilize the laboratory experience and self-directed capstone research project to explore geospatial resources and computational techniques for running basic spatial analyses and data visualization, with their own academic and professional goals in mind.

Learning Outcomes

On completion of this course, students should be able to:

- Describe the main types of spatial data, methods for their creation, and relevant factors for choosing amongst them;
- Describe the main types of maps, issues pertaining to geographic information and the creation of maps;
- Explain basic spatial analysis and modeling methodologies and choose appropriate methods for answering various spatial questions;
- Create quantitative and qualitative maps that communicate the products of spatial data analysis and modeling;

- Explain how modern geographic analysis and visualization tools can be used across a variety of disciplines; and
- Apply modern mapping and GIS technologies to problem solving within diverse fields of study.

Students may vary in their competency levels on these abilities. You can expect to acquire these abilities only if you honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

Prerequisite(s): None
Co-Requisite(s): None

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodations you may contact the Title IX Coordinator directly (https://titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours).

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect of others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Course Structure

This is a four-credit course comprised of lectures (two per week) and lab (one per week). The lecture sessions will discuss various aspects of cartography, spatial reasoning, and the hardware and software systems used to investigate these processes. The weekly lab meetings are designed to introduce you to the tools of scientific inquiry and to give you practical experience implementing them within the framework of the scientific method. The lecture and lab sessions complement each other to provide you with sound theoretical reasoning and the technical skills

to investigate various physical and/or social processes. **It is required that you register for both the lecture and one laboratory session for this course.**

Course materials and assignments will be posted on the course Blackboard website. Your assignments will be graded and returned via Blackboard. As a registered student you will find this course available for you to access at 10 am PT on the first day of classes**.**

Technological and Communication Requirements

The GIS software and geospatial data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute. Instead, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use in the event that the student needs to communicate with the instructors remotely
- An up-to-date web browser to access the SSI Server, in the event that the student accesses our software and data online

If a student does not have access to any of these, please speak with the instructor at the start of the semester. Also, see the USC ITS Student Toolkit here: https://keepteaching.usc.edu/students/student-toolkit/.

Communications – All materials to be handed in will be submitted via Blackboard. It is each student's responsibility to stay informed about what is going on in our course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Do not ignore course email until the day before assignments are due. Also double check to be sure that email sent from the USC blackboard account does not go into your junk mail!

While I am usually on-line all day and will probably respond to emails from students very quickly, I will endeavor to respond to all email within 36 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be off-line for more than 72 hours, I will post an announcement on the Blackboard site.

Required Readings and Supplementary Materials

The required textbooks for this course are:

- Kimerling, A. Jon, Aileen R. Buckley, Phillip C. Muehrcke, and Juliana O. Muehrcke. 2016. *Map Use: Reading, Analysis, Interpretation*, 8th Ed., Redlands, CA: Esri Press.
- Smith, David, Nathan Strout, Christian Harder, Steven Moore, Tim Ormsby, and Thomas Blastrom. 2018. *Understanding GIS: An ArcGIS Pro Project Workbook*, 4th Ed. (for ArcGIS Pro 2.6), Redlands, CA: Esri Press.

The following readings will be posted to Blackboard:

- Biehl, A., Ermagun, A., Stathopoulos, A. 2018. Community mobility MAUP-ing: A socio-spatial investigation of bikeshare demand in Chicago. *Journal of Transport Geography,* 66, 80-90.

- Bolstad, P., Manson, S. 2022. *GIS fundamentals: A first text on geographic information systems* (7th ed.). XanEdu (Ch. 2 and 5).

- Cetl, Vlado, Tomáž Kliment, and Tomislav Jogen. 2017. A comparison of address geocoding techniques: Case study of the City of Zagreb, Croatia. *Survey Review*, 50, 359.

- Goldberg, D.W., Wilson, J.P., Knoblock, C.A. 2007. From text to geographic coordinates: The current state of geocoding. *URISA Journal,* 19(1), 33-46.

- Goodchild, M.F. 2007. Citizens as sensors: The world of volunteered geography. *GeoJournal,* 69(4), 211-221.

- Harley, J.B. 2001. *The new nature of maps: Essays in the history of cartography*. Johns Hopkins University Press (Ch. 2).

- Hogdson, J.C., Baylis, S.M., Mott, R., Herrod, A., Clarke, R.H. 2016. Precision wildlife monitoring using unmanned aerial vehicles. *Scientific Reports,* 6, 22574.

- Hodza, P. 2014. Appreciative GIS and strength-based community change. *Transactions in GIS,* 18(2), 270-285.

- Hubbard, P., Kitchin, R., Bartley, B., Fuller, D. 2002. *Thinking geographically: Space, theory and contemporary human geography*. Continuum (Ch. 1).

- Lee, J.-G., Kang M. 2015. Geospatial big data: Challenges and opportunities. *Big Data Research,* 2(2), 74-81.

- Logan, J.R. 2012. Making a place for space: Spatial thinking in social science. *Annual Review in Sociology, 38,* 507-524

- Reynard, D. 2018. Five classes of geospatial data and the barriers to using them. *Geography Compass,* 12, e12364.

- Schuurman, N. 2004. *GIS: A Short Introduction*. Blackwell (Ch. 1).

- Snyder, J.P. 2011. Emergence of map projections (Excerpt from Flattening the Earth: Two thousand Years of map projections). In M. Dodge, R. Kitchin, C. Perkins (Eds.), *The map reader: Theories of mapping practice and cartographic representation* (pp. 164-169). John Wiley & Sons.

- Wilson, M.W. 2017. *New lines: Critical GIS and the trouble of the map*. University of Minnesota Press (Ch. 1).

- Zeiler, M., Murphy, J. 2010. *Modeling our world: The Esri guide to geodatabase concepts*. Esri Press.

Description and Assessment of Assignments

Your grade in this class will be determined on the basis of several different assessments:

Laboratory Assignments (40%): This course includes a laboratory meeting each week to develop technical competency with geospatial software platforms and analytic tools. There will be a total of ten laboratory reports due over the course of the semester. Laboratory assignments related to the final project (see Schedule below) are separate lab deliverables and scored as part of the lab.

Midterm Exams (20%): The mid-term exams will consist of short answer questions. Students are expected to take the exam at the indicated time.

Final Project (20%): The final project is the capstone assignment for this course. Students will be expected to draw upon course lectures, discussions, lab assignments, readings, and outside sources to organize and deliver a self-directed study utilizing spatial data and analytical methods. The four deliverables for this project are: (1) a project proposal; (2) a draft report; (3) a final written report; and (4) an oral presentation in class.

Final Exam (20%): The final exam may be mixed format and may consist of multiple choice, short answer, and simple problem questions. Students are expected to take the exam at the indicated time.

Grading Breakdown

Assessment	Number	Points Each	Total Points
Laboratory Assignments	10	4	40
Midterm Exam	2	10	20
Final Project	1	20	20
Final Exam	1	20	20
Totals	**14**	**--**	**100**

Assignment Submission Policy

Students are expected to attend and participate in every class and lab session and to complete and upload all assignments before the deadlines detailed in the Course Schedule. All assignments will be submitted for grading via Blackboard. Late work will be assessed a penalty of 10% per day and zero grades will be assigned for work that is more than seven days late. Additionally, no work will be accepted for grading after 5 p.m. PT on the last day of classes.

Weekly Schedule

	Topic	Readings and Assignments	Deliverables/Due Dates
Module 1: Spatial Thinking and GIS			
Week 1* 1/10	**Introduction to the Course** Introduction to the class and discussion of goals, assignments, projects, and technologies	Kimerling et al. (2016, Introduction) Schuurman (2004, Ch. 1)	No labs
1/12	**Spatial Reasoning** Key concepts underlying spatial sciences, the scientific method, and spatial reasoning	Hubbard et al. (2002, Ch. 1) Logan (2012) Hodza (2014)	
Week 2* 1/17 *Monday, 1/16 is a university holiday	**Spatial Data Models** An introduction to vector, raster and other data models plus data and file structures	Bolstad and Manson (2022, Ch. 2)	Lab Report 1 – Introduction to mapping and SSI technologies: Due one week after lab
1/19	**Scale** Role of scale in physical and social processes as well as in cartography	Kimerling et al. (2016, Ch. 2) Biehl et al. (2018)	
Week 3 1/24	**Administration of Space** Land tenure, methods for managing and regulating land use, traditional knowledge and place names	Kimerling et al. (2016, Ch. 5)	Lab Report 2 – UGIS Lessons 1 - 2: Due one week after lab
1/26	**The Power of Maps** The power inherent in creating spatial information and mapping them, the historical consequences	Harley (2001, Ch. 2)	
Module 2: Spatial Data Handling			
Week 4 1/31	**Geodesy, Datums, and Geographic Coordinate Systems** Concepts and terms from the geoid and spheroids to coordinate systems	Kimerling et al. (2016, Ch. 1)	Lab Report 3 – UGIS Lessons 3 - 4: Due one week after lab
2/2	**Map Projections** Map projections and distortions that arise in 2D mapping of a 3D planet	Kimerling et al. (2016, Ch. 3) Snyder (2011)	
Week 5 2/7	**Projected Coordinate Systems** Need for and key characteristics of projected coordinate systems	Kimerling et al. (2016, Ch. 4)	No labs
2/9	**MIDTERM 1**		
Week 6 2/14	**Spatial Data Management** Geodatabases and best practices for organizing and storing spatial data	Zeiler & Murphy (2010)	

	Topic	Readings and Assignments	Deliverables/Due Dates
2/16	**Global Navigation Satellite Systems** GNSS and GPS technologies and uses	Bolstad and Manson (2022, Ch. 5)	Lab Report 4 – Map Production: UGIS Lessons 5-6: Due one week after lab
Week 7 2/21 *Monday, 2/20/23 is a university holiday	**Remote Sensing** Remote sensing technologies and uses	Kimerling et al. (2016, Ch. 10) Hodgson et al. (2016)	Lab Report 5 – UGIS Lessons 7-9: Due one week after lab
2/23	**Spatial Data Quality and Privacy Concerns** Evaluation of spatial data quality; Overview of government and private sector data and issues related to data collection and analysis	Kimerling et al. (2016, Ch. 11)	
Week 8 2/28	**Geocoding** Exploration of the problems associated with place names and street addresses	Goldberg et al. (2007) Cetl et al. (2017)	Lab Report 6 – Working with remotely sensed data: Due one week after lab
3/2	**Final Project Discussion and Fieldwork Introduction** Discuss expectations, rubric, and past examples of capstone project; Introduction to group fieldwork project		
Module 3: Turning Spatial Data into Actionable Information			
Week 9 3/7	**Spatial Analysis of Vector Data** Proximity, network, and cluster analysis	Kimerling et al. (2016, Ch. 15)	Lab Report 7 – Geocoding: Due one week after lab
3/9	**Spatial Analysis of Fields and Raster Data** Terrain analysis and spatial interpolation methods	Kimerling et al. (2016, Ch. 16 (slope, aspect, curvature, profiles, visibility analysis)	
Week 10 3/21	**Intro to Spatial Modeling** Use of spatial modeling techniques		Lab Report 8 – Integration of field data with other data: Due one week after lab
3/23	**Project Proposal Workshop** Students share drafts of project proposals and provide peer review		Project Proposals: Due: 3/25/23
Week 11 3/28	**MIDTERM 2**		No labs

	Topic	Readings and Assignments	Deliverables/Due Dates
3/30	**Librarian Visit** USC Librarian visits the class to discuss websites for accessing spatial data		
Week 12 4/4	**Cartography and Graphic Elements** Map design principles, symbology, and techniques plus the use of graphics for communication	Kimerling et al. (2016, Ch. 6)	Lab Report 9 – Project related spatial analysis: Update due one week after lab
4/6	**Digital Representation of Data and Types of Maps** Methods and issues relating to representation of physical world in digital and print maps	Kimerling et al. (2016, Ch. 7-8 plus DEM section of Ch. 9)	
Week 13 4/11	**Project Peer Review** In class peer-review of final projects		Lab – Work on Final Project Draft Report (part of Final Project grade): Due Monday 4/10/23
Module 4: Looking Forward with Geospatial Data and Technologies			
4/13	**Big Data and Real-Time Data** Technologies and methods for sharing and working with large datasets and real-time data	Lee and Kang (2015) Reynard (2018)	
Week 14 4/18	**Crowdsourcing Spatial Data** Technologies and cultural changes leading to data creation and mapping by non-professionals	Goodchild (2007)	Lab Report 10 – Project related spatial data visualization: Update due one week after lab
4/20	**Critical GIS** Consideration of what it means to engage with GIS and spatial data in an ethical, meaningful way	Wilson (2019)	
Week 15 4/25 and 4/27	**Final Project Presentations** Students present their final projects in class		No Labs Final Project Written Reports: Due Friday, 4/28/23
Final Examination – 2:00 to 4:00 p.m., Thursday, May 4			

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It

stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-

8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services (RSVP)](#) - *(213) 740-9355(WELL) – 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX (EEO-TIX)](#) - *(213) 740-5086*

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - *(213) 740-5086 or (213) 821-8298*

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services (OSAS)](#) - *(213) 740-0776*

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - *(213) 740-0411*

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - *(213) 740-2101*

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - *UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - *UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call*

Non-emergency assistance or information.

[Office of the Ombuds](#) - *(213) 821-9556 (UPC) / (323-442-0382 (HSC)*

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - *(323) 442-2850 or* otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.