SSCI 599 – Spatial Modeling (Section 35784D)
Course Syllabus – Summer Semester 2014

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Office Hours: Monday and Wednesday, 9:00-10:00 a.m. PT

I am always available asynchronously via email. I am also available for synchronous chats via phone, audio or video most days and times by prior arrangement via email. Or we can meet in my Adobe Connect room. Just get in touch!

Course Scope and Purpose

The use of spatial analytical models has become increasingly common in the study of social and environmental systems. Such models are used to help us learn about the systems we are interested in, to help guide future research by identifying knowledge and data 'gaps', to aid in the design of management and monitoring strategies, and to make predictions about unmeasured patterns and processes. This course goes a step beyond the exploration of spatial form and pattern that is the focus of *SSCI 583: Spatial Analysis.*

Why should you take this course? This course will provide you with an understanding of a range of spatial modeling concepts, approaches and applications, as well as methods for determining the suitability of a particular modeling approach for a given task. Designed as an online version of an advanced studio course and graduate seminar, you will work individually and in groups to explore, learn, and teach about several different solutions to geospatial modeling challenges.

Expectations in the workplace for today's GIS professionals include the ability to learn continuously, work with many different kinds of data and with professionals in other disciplines, domains, and agencies. There are many unique and deep skill sets needed in today's world. However, they do not stand alone; the ability to collaborate, to learn from others and to expand opportunities jointly are essential. The collaborative component of this course is essential.

Learning Outcomes

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

- Explain how complex spatial models can be used to help solve and understand environmental and social problems and management challenges.
- Describe the range of tools and techniques that fall within the collection of spatial analytical models.
- Represent spatially and temporally dynamic social and environmental processes using spatial modeling tools.
- Assess the validity, uncertainty and sensitivity of model results, both in the research literature and in your own work.
- Use and integrate with ArcGIS, alternative modeling solutions including open source tools and external software applications
- Solve GIS tasks of moderate complexity independently with the help of various online resources.

- Collaborate with others to develop team expertise in advanced modeling tools.
- Working with domain experts, outline possible modeling solutions for their loosely specified spatial problems.
- Convey complex technical information and modeling results to a non-technical audience through presentations, reports and graphics.
- Describe how different GIS, modeling, mathematical, and statistical software packages can be integrated to produce results that none of these systems in isolation is able to produce.

Course Formats

This a graduate level course, so you should expect this class to be both academically robust and intellectually challenging. As graduate students 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 thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our 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 this path of discovery and you will find that you will learn much from your fellow classmates. The challenge for us is to replicate such an academic experience within the milieu of "online learning".

The main theoretical concepts will be provided through text readings and self-directed research you will do in the published literature and on the web and through hands-on experimentation with various tools and technologies.

The course will generally unfold on a biweekly basis. Each pair of weeks will be focused on a particular aspect of spatial modeling. In order to make sure you are exposed to as broad a range of material as possible, the class will be divided into small groups, each of which will be charged with learning about a different modeling solution or environment. Group members will support each other as you learn your assigned topic, completing some intermediate assignments. At the end of some two week sections, each group will present what they have learned to the remainder of the class in a brief tutorial (written or online). In this way you will learn some of the material deeply while also learning something about related topics. You will finish the course by completing a spatial modeling project on a topic of your choice either on your own or in a self-identified group.

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

We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. These include:

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

Discussion boards – On the Blackboard site, we will post a number of discussion threads relevant to various sections of the course. These threads are very important in terms of providing support to each other while working on class exercises to share hints and helpful tips, as you would in a classroom laboratory. I check the discussion threads periodically and offer occasional comments.

Please send me an email directly if you have a question or concern that requires my immediate attention.

Live meetings and presentations – We will use a browser-based service called Adobe Connect to create synchronous, interactive sessions. With voice and webcam capabilities Adobe Connect can be used to share presentations and even our desktops between two or more people.

Individual meetings – While Adobe Connect can be used for one-on-one meetings, we generally find it is easier to use the free VOIP and chat technology, Skype (http://www.skype.com) for individual chats.

GIST server and tech support – This course will utilize the GIST Server which is a virtual desktop. You can access the GIST Server at https://gistonline.usc.edu/ If you are unable to connect to the server or experience any type of technical issues, send an email to GIST Tech Support at: gistsupport@dornsife.usc.edu and make sure to copy (cc) me on the email. GIST Tech Support is available Monday through Friday, 9:00 a.m.-5:00 p.m. PT.

Assessment

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

Resume Assignment – 1 for a total of 2 points. We require all current students to post and maintain a public resume, short biography and recent photo on our shared GIST Student Community Blackboard site. With your permission, your photo and resume will be posted to the Spatial Sciences Institute website and your resume will be included in the GIST Resume Book. The latter is compiled annually and along with our web presence used to promote our programs and more importantly, your skills, experience, and professional aspirations.

Wikis and Blogs – 4 for a total of 23 points. Throughout the term the class will explore a variety of topics through graded blogs and wikis. These tasks are designed to engage you in the material and to expand your research results beyond what you are personally able to uncover. Requirements for participation by way of comments and responses will be provided in detail in the assignment instructions.

Modeling Assignments – 4 for a total of 21 points. The modeling assignments will give you hands on experience with several different modeling tools and environments (including ArcGIS, NetLogo, and R).

Lesson Presentations – 2 for a total of 24 points. Two of the sections will end with the presentation of a brief learning module through which you will teach your classmates what you have learned (teaching is the best way to learn!). A portion of these points will be assigned through self and peer review which will be described in the assignment instructions.

Project Component – 3 for a total of 30 points. To integrate your learning of all of the material covered in the course, you will design, undertake and report on an individually chosen spatial modeling project. The Final Project will have three components including a proposal with theoretical context and model conceptualization (12 points), a public presentation (6 points, made online via *Adobe Connect*) and a fully annotated and illustrated model report on your model implementation (12 points).

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 at the top of the next page summarizes the *SSCI 599* course assignments and their point distribution.

Assignments	Number	Points Per Assignment	Total Points
Resume Assignment	1	2	2
Wikis and Blogs	4	5 or 6	23
Modeling Assignments	4	3 or 6	21
Lesson Presentations	2	12	24
Project Components:			
Proposal	1	12	12
Presentation	1	6	6
Final Report	1	12	12
Totals	**14**	**-**	**100**

Grades in this and other GIST courses will use the standard USC grading criteria, as follows:

A	≥ 93 points	B-	80-82 points	D+	67-69 points
A-	90-93 points	C+	77-79 points	D	63-66 points
B+	87-89 points	C	73-76 points	D-	60-62 points
B	83-86 points	C-	70-72 points	F	< 60 points

And finally, it is important to note from the outset that: (1) late postings and assignments will be docked one grade and no grade will be given for postings or assignments turned in more than one week late; and (2) no written work will be accepted for grading after 5:00 p.m. PT on the last day of classes (i.e. 8/15/14).

Requirements

Textbooks – There are two required texts for this course. They are available from the USC Bookstore or online outlets such as Amazon. We encourage you to purchase these books quickly since you will need these materials from the opening day of class:

- O'Sullivan, D., and G.L.W. Perry. 2013. *Spatial Simulation: Exploring Pattern and Proces*s. Hoboken, NJ: Wiley-Blackwell.
- Mitchell, A. 2012. *The Esri Guide to GIS Analysis, Volume 3: Modeling Suitability, Movement, and Interaction*. Redlands, CA: Esri Press.

These textbooks will be supplemented with Course Notes and a mixture of readings from academic journals, professional reports, and authoritative websites.

Readings – In addition to the textbooks, you will be required to read broadly across the spatial modeling literature. Some of what you will read and report on will be identified through your own research in the online USC library. Some articles, also available online at the Library, are specifically included in weekly assignments. These include:

- Beven, K. 2002. Towards a coherent philosophy for modelling the environment. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences* 458: 2465-2484.

- Beven, K. 2007. Towards integrated environmental models of everywhere: Uncertainty, data and modeling as a learning process. *Hydrology and Earth System Sciences* 11(1): 460-467.
- Beven, K.J., and R.E. Alcock. 2012. Modelling everything everywhere: A new approach to decision-making for water management under uncertainty. *Freshwater Biology* 57(1): 124-132
- Beven, K., and P. Young. 2013. A guide to good practice in modeling semantics for authors and referees. *Water Resources Research* 49: 5092-5098.
- Bian, L. 2004. A conceptual framework for an individual-based spatially explicit epidemiological model. *Environment and Planning B: Planning and Design* 31: 381-395.
- Grim, V., U. Berger, D.L. DeAngelis, J.G. Polhill, J. Giske, and S. F. Railsback. 2010. The ODD protocol: A review and firs update. *Ecological Modelling* 221: 2760-2768.
- Juston, J.M., A. Kauffeldt, B.Q. Montano, J. Seibert, K.J. Beven, and I.K. Westerberg. 2013. Smiling in the rain: Seven reasons to be positive about uncertainty in hydrological modelling. *Hydrological Processes* 27: 1117-1122.
- Matott, L.S., J.E. Babendreier, and S.T. Purucker. 2009. Evaluating uncertainty in integrated environmental models: A review of concepts and tools. *Water Resources Research* 45(6): W06421.
- Millington, J.D.A., D. O'Sullivan, and G.L.W. Perry. 2012. Model histories: Narrative explanation in generative simulation modelling. *Geoforum* 43: 1025-1034.
- Morrison, M. 2009. Models, measurement and computer simulation: the changing face of experimentation. *Philosophical Studies* 143: 33-57.
- Rykiel Jr., E.J. 1996. Testing ecological models: The meaning of validation. *Ecological Modelling* 90: 229-244.
- Schmolke, A., P. Thorbek, D.L. DeAngelis, and V. Grimm. 2010. Ecological models supporting environmental decision making: A strategy for the future. *Trends in Ecology and Evolution* 25: 479-486.
- Thiele, J.C., and V. Grimm. 2010. NetLogo meets R: Linking agent-based models with a toolbox for their analysis. *Environmental Modelling and Software* 25: 972-974.
- Walker, W.E., P. Harremoes, J. Rotmans, J.P. Van Der Sluijs, M.B.A. Van Asselt, P. Janssen, and M.P. Krayer Von Krauss. 2003. Defining uncertainty: A conceptual basis for uncertainty management in modeling-based decision support. *Integrated Assessment* 4(1): 5-17.

Technology – ArcGIS is provided online via the GIST server; hence, you do not need to install it on your own computer. You will need to download and install on your own computer some free modeling tools including NetLogo and RStudio. For all courses in the GIST Program there are several technology requirements:

- Every student must have a computer with a fast Internet connection.
- Every student MUST have a functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- A current web browser. Firefox recommended, to access the GIST Server

Communications – 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 the Blackboard Assessment link. I will also create Blackboard discussion forums throughout the semester that we will use for the aforementioned assignments and so we can discuss issues and comments on the course assignments, exercises, and projects as the need arises.

In addition, 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. Check now to make sure that mail sent from both the USC blackboard accounts and my private domain (sujinlee@usc.edu and sujinlee@dornsife.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 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.

That said, 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.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to an instructor as early in the semester as possible. DSP is located in STU 301 and is open from 8:30 a.m. to 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles.

Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A (see http://scampus.usc.edu/wp-content/uploads/2011/07/university_governance.pdf for additional details). Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at http://www.usc.edu/student-affairs/SJACS/.

Important Administrative Dates

5/21:	Summer semester classes begin
5/26:	Memorial Day, university holiday
6/4:	Last day to drop a class without a mark of "W" and receive a 100% refund (no partial refund after this date), and last day to register and add classes
6/24:	Deadline to submit signed Approval to Submit form to the Graduate School**
7/1:	Deadline to upload thesis or dissertation manuscript**
7/4:	Independence Day, university holiday
7/29:	Last day to drop a class with a mark of W
8/15:	Summer semester classes end

Tentative Schedule (35784 D)

Week #	Week Begins	Theme	Week's Readings	Assignments Due Monday Following …			
			Reading	Wikis & Blogs	Modeling Assignments	Lessons	Other Assignments
1	5/21	Modeling Foundations	O&P 1, Mitchell1+ others	Intro Blog			Resume
2	5/27		O&P 2,6 + others	Modeling Wiki 1			
3	6/2	Modeling with ArcGIS	Mitchell 4-6		ArcGIS		
4	6/9		Literature Research			ArcGIS	
5	6/16	Agent-based Models	O&P 3-5	Modeling Wiki 2			
6	6/23		Literature Research		NetLogo		
7	6/30	External Models	Web Research	Modeling Wiki 3			
8	7/7		Literature Research			Topics TBA	
9	7/14	Documenting Models	O&P 7-9				Project Proposal
10	7/21	Modeling with R	R tutorial		R Software 1		
11	7/28		R book		R Software 2		
12	8/4	Project					Project Presentation
13	8/11						Project Report
	8/15	End of Semester; All of your work must be submitted by 5:00 p.m. on this date					