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

SSCI 382 (35654), Principles of Geographic Information Science

Units: 4
Term-Day-Time: Spring 2016
Lecture: Mon./Wed. 2:00 – 3:20 p.m. PT
Lab: Wed. 12:00 - 1:50 p.m., Fri. 2:00-3:50 p.m. PT
Location: Lecture: VKC 260, Lab: AHF 145A

Instructor: Jennifer N. Swift, Ph.D.
Office: AHF B57D
Office Hours: Tues and Thurs 2-4 p.m. PT, also available most other days by appointment.
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Library Help: Katharin Peter
Office: VKC B40a
Hours of Service: By appointment
Contact Info: kpeter@usc.edu, 213-740-1700

IT Help: Richard Tsung
Office: AHF B57B
Hours of Service: Mon.-Fri. 9 .am. – 5 p.m. PT
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Course Description

The spatial sciences focus on the various ways in which Geography can be used to acquire, represent, organize, analyze, model and visualize information. These views of the world are supported by Geographic Information Systems (GIS) and the related geospatial technologies (GPS, remote sensing systems, etc.) which, in turn, rely on the underlying geographic information science concepts and methods. This much is known from SSCI 301L: Maps and Spatial Reasoning and this particular course (the second in a three-course sequence) seeks to elucidate how these systems and the underlying science provides a gateway to the natural and social sciences and problem-solving in general.

That said, a large part of the course is focused on various kinds of spatial analysis since they constitute the crux of GIS, providing the means of adding value to geographic data and for turning these data into useful information. Numerous examples will be used throughout the course to illustrate how spatial analysis helps us in situations when our eyes might deceive us and/or to reveal things that might otherwise be invisible. The combination of class and

laboratory sessions will show how effective spatial analysis requires an informed and intelligent user in addition to the appropriate computer hardware and software tools.

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through lectures, class participation activities and computer labs using hands-on experimentation with various tools and technologies, text readings and self-directed research you will do in the published literature and on the web.

Learning Objectives

When you have completed this course, you will be able to:

- Recognize geographic data and what is special about it and why it is important.
- Discuss the kinds of decisions made with geographic information.
- Understand how scientists, managers and policy makers use Geographic Information Systems, and why they may find it helpful.
- Discuss what constitutes a Geographic Information System and how managers and policy makers would know one if they saw it.
- Explain how modern geographic analysis and visualization tools can be used to advance our knowledge and understanding of human and environmental activities and events from a variety of disciplinary perspectives.

Prerequisite(s): None

Co-Requisite (s): None

Concurrent Enrollment: None

Recommended Preparation: SSCI 301: Maps and Spatial Reasoning. Student enrolled in GeoDesign major or Spatial Studies Minor.

Course Structure

This residential course will unfold on a weekly basis. Each week will be focused on a particular aspect of Geographic Information Science, delivered through lectures, class participation activities, hands-on computer lab assignments and field data-gathering exercises. In order to facilitate collaboration, for some assignments the class will be divided into small groups to work on assignments. Group members will share each other's work and present results in Blackboard Discussion threads that will be shared with the entire class. Students are encouraged to bring questions and problems to class, to be explored in that congenial setting. The aim is to encourage deep-learning by active participation.

Technological Proficiency and Hardware/Software Requirements

We have several technologies that will facilitate our course work and our interactions:

GIS and Geospatial Data – The GIS software and geospatial data required for the course assignments will be accessed using computing resources provided by the Spatial Sciences Institute.

Blackboard – All course materials will be posted on the course Blackboard site. As a registered student, you will find this course will show up in your available classes no later than 12:00 noon, PT on the first day of classes. It is here that the weekly flow of the course will be recorded.

Discussion boards – On the Blackboard site, we will have several discussion threads related to various course topics. These threads will provide an opportunity to collaborate on computer lab assignments, for example to facilitate group work or offer helpful tips to each other. Your course instructor will check the discussion threads and offer occasional comments. Please send your course instructor an email directly if you have a question or concern that requires immediate attention.

Other Software – Every student should be proficient with the MS Office suite (Excel, PowerPoint, and Word). Documents in other software formats will not be accepted.

Required Readings and Supplementary Materials

The required textbooks for this course are:

- Longley, Paul A., Michael F. Goodchild, David J. Maguire, and David W. Rhind. 2015. *Geographic Information Systems and Science*, 4th ed., New York: John Wiley and Sons, 477 pp.
- Schmidts, Miriam. 2013. *Esri ArcGIS Desktop Associate Certification Study Guide*. Redlands, CA, 377 pp. ISBN 1589483510

The recommended (optional) textbooks for this course are:

- Law, Michael, and Amy Collins. 2015. *Getting to Know ArcGIS Desktop,* 4th ed., Redlands, CA: Esri Press, 768 pp.
- Wade T and Sommer S 2006 *A to Z GIS*, Redlands, CA: Esri Press, 268 pp.

Description and Assessment of Assignments

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

Class Preparation Assignments (10%): These classroom assignments are discussions that will focus on combinations of theory and practice. These will typically consist of five to 10 questions. The questions will serve as a guide in your reading and as a basis for class discussions and spatial database tutorials. The goal of the class participation is to have informed class activity, and to use class time to focus on applying, analyzing and evaluating the material with the aid of fellow students and with your instructor's guidance.

Lab Assignments (26%) – There are 13 labs in this class. Each lab assignment is completed in the weekly two-hour lab session, led by the Instructor. In order to demonstrate that you understand the basic concepts and skills learned in the class, you will utilize your knowledge of Geographic Information Science to complete hands-on assignments that involve the use of GIS.

Individual & Group Projects (20%) - Hands-on individual and group projects will be used to practice the techniques explored in theory and in the laboratory assignments. At the completion of each project, you will turn in some digital output to demonstrate that you have completed it.

Mid-term Examination (14%) - The mid-term exam in this class covers material all parts of the class, including lectures, labs, and readings, covered between the start of the semester until the date of the mid-term exam. This exam is scheduled for 11 a.m. to 1:00 p.m. on Wednesday, 11th of March.

Final Exam (30%) - The final exam in this class covers material from all parts of the class, including lectures, labs, and readings, spread across the entire semester. This project is due no later than 1:00 p.m. on Wednesday, 13th of May.

Grading Breakdown

The table below summarizes the SSCI 382 course assessments and their point distribution:

Assessment	Number of Assignments	Points	% of Grade
Lab Assignments	13	26	26
Class Participation Assignments	10	10	10
Independent & Group Projects	5	20	20
Mid-term Examination	1	14	14
Final Exam	1	30	30
Total	30	100	100

It is important to note from the outset that: (1) you are expected to attend and participate in all classes and to complete and turn in or upload all assignments according to the deadlines detailed in the Course Schedule; (2) late assignments will be docked one grade and no grade will be given for postings or assignments turned in more than seven days late; and (3) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes (i.e. 29th April, 2016).

Assignment Submission Policy

Unless otherwise noted, assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below.

Additional Policies

Students are expected to attend and participate in every class session and to complete and upload all assignments to Blackboard before the deadlines detailed in the Course Schedule.

Each of the lab sessions will start on the hour with a brief introduction from the instructor. These introductions will take no longer than 10 minutes and students arriving more than 10 minutes after the scheduled start times for their laboratory sessions will be turned away and assigned a zero grade for that particular lab assignment. Self-guided or group work tasks using one or more geospatial datasets will then follow for approximately an hour after which time the instructor will convene a 15-minute roundtable discussion of what you have done, what it means, and how these tasks might have been varied and/or enhanced if performed by professionals in a real world setting. Students must purchase and use their own copies of the lab textbook.

In addition, I will send via e-mail through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all e-mail sent from Blackboard or from me. Check now to make sure that mail sent from both the USC blackboard accounts and my email jswift@usc.edu does not go into your junk mail! While I am usually online and will probably respond to e-mails from students relatively quickly, I will endeavor to respond to all e-mail within 24 hours of receipt, aiming for no more than 48 hours delay. In the rare case when I expect to be offline for more than 72 hours, I will post an announcement on the Blackboard site.

It is each student's responsibility to stay informed about what is going on in our course. In addition to e-mail 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.

Course Schedule (Tentative)

The course will be organized around the following modules and the accompanying lecture and laboratory topics. The labs will be organized around the lab topics as shown in the Course Schedule below. The dates shown to the left of the individual topics indicate the day on which these labs start, and the lab assignments, themselves, are due the same day the lab is conducted.

	Topics/Daily Activities	**Readings and Assignments**	**Deliverables/Due Dates**
Week 1			
1/11	**Introduction to the Course** Brief introductions coupled with discussions of class goals, lab assignments, projects, and technology.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 1 & 2, pp. 1-54)	Introductions
1/13,15	**Geographic Information Science & The Nature of Geographic Data** Introduction to Geographic Information Science, systems, Spatial data sampling and Big Data.	Class Participation Assignment 1 Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 1 & 2, pp. 1-26)	Class Participation Assignment 1 Lab 1: Introduction to ArcGIS & Working with Geographic Data
Week 2			
1/18	**University Holiday** **Representing Geography** Discussion of the concept of representation of a digital model of the earth's surface, and awareness of spatial variation and how to measure it.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 3 ,4 pp. 55-95)	
1/20,22	**Coordinate Systems** Creating and managing geographic data, discussion of projections and coordinates of geographic data.	Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 3, 4, & 5, pp. 27-86)	Lab 2: Managing Geographic Data & Understanding Coordinate Systems

Week 3 1/25	**Georeferencing & Spatial Adjustment** Discussion of geographic location, aligning geographic data missing real-world spatial references.	Class Participation Assignment 2 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 4, pp. 95-98) Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 6, 7 & 8, pp. 87-132)	Class Participation Assignment 2 Lab 3: Evaluating Data for Tasks, Entering Data into Tables, and Georeferencing raster or CAD data *(may be completed in Week 4)*
1/27-28	**Engaging Professionals** Attend the Ersi GeoDesign Summit in Redlands, CA.		
Week 4 2/1	**Geographic Uncertainty** Discussion of why uncertainty arises in geographic representation and how to identify sources of uncertainty.	Class Participation Assignment 3 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 5, pp. 99-127)	Class Participation Assignment 3
2/3,5	**The Art of Geocoding** Discussion about how to create map features from addresses, place names, and other information with a spatial component. Students work in groups to complete a project.	Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 9, pp. 133-148)	Lab 4: Geocoding Group Project #1
Week 5 2/8	**GIS Software** Discussion of what GIS software architecture consists of, the different types, and how it works.	Class Participation Assignment 4 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 6 & 7, pp. 128-172)	Class Participation Assignment 4
2/10,12	**Geographic Data Modeling** Discussion of the technical aspects and issues involved in modeling the real world in a GIS.	Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 10 & 11, pp. 149-178)	Lab 5:Modeling Data: Creating and Maintaining Feature Geometries in a GIS

Week 6			
2/15	**University Holiday**		
2/17,19	**GIS Data Collection in Practice & Acquiring Data in the Field** Discussion of geospatial data collection workflows, the diversity of this data, capture techniques, and how to analyze practical issues that arise in collection projects. Students work individually to complete a unique project.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 8, pp. 173-193) Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch.12, 13 & 14, pp. 179-222)	Independent Project #1 Lab 6: Geographic Data Attributes, Maintaining Data Integrity, & Topology
Week 7			
2/22	**Role of Database Management Systems in GIS** Discussion of the importance of geographic databases and database management practices.	Class Participation Assignment 5 Longley, et al. *Geographic Information Systems and Science* (4th Ed) (Ch. 9, pp. 194-216)	Class Participation Assignment 5
2/24,26	**Creating and Maintaining Geographic Databases** Discussion of the geographic database as the foundation of GIS, and how they are designed, built and maintained over time.	Esri Virtual Campus Course: Enterprise Geodata Management	Lab 7: Geodatabase Design Case Studies
Week 8			
2/29	**The GeoWeb** Discussion about how the parts of a GIS can be distributed and how geolibraries and geoportals are created and utilized.	Class Participation Assignment 6 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 10, pp. 217-236)	Class Participation Assignment 6
3/2,4	**The Mobile User** Discussion about the integration of mobile devices into our world, and service-oriented architectures that support the GeoWeb.	Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch.18, 19 & 20, pp. 273-308)	Lab 8: Gathering and Synthesizing Data From Many Sources
Week 9			
3/7	**Cartography and Map Production** Discussions of key map design principles, symbology and the map production workflow.	Longley et al. *Geographic Information Systems and Science* (4th Ed) (2015) (Ch.11, pp.237-265)	No Lab. Review for Mid-Term
3/9	**Mid-term Exam** (2:00 – 3:20 PM)		

3/14-20	**Spring Break**		
Week 10			
3/21	**Geovisualization, Spatial Query and User Interaction** Discussion about how GIS facilitates visual communication, exploration, analysis of the meaning of representations and map transformations	Class Participation Assignment 7 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 12, pp. 266-289)	Class Participation Assignment 7
3/23,25	**2.5D & 3D Representation** Discussion about how virtual worlds and 3D tools can improve our understanding of the world in general. Students work in teams to complete a project.	ArcGIS Pro / CityEngine Lab Module	Lab 9: Introduction to 3D GIS Group Project #2
Week 11			
3/28	**Spatial Analysis** Discussion of spatial analysis, buffering, cluster detection, density and interpolation.	Class Participation Assignment 8 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 13 & 14, pp.290-328)	Class Participation Assignment 8
3/30,4/1	**Spatial Inference** Discussion of spatial analysis of surfaces, slope, modeling travel, computing watersheds and visibility.	Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 16 & 17, pp. 241-272)	Lab 10: Analyzing & Querying Data, Performing Spatial Analysis
Week 12			
4/4	**Spatial Decision Support** Discussion of design methods using geographic information systems, the context of geodesign, and the relationship of hypothesis testing to geographic information science.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 14, pp.329-337)	Independent Project 2
4/6,8	**Optimization** Discussion of spatial decision support and methods of statistical inference applied to geographic data. Students work individually to complete a unique project.	Longley et al. (2015) Optimization and Hypothesis Testing (Ch. 14, p. 330-337 & Module)	Lab 11: Advanced Spatial Analysis: Optimization Problems

Week 13 4/11 4/13,15	**Spatial Modeling with GIS** Discussion of what modeling means in the context of GIS, different types of models and potential applications, and software that supports modeling. **Accuracy and Validity in Models** Discussion of the needs of modeling, understanding model validity and how this can be addressed using current GIS software. Students work in teams on a project involving field data acquisition using Collector for ArcGIS, perform data analysis, map production, and produce group story maps.	Class Participation Assignment 9 Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 15, pp. 339-357) Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 15, pp. 223-240)	Class Participation Assignment 9 Lab 12: Analyzing Vector & Raster Data Using Geoprocessing Models Group Project #3
Week 14 4/18 4/20,22	**Managing GIS Systems** Discussion of GI systems project management, applied to an example spatial analysis project. **GIS Operational Challenges** Discussion of the decision making challenges and risks involving use of GIS by individuals, academia, small vs. large organizations.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 16 & 17 pp. 358-410) Schmidts (2013) *Esri ArcGIS Desktop Associate* (Ch. 22, 23 & 24, pp. 319-362)	 Lab 13: Preparing, Publishing & Sharing Maps
4/22	**Earth Day Event at USC**		

Week 15 4/25	**GIS Partnerships & Law** Discussions of the law and geographic information, what GIS partnerships involve and national-level partnerships that aim to utilize GIS.	Class Participation Assignment 10	Class Participation Assignment 10
4/27,29	**Future of Geographic Information Science & Systems** Discussion of the many social, economic, and environmental challenges faced today and how GIS can be used to address these in the service of humanity. Coping with population growth, health and natural and manmade disasters.	Longley et al. (2015) *Geographic Information Systems and Science* (4th Ed) (Ch. 18 & 19, pp. 411-460)	No Lab. Review for Final Exam
5/9	**Final Exam** (2:00 – 4:00 PM)		

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* http://studentaffairs.usc.edu/scampus/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://www.usc.edu/schools/GraduateSchool/academic_conduct.html.

Discrimination, harassment, and sexual assault are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The *Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. The *Office of Disability Services and Programs* https://dsp.usc.edu/ provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Other Resources for Students

Our course the Blackboard site provides links to several different resources that you may need. In particular, you will be making frequent use of the online USC Library that is available to all registered students through the link http://www.usc.edu/libraries. Once on this site, you can find additional resources for distance students under the link "Library Services". Many other resources and links to key people you may need to contact are also listed on the Blackboard site under Other Resources and Contacts.