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

# SSCI 587 (Section 35715), Spatial Data Acquisition

*Syllabus*

**Units:** 4

**Term — Day — Time:** Fall, 2017, Online

**Location:** Online

**Instructor:** Laura C Loyola, Ph.D.
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**Regular Office Hours:** Tues 10-11 AM and Wed 1-2 pm PT.
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## Course Scope and Purpose

This course provides students with the requisite knowledge and practical skills to source and evaluate data against recognized quality standards for use in GIS-based projects. It also helps students understand how to assess the quality of information output from those projects. It is a required course for both the GIST M.S. and Graduate Certificate programs; however, it is not an elective for any other programs in SSI. We cover several topics, including:

*Data Needs and Types* – We start by focusing on the data challenge, defining data needs, and the role of conceptualization, entitation (recognition of an entity that can be studied as a system), and quantification in scientific research and management, and an introduction to some of the ways in which spatial and attribute data can be gathered and used to serve specific needs.

*Remotely Sensed Data* – We discuss the diverse ways in which data can be collected remotely using various platforms. We focus on Global Navigation Satellite Systems (GNSS) as well as other aerial and satellite systems as valuable sources of spatial data.

*Data Capture and Estimation* – We discuss the various ways legacy digital data can be sourced, evaluated, and used in specific projects, as well as ways to interpolate attribute values at unsampled locations and/or times.

*Data Quality* – We discuss data standards and how they are used to promote and/or preserve data quality. We also examine the various types and sources of error that we may encounter as a part of the data stream. We consider the various ways we can check for errors and cope with uncertainty when using GIS to help inform decisions about actions we may take in the real world.

*GIS and GPS Skills* – We explore the ways in which the Esri and Trimble software ecosystems can be used to support spatial data acquisition, analysis, and visualization. Tutorials focused on GPS and GIS skills support a field project conducted during a one-week field trip on Catalina Island in which students design, conduct, and present the results of their own GPS-based data collection projects.

*Master's Thesis Prospectus* – All Masters students in the GIST program are required to complete a thesis at the end of their studies. To help these students, and GIST Graduate Certificate students planning to transition to the GIST M.S. Program, move quickly towards the development of their thesis plans, these students apply concepts and ideas gleaned from *SSCI 581: Concepts for Spatial Thinking* and this course to prepare an abstract, extended abstract, and a preliminary prospectus for their master's thesis project. The thesis represents the capstone project for the GIST M.S. degree; additional thesis elements are interspersed throughout the required and elective courses leading to *SSCI 594a/b: Master's Thesis*. Students who do not intend to complete a thesis will complete alternative assignments.

*Written Communication Skills* - Since successful spatial scientists need cutting-edge spatial skills as well as effective communication competence to prosper in today's rapidly evolving world, faculty members from the USC Writing Program coach students on their writing skills in selected assignments during this course.

***Learning Objectives***

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

- Design and implement a strategy for capturing or sourcing geospatial data and any accompanying metadata;
- Assess the impact of national and international data standards on the sourcing and availability of geospatial data;
- Critically evaluate the potential impacts of data quality on spatial analysis and decision making;
- Specify fitness for purpose (i.e. use) criteria and apply them to the evaluation of geospatial data for specific applications; and
- Master the basic elements of Trimble's GPS field mapping and Esri's ArcGIS spatial analysis and mapping ecosystems so you can acquire, organize, store, analyze, model, visualize, and share your own spatial data.

**Prerequisite(s):** None
**Co-requisite(s):** None
**Concurrent Enrollment:** None
**Recommended Preparation:** *SSCI 581: Concepts for Spatial Thinking*

## Course Structure

This is a graduate level course, so you should expect this class to be both academically robust and intellectually challenging. As a graduate student, you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to interrogate thoroughly the subject at hand. Learning arises from active engagement with the knowledge found in the reading materials and with one another. As in any graduate level class, the instructor's role is that of a guide who keeps you on path of discovery and you will find that you will learn much from your fellow classmates. This is especially the case within the milieu of "online learning".

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through the course notes and assigned readings. Hands-on practical exercises will use various software products accessible over the Internet. Assignments will give you an opportunity to internalize and apply the concepts and theory learned from readings. Some assignments require student interaction; all will benefit from it.

*Workload* – This is a four credit, one semester graduate level course. Students should expect to spend 10-15 hours per week complete the work in this class. Please note that in addition to the weekly workload, there is a required weeklong field excursion to the Philip K. Wrigley Marine Science Center on Catalina Island. *Note: There is a required room and board fee for the Catalina trip of approximately $360 that is supplemental to the regular tuition cost.*

## Technological and Communication Requirements

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

ArcGIS is provided online via the SSI Server; hence, you do not need to install it on your own computer. In addition, your instructor will provide laptops with Esri and Trimble software and a variety of GPS and related data capture devices for the Catalina field component. At their home workspaces, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- An up-to date web browser to access the SSI server.

*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 SSI Tech Support at spatial_support@usc.edu, making sure to copy (CC) your instructor on the email.

*Communications* – Apart from the week on Catalina Island, this is a distance-learning course, so most of our interactions will be asynchronous (not at the same time). 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 the 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.

In addition, I will send via email, or through Blackboard, any notices that are time sensitive. Please be sure that you read all email send from Blackboard or from me directly as soon as possible. Check now to make sure that email sent from both the USC Blackboard accounts and my personal email account (loyola@usc.edu) does not go into your junk mail.

While I am usually online and will probably respond to emails from students relatively quickly, I will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be offline for more than 72 hours, I will post an announcement on Blackboard.

*Discussions and Collaborative work* – On Blackboard, you will discuss your learnt concepts and theory with classmates and work with them to complete course assignments, exercises, and projects as the need arises. Through discussion and collaborative work, students can provide support to each other while working your assignments, and sharing helpful tips.

## Required Readings and Supplementary Materials

The required textbooks for this course are:

- Bolstad, Paul. 2016. *GIS Fundamentals: A First Text on Geographic Information Systems*, 5th edition. White Bear Lake, MN, Edler Press. This text is available as a hardbound copy or e-book for purchase at: www.xanedu.com.

- Wilson, John P., and A. Stewart Fotheringham (editors). 2008. *The Handbook of Geographic Information Science*. Oxford, Blackwell. While you may purchase this book if you wish to own a bound copy, it is available through the USC Libraries.
- Law, Michael, and Amy Collins. 2016. *Getting to Know ArcGIS Pro (1st edition)*. Redlands, CA, Esri Press.

You will recognize that all three books are also required for *SSCI 581: Concepts for Spatial Thinking*. These textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports, and authoritative websites.

**Supplemental Readings** – The following readings will be posted to Blackboard under Weekly Assignments and most (including the book chapters) are available online at the USC Libraries:

- Chrisman, Nicholas R. 1984. The Role of Quality Information in the Long-Term Functioning of a Geographic Information System. *Cartographica* 21: 79-87.
- Johnson, Chris E and Christopher C. Barton. 2004. Where in the World Are My Field Plots? Using GPS Effectively in Environmental Field Studies. *Frontiers in Ecology and the Environment* 2: 475-482.
- Walter, Brittany S, and John J. Schultz. 2013. Mapping Simulated Scenes with Skeletal Remains Using Differential GPS in Open Environments: An Assessment of Accuracy and Practicality. *Forensic Science International* 228: e33-e46.
- Patino, Jorge E, and Juan C. Duque. 2013. A Review of Regional Science Application of Satellite Remote Sensing in Urban Settings. *Computers, Environment and Urban Systems* 37: 1-17.
- Goodchild, Michael F. 2011. Scale in GIS: An Overview. *Geomorphology* 130: 5-9.
- Goldberg, Daniel W, and Myles G Cockburn. 2010. Improving Geocoding Accuracy with Candidate Selection Criteria. *Transactions in GIS* 14: 149-176.
- Fisher, Peter, Alexis Comber, and Richard Wadsworth. 2010. What's in a Name? Semantics, Standards, and Data Quality. In *Spatial Data Quality: From Process to Decisions*, edited by Rodolphe Devillers and Helen Goodchild. 3-16. Boca Raton: CRC Press.
- De Genst, William, Frank Canters, and Hubert Gulinck. 2001. Uncertainty Modeling in Buffer Operations Applied to Connectivity Analysis. *Transactions in GIS* 5: 305-326
- Li, Peng, Chuang Shi, Zhenhong Li, Jan-Peter Muller, Jane Drummond, Xiuyang Li, Tao Li, Yingbing Li, and Jingnan Liu. 2013. Evaluation of ASTER GDEM Using GPS Benchmarks and SRTM in China. *International Journal of Remote Sensing* 34: 1744-1771.
- Onsrud, Harlan J, 2010. Liability for Spatial Data Quality. In *Spatial Data Quality: From Process to Decisions*, edited by Rodolphe Devillers and Helen Goodchild. 3-16. Boca Raton: CRC Press.

## Description and Assessment of Assignments

### *Weekly Assignments*

There are several different kinds of assignment with at least one due weekly. These are described in the Weekly Folders on Blackboard. Due dates are shown in the Schedule below.

*Resume Assignment – 1 worth 2 points.* We require all current students to post and maintain a public resume, short biography, and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template that will be provided to you. Unless you opt out, your resume will be included in the Spatial Science Institute Graduate Programs Resume Book. This resume book is complied annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience, and professional aspirations.

*Reading Assignments – 5 worth 10 points.* Each student is required to complete a minimum of five of the 10 reading assignments for this class. The reading assignments focus on the theory portion of the course as presented in the weekly readings. The objective is to help you evaluate and integrate the information you have acquired from the course readings. The first reading assignment is required and from there you are free to choose any four of the nine subsequent assignments. However, you must complete and submit them for grading in the weeks specified in the Schedule below. If you complete more than five reading assignments, your instructor will use your five highest scores to calculate your course grade.

*GPS Tutorials – 2 worth 6 points.* The "hands-on" GPS assignments require you to work through various GPS skill development activities. To demonstrate that you have completed the steps comprising each of these assignments, you will submit a Word document containing output such as a map and/or brief written answers.

*ArcGIS Tutorials – 4 worth 12 points*. The "hands-on" ArcGIS assignments require you to work through various GIS skill development activities. To demonstrate that you have completed the steps comprising each of these assignments, you will submit a Word document containing output and/or brief written answers.

*Discussion Forums – 2 worth 4 points*. These focus on varying combinations of theory and practice. Anticipate that you will be required to post a minimum of three new messages (i.e. one per forum) and six replies (i.e. two per forum) to messages posted by your classmates at designated times throughout the semester.

*Exercises – 3 worth 9 points.* To demonstrate your understanding of the basic concepts and skills learned in the class, you will complete three exercises that will integrate key concepts and ideas and will require independent thought. The final two exercises will take one of two forms depending on your student status. Students enrolled in the GIST M.S. Program and GIST Graduate Certificate students planning to transition to the GIST M.S. Program will start work on their proposed thesis prospectus and the remainder of the students will tackle a pair of exercises focused on fundamental geospatial information management challenges.

*Summative Assignment – 1 worth 4 points.* A final summative written assignment to be completed during the final examination period is required. In this assignment, you will reflect on the course learning outcomes and explain how the assigned work completed during the semester address these.

***Catalina Field Component***

For this part of the course, you will be divided into small teams to undertake your field work together. In addition to completing the data collection project, each team will deliver two oral presentations and a poster summarizing your project and results.

*First Presentation – 5 points.* This 10-15 minute presentation will take place at the start of the week and will describe your team's proposed research project.

*Second Presentation – 10 points.* This 15-20 minute presentation will take place at the end of the week and will summarize your team's methodology, results and findings.

*Poster – 8 points.* The poster will present a summary of your project and visualization of results. The posters must be submitted for grading to Blackboard before leaving the island.

***Research Reports***

Two research reports provide students an opportunity to integrate learning from various aspects of the course through the practice of a more in-depth assignment.

*First Report – 10 points.* The first report will provide you with an opportunity to describe the data capture options and challenges for a project of your choice from a list of projects spanning a variety of application domains. The first report must not exceed six single-spaced pages excluding figures, maps, tables, and references.

*Second Report – 20 points.* The second report will take one of two forms depending on your student status. Students enrolled in the GIST M.S. Program and GIST Graduate Certificate students planning to transition to the GIST M.S. Program (Group 1) will prepare a prospectus for a thesis project and outline some of the methods and geospatial data sources that could be used in such a project. The remainder of the students (Group 2) will be afforded the opportunity to integrate all that they have learned in the semester in an investigation of data quality for a specific application that your instructor will designate. The second report (for both groups) must not exceed 10-12 single-spaced pages excluding figures, maps, tables, and references.

## Grading Breakdown

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other GIST courses. The table on the next page summarizes the SSCI 587 course assignments and their point distribution:

| Assignments | Number | Points Each | Total Points |
|---|---|---|---|
| Weekly Assignments | | | |
| Resume Assignment | 1 | 2 | 2 |
| Reading Assignments | 5 | 2 | 10 |
| GPS Tutorials | 2 | 3 | 6 |
| ArcGIS Tutorials | 4 | 3 | 12 |
| Discussion Forums | 2 | 2 | 4 |
| Exercises | 3 | 3 | 9 |
| Summative Assignment | 1 | 4 | 4 |
| Catalina Island Excursion | | | |
| First Presentation | 1 | 5 | 5 |
| Second Presentation | 1 | 10 | 10 |
| Poster | 1 | 8 | 8 |
| Research Reports: | | | |
| First Report | 1 | 10 | 10 |
| Second Report | 1 | 20 | 20 |
| Totals | 23 | - | 100 points |

***Assignment Submission Policy***

Unless otherwise noted, assignments must be submitted via Blackboard by the due dates specified in the Schedule below and on the assignment instructions.

Unless otherwise noted, all Reading Assignments, Exercises, Discussions, and Tutorials are *due by 11:59 pm Pacific Time (PT) on Mondays*. Fieldwork components have different due dates as indicated on the Schedule below. Attention to on-time assignment submission is essential if your instructor is to meet the goal to return comments on submitted assignments before the next one is due. Sometimes this is impossible, so your instructor will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points for up to FOUR days late. No points will be given for submission more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes.

## Course Schedule: A weekly Breakdown

| | Topics | Readings and Assignments | Deliverables/ Due Dates |
|---|---|---|---|
| **Week 1**<br>8/21 | Introduction to Class | Wilson & Fotheringham, Ch. 1<br>Resume Assignment<br>Discussion Forum 1 | No deliverables |
| **Week 2**<br>8/28 | Data Needs and Types | Course Notes<br>Reading Assignment 1 | Resume Assignment:<br>Monday, 8/21<br>Discussion Forum 1:<br>Monday, 8/21 |
| **Week 3**<br>9/5*<br>*Monday, 9/4 is a university holiday | Maps, Data Entry, Editing, and Output | Bolstad, Ch. 4<br>Reading Assignment 2<br>ArcGIS Tutorial 1 | Reading Assignment 1:<br>Tuesday, 9/5 |
| **Week 4**<br>9/11 | Global Navigation Satellite Systems | Bolstad, Ch. 5<br>Reading Assignment 3<br>GPS Tutorial 1 | Reading Assignment 2:<br>Monday, 9/11<br>ArcGIS Tutorial 1:<br>Monday, 9/11 |
| **Week 5**<br>9/18 | Aerial and Satellite Images I | Bolstad, Ch. 6<br>Reading Assignment 4<br>Exercise 1<br>Introduce Report 1 | Reading Assignment 3:<br>Monday, 9/18<br>GPS Tutorial 1:<br>Monday, 9/18 |
| **Week 6**<br>9/25 | Aerial and Satellite Images II | Wilson & Fotheringham, Ch. 3<br>GPS Tutorial 2<br>Discussion Forum 2 | Reading Assignment 4:<br>Monday, 9/25<br>Exercise 1:<br>Monday, 9/25 |
| **Week 7**<br>10/2 | Catalina Field Component | Course Notes<br>Proposal Presentation<br>Final Presentation<br>Poster | GPS Tutorial 2:<br>Sunday, 10/1<br>Discussion Forum 2:<br>Sunday, 10/1<br>----------<br>First Presentation:<br>Tuesday, 10/3<br>Second Presentation:<br>Sunday, 10/8<br>Poster:<br>Sunday, 10/8 |
| **Week 8**<br>10/9 | Scale | Reading Assignment 5<br>Exercise 2 | Report 1:<br>Monday, 10/9 |
| **Week 9**<br>10/16 | Geocoding | Course Notes<br>Reading Assignment 6 | Reading Assignment 5:<br>Monday, 10/16<br>Exercise 2:<br>Monday, 10/16 |
| **Week 10**<br>10/23 | Digital Data | Bolstad, Ch. 7<br>Exercise 3<br>ArcGIS Tutorial 2 | Reading Assignment 6:<br>Monday, 10/23 |

| | | | |
|---|---|---|---|
| **Week 11**<br>10/30 | Data Quality and Management | Wilson and Fotheringham, Ch. 2 and 4<br>Reading Assignment 7 | Exercise 3:<br>Monday, 10/30<br>ArcGIS Tutorial 2:<br>Monday, 10/30 |
| **Week 12**<br>11/6 | Data Standards and Data Quality | Bolstad, Ch. 12<br>Reading Assignment 8 | Reading Assignment 7:<br>Monday, 11/6 |
| **Week 13**<br>11/13 | Data Quality and Management | Bolstad, Ch. 14<br>Reading Assignment 9<br>ArcGIS Tutorial 3<br>Report 2 | Reading Assignment 8:<br>Monday, 11/13 |
| **Week 14**<br>11/20*<br>*11/22-11/26 is a university holiday | | Wilson & Fotheringham, Ch. 12<br>Reading Assignment 10<br>ArcGIS Tutorial 4 | Reading Assignment 9:<br>Monday, 11/20<br>ArcGIS Tutorial 3:<br>Monday, 11/20 |
| **Week 15**<br>11/27 | | Completing Report 2 | Reading Assignment 10:<br>Monday, 11/27<br>ArcGIS Tutorial 4:<br>Monday, 11/27<br>Report 2: No later than 05:00 pm PT on Friday, 12/1 |
| **Study Days**<br>12/2-12/5 | | | |
| **Exam Week**<br>12/6-12/13 | Summative Assignment | Summative Assignment | Summative Assignment:<br>Wednesday, 12/6 |

## 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* https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment 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://adminopsnet.usc.edu/department/department-public-safety. 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 Relationship and Sexual Violence Prevention Services* http://engemannshc.usc.edu/rsvp/ 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* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html 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.

***Resources for Online Students***

The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/. Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. This includes instructional videos, remote access to university resources, and other key contact information for distance students.