

USC Dornsife

Dana and David Dornsife
College of Letters, Arts and Sciences
Spatial Sciences Institute

SSCI 301, Maps and Spatial Reasoning

Syllabus

Units: 4

Term Day Time: Fall 2023

Lecture: Tuesday and Thursday, 9:30-10:50 am

Labs: See schedule.

Location: MPH B7B

Instructor: Laura C Loyola, PhD

Office: B55C

Regular Office Hours: Wednesday 1-3pm. Also available by appointment via email.

Contact Info: loyola@usc.edu, 213-740-5612

Lab Instructor: TBD

Office: AHF B55

Regular Office Hours: TBD

Contact Info:

Library Help: Andy Rutkowski

Office: LIPA B40-A

Office Hours: Thursdays 10 a.m.-12 p.m. PT or by appointment

Contact Info: arutkows@usc.edu see contact page on Blackboard for Zoom Room

IT Help: Myron Medalla

Office: AHF B56B

Office: By appointment via email

Contact Info: spatial_support@usc.edu, 213-740-4415

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 and proximity analysis) to more advanced forms of spatial analysis and modeling. An explosion in geographic information (GI) technologies over the past two decades has enabled the development of quick visualization tools (Google Maps), sophisticated GISystems (GIS) such as ArcGIS and TerrSet, and many kinds of Global Positioning Satellite (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, such as data modeling, spatial analysis, and data visualization, with their own academic and professional goals in mind.

Learning Outcomes

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

- Explain how modern geographic analysis and visualization tools can be used across a variety of disciplines.
- Describe the main types of maps and discuss the issues pertaining to geographic information and the creation of maps.
- Discuss data representation methods and implications for selecting certain methods.
- Create quantitative and qualitative maps that communicate the products of spatial data analysis.

- 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 (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 lecture and lab sessions are intended to complement each other to provide you with sound theoretical reasoning and the technical skills to investigate various physical and/or social processes. The weekly lab meetings are designed to introduce you to the tools of scientific inquiry and to give you practical experience in implementing these tools to explore various problems within the framework of the scientific method. Your weekly laboratory assignments will be graded and returned via

Blackboard, and the exams will all have a laboratory component to them. **It is required that you register for both the lecture and one laboratory session for this course.**

Technological and Communication Requirements

This class incorporates in-class activities that at times may be completed on a smart phone, tablet, or laptop computer. If a student does not have access to any of these, please speak with the instructor at the start of the semester to establish a workaround. GIS software and the geospatial data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute. No previous experience is required.

SSI Server and Tech Support – This course utilizes the SSI Server, which is a virtual desktop giving access to many different professional software programs. If you are unable to connect to the server or experience any type of technical issues, send an email using your USC account to Tech Support at spatial_support@usc.edu, making sure to copy (cc) your instructor on the email. Questions pertaining to specific assignments should be directed to your lab instructor.

Communications – All course materials and correspondence will be posted on the course Blackboard website. Your assignments will be graded and returned via Blackboard. In addition to email about time-sensitive topics, announcements will be posted on the Blackboard Announcement page. It is each student's responsibility to stay informed as to course activities and updates. All students are in charge of ensuring that email sent from the USC Blackboard account is not directed to junk mail.

The instructor will endeavor to respond to email within 24 hours of receipt, aiming for no more than a 72-hour delay. An announcement will be posted in the rare instance when an instructor is offline for 72 hours or more.

Required Readings and Supplementary Materials

The required textbooks for this course are:

- Kimerling, A. Jon, A.R. Buckley, P.C. Muehrcke, and J.O. Muehrcke. 2016. *Map Use: Reading, Analysis, Interpretation*, 8th Ed., Redlands, CA: Esri Press.
- Smith, D., N. Strout, C. Harder, S. Moore, T. Ormsby, and T. Balstrom. 2018. *Understanding GIS: An ArcGIS Pro Project Workbook*, 4th Ed. (for ArcGIS Pro 2.6), Redlands, CA: Esri Press. **(Do NOT use a different edition, be sure you find the one for Pro 2.6)**

The following readings will be posted to Blackboard:

- Arctur, D. and M. Zeiler. 2004. *Designing Geodatabases: Case Studies in GIS Data Modeling*. Redlands, CA: Esri Press.
- Biehl, A., A. Ermagun, A. Stathopoulos. 2018. Community Mobility MAUP-ing: A Socio-spatial Investigation of Bikeshare Demand in Chicago. *Journal of Transport Geography*. 66: 80-90.
- Cetl, V., T. Kliment, and T. Jogen. 2017. "A Comparison of Address Geocoding Techniques – Case Study of the City of Zagreb, Croatia." *Survey Review*, 50:359.

- D'Ignazio, C. and L.F. Klein. 2020. *Data Feminism*. Cambridge, MA: MIT Press. (available as open access eBooks at: <https://mitpress.mit.edu/9780262358538/data-feminism/>)
- Goodchild, Michael. 2007. "Citizens as Sensors: The World of Volunteered Geography." *GeoJournal* 69(4): 211-221.
- Harley, John Brian. 2001. *The New Nature of Maps: Essays in the History of Cartography*. Baltimore, MD: The Johns Hopkins University Press. (chapter 2)
- Harvey, Francis. 2016. *A Primer of GIS: Fundamental Geographic and Cartographic Concepts* (Second Edition). New York: Guilford Press. (chapter 8).
- Hodgson, Jarrod C. Shane M. Baylis, Rowan Mott, Ashley Herrod, and Rohan H. Clarke. 2016. Precision Wildlife Monitoring Using Unmanned Aerial Vehicles. *Scientific Reports*. 6: 22574. [doi:10.1038/srep22574](https://doi.org/10.1038/srep22574)
- Hubbard, Phil, Rob Kitchin, Brendan Bartley, and Duncan Fuller. 2002 (reprint 2005). *Thinking Geographically: Space, Theory and Contemporary Human Geography*. New York: Continuum. (chapter 1)
- Logan, John R. 2012. Making a Place for Space: Spatial Thinking in Social Science. *Annual Review of Sociology*. 38 (August). [doi:10.1146/annurev-soc-071811-145531](https://doi.org/10.1146/annurev-soc-071811-145531)
- Reynard, Darcy. 2018. Five Classes of Geospatial Data and the Barriers to Using Them. *Geography Compass*. (January). <https://doi.org/10.1111/gec3.12364>
- Snyder, J. P. 2011. "Emergence of Map Projections" (Excerpt from *Flattening the Earth: Two Thousand Years of Map Projections*) in *The Map Reader: Theories of Mapping Practice and Cartographic Representation*, 1st Edition. Edited by Martin Dodge, Rob Kitchin and Chris Perkins. John Wiley & Sons.
- van Oort, P.A.J. (Pepijn). 2005. *Spatial Data Quality: From Description to Application*. Doctoral dissertation, Netherlands Geodetic Commission, Delft. (selected chapters)

Description and Assessment of Assignments

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

In-Class Work – worth 10 points total: A grade for the semester will be assigned based on your engagement in class, discussion posts and/or in-class active learning activities. Students are expected to complete and discuss assigned readings, engage in lecture material, and complete and discuss in-class assignments, among other forms of active engagement in the course. Students will be required to also engage with and share course concepts via the Discussion Board or Wiki posts. Students will earn full credit by engaging consistently throughout the entirety of the semester.

Laboratory Assignments – 10 worth a total of 30 points: 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, and one week will include an outdoor (open-air) field assignment within the greater Los Angeles area. Laboratory assignments related to the final project (see Schedule below) are separate lab deliverables and scored as part of the lab.

Absences from lab (discussion) sessions must be requested by sending an email to the laboratory instructor for your lab section *prior to the lab discussion session you need to miss*.

Excused absences from lab discussion sections will be granted only for valid reasons; please notify us of the reason for your absence in your email.

Mid-Term Quizzes – 2 worth a total of 20 points: The mid-term quizzes may be mixed format and may consist of multiple choice, short answer, and simple problem questions. Students are expected to take the quizzes at the indicated times.

Final Project – 1 worth a total of 20 points: 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 analysis and geospatial technologies. The four deliverables for this project are: 1) a project proposal; 2) a mid-project report; 3) a final written report; and 4) an oral presentation in class.

Final Exam – 1 worth a total of 20 points: 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
In-Class Work		10	10
Laboratory Assignments	10	3	30
Mid-term Quizzes	2	10	20
Final Project	1	20	20
Final Exam	1	20	20
Total		-	100 points

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 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.

Schedule

	Topic	Readings and Assignments	Deliverables/Due Dates
Module 1: Spatial Thinking and GIS			
Week 1 8/22	Introduction to the Course and GIS Introduction to the class and discussion of goals, assignments, projects, technology. Current uses of Geographic Information Systems and how GIS is applied in our current world	Kimerling, Introduction Hubbard, Ch. 1 Logan (pp.1-11, 14-15)	No labs
8/24	Spatial Reasoning A discussion of key concepts underlying spatial sciences, the scientific method, and spatial reasoning		
Week 2 8/29	Spatial Data Models An introduction to vector, raster, and other data models plus data file structures	Kimerling, Ch. 7 (pp 150-154) Kimerling Ch. 2 Biehl et al 2018	Lab Report 1: Introduction to mapping and SSI technologies /Due one week after lab
8/31	Scale Discuss concepts of scale in physical and social processes as well as in cartography; introduction to the MAUP		
Week 3 9/5* *Monday, 9/6 is a university holiday	Administration of Space and the Power of Maps Discussion of traditional knowledge and place names, current ways space is administered and the power inherent in creating maps and its historical consequences	Kimerling, Ch. 5 Harley 2001 Kimerling, Ch. 21 for further reading	Lab Report 2: UGIS Lessons 1 – 2/Due one week after lab
Module 2: Spatial Data Handling			
9/7	An Introduction to Geodesy and Geographic Coordinate Systems Overview of the concepts and terms from the geoid and spheroids to coordinate systems	Kimerling, Ch. 1	

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 4 9/12	Map Projections Map projections and the difference between PCS, mapping issues	Kimerling, Ch. 3 Snyder 2011 Kimerling, Ch 4	Lab Report 3: UGIS Lessons 3 – 4/Due one week after lab
9/14	Projected Coordinate Systems (PCS) Discussion and explanation of projected coordinate systems and their importance.		
Week 5 9/19	Spatial Data Management; Quiz Prep Discuss how to organize and store spatial data, introduction to the geospatial database	Arctur and Zieler, Ch. 1	Lab Report 4: Map Production: UGIS Lessons 5 – 6/ Due one week after lab
9/21	Quiz #1		
Week 6 9/26	Global Navigation Satellite Systems Overview of technologies and uses of GNSS and GPS	Harvey, Ch. 8 Hodgson et al 2016	Lab Report 5: UGIS Lessons 7 – 8 /Due one week after lab <i>Extra Credit:</i> UGIS Lesson 9: printed and online map publication /Due one week after lab (1 pt each, printed map and AGOL submission)
9/28	Remote Sensing; Review of quiz 1 Overview of remote sensing technologies and uses from satellite data to UAV		
Week 7 10/3	Spatial Data Quality Discussion on evaluating and maintaining spatial data quality	Kimerling, Ch. 11 van Oort 2006	Lab Report 6: Working with remotely sensed data/ Due one week after lab
Module 3: Turning Spatial Data Into Actionable Information			
10/5	Final Project Discussion; Fieldwork Intro Discuss expectations, rubric and past examples of capstone projects; Introduction to fieldwork and mobile technologies		

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 8 10/10* *10/12-10/13 is a university holiday	<p>Geocoding and Georeferencing; Cartography I</p> <p>Exploration of the problems associated with place-names, street addresses and other human systems and how to define real-world locations; discussion of map design principles, symbology, and cartographic technique.</p> <p>No Class on Thursday</p>	<p>Cetl et al 2017 Kimerling, Ch. 6 (pp. 122-142); Ch. 7 (pp. 154-168); Ch. 8 (pp. 172-206)</p>	<p>No lab meetings; independent field work</p>
Week 9 10/17 10/19	<p>Librarian Visit</p> <p>USC Librarian visits the class to discuss digital data acquisition as related to projects, an introduction to spatial data and ethics</p> <p>Graphic Elements and Map Types for Digital Representation of Data</p> <p>The use of graphics to communicate, stylize, and problem solve; Discussion of methods and issues relating to representing the physical world in digital and print maps</p>	<p>Kimerling, Ch. 6 (pp. 143-145); Ch. 7 (p. 169); Ch. 8 (pp. 207-213) TBD</p>	<p>Lab Report 7: Geocoding and georeferencing/Due one week after lab</p> <p>Final Project Proposal Due Friday 10/21 5:00pm</p>
Week 10 10/25 10/27	<p>Quiz #2</p> <p>Spatial Analysis of Vector Data</p> <p>Introduction to spatial analysis methodologies</p>	<p>Kimerling, Ch. 17</p>	<p>Lab 8: Integration of field collected data with other data/Due one week after lab</p>
Week 11 10/31 11/2	<p>Spatial Analysis of Fields and Raster Data</p> <p>Introduction to spatial analysis methodologies</p> <p>Spatial Modeling and Visualization; Review of quiz 2</p> <p>Introduction to the use of spatial modeling techniques, advanced visualizations, and 3D visualizations</p>	<p>Kimerling, Ch. 16 (slope, aspect, curvature, profiles, visibility analysis) TBD</p>	<p>Lab Report 9: Project related spatial analysis & visualization/ Due one week after lab</p>

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 12 11/7	Project Peer Review In class review of final project brief discussion of Core Geospatial Datasets for spatial analysis and research methods		
11/9* *Friday, 11/10 is university holiday (Veterans Day)	Crowdsourcing Spatial Data: Volunteered Geographic Information Discussion of technologies and cultural changes leading to data creation and mapping by non-professionals; fitness for use and quality management of VGI MapCreator and OSM introduction	Goodchild 2007 Reynard 2018	No lab meetings – independent work on project
Module 4: Looking Forward with Geospatial Data and Technologies			
Week 13 11/14	GIS Day Event (TBD)		
11/16	Big Data, Real-Time Data, and Privacy Concerns Discussion of technologies and methods for sharing and working with large datasets and real-time data; Overview of government and private sector data and issues related to data collection and analysis		Lab Report 10: Project related spatial analysis & visualization/ Due one week after lab
Week 14 11/21*	Critical GIS; Looking Forward with Geospatial Technologies Consideration of what it means to engage with GIS and spatial data in an ethical, accessible, and meaningful way	D'Ignazio and Klein 2020 (selected sections) Kimerling, Ch. 22	No lab meetings
*11/22-11/24 is a university holiday	No Class on Thursday		
Week 15 11/28	Final Project Presentations Students present their final projects in class		Presentations Due Tuesday, 11/29 9:00am
11/30	Final Project Presentations Students present their final projects in class		Final Project Written Reports/Due by 12/2 5:00pm
Final Exam	Thursday, December 7, 11:00am – 1:00pm, MHP B7B Final exam		

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.