Syllabus
STA 6934 Sec. 5592, TOPICS IN SPATIAL STATISTICS, Spring 2011

Meeting Times: Thursday Periods 1, 2, and 3 (7:25 – 10:25 am)
Classroom: Weimer 1070

Instructor: Prof. Mary C. Christman, 406 McCarty C, 392-1946, mcxman@ufl.edu
Office Hours: TBA

Class Website: TBA

Course Description: This course provides an introduction to spatial data analysis, including sampling strategies for optimizing estimation and other inferences. Emphasis is on geostatistical analyses of continuous random fields and sampling methods, lattice data and point pattern analysis. We will cover basic methodologies for collection and inference of spatial data. The course is a mix of theory and hands on application to data.

Prerequisites:

1) 2 courses in upper level statistics, preferably including introduction to mixed models and regression and some mathematical statistics, or permission of instructor. Additional course work in either geostatistical mapping, sampling theory, or modeling is an advantage but not required.
2) Experience with statistical software such as R, SAS, or SPSS, or with mapping software such as ArcGIS.

Required Text: Schabenberger, O. and Gotway, C.A. 2004. *Statistical Methods for Spatial Data Analysis*, Chapman & Hall/CRC, Boca Raton, FL.

Texts for Additional Reading:

Cochran, W. G. 1977. *Sampling Techniques, 3rd edition*, Wiley and Sons, New York.

Cressie, N. A. C. 1993. *Statistics for Spatial Data, revised edition*. Wiley and Sons, New York.

Fortin, M-J., and Dale, M. 2005. *Spatial Analysis: A Guide for Ecologists.* Cambridge University Press, New York.

Gelfand, A. E. , Diggle, P. J. Fuentes, M. and Guttorp, P. (Eds.) 2010. *Handbook of Spatial Statistics.* Chapman & Hall/CRC, Boca Raton, FL.

Griffith, D. A. 2003. *Spatial Autocorrelation and Spatial Filtering: Gaining Understanding Through Theory and Scientific Visualization.* Springer, New York.

Griffith, D. A. and Layne, L. J. 1999. *A Casebook for Spatial Statistical Data Analysis: A compilation of analyses of different thematic data sets.* Oxford University Press, New York.

Haining, R. 1990. *Spatial Data Analysis in the Social and Environmental Sciences*. Cambridge University Press, New York.

Hunsaker, C. T., Goodchild, M. F., Friedl, M. A., and Case T. J. (Eds.) 2001. *Spatial Uncertainty in Ecology: Implications for Remote Sensing and GIS Applications*. Springer-Verlag, New York, NY.

Kanevski, M. and Maignan, M. 2004. Analysis and Modeling of Spatial Environmental Data. EPFL Press (Marcel Dekker, Inc.), New York.

Kitanidis, P. K. 1997. *Introduction to Geostatistics: Applications in Hydrogeology.* Cambridge University Press, New York.

Thompson, S. K. 2002. *Sampling, 2nd ed.* Wiley and Sons, New York.

Upton, G. J. G. and Fingleton, B. 1989. *Spatial Data Analysis by Example. Volume 1. Point Pattern and Quantitative Data.* Wiley and Sons, New York.

Upton, G. J. G. and Fingleton, B. 1989. *Spatial Data Analysis by Example. Volume 2. Categorical and Directional Data.* Wiley and Sons, New York.

Waller, L., A., and Gotway, C.A.2004. *Applied Spatial Statistics for Public Health Data.* Wiley and Sons, New York.

Grading:

Class Participation:	30%
Homework:	40%
Final Project:	30%

Class Participation: Students will present examples out of the text or solutions to homework problems in each class. Over the course of the semester, a student may present several times, possibly up to 8 times. In addition, participation in class discussions is expected.

Homework: There will be more-or-less weekly assignments that may include theory questions, simulations, data analyses, or critiques of published articles. Please submit hardcopies of all homework assignments, including the software code used for analysis or simulation.

Final Project: Students will conduct a research project that can be either a complete analysis of a data set, a simulation study, development of a new statistical method or approach, or a comparative study of techniques. The final write-up is to be presented in the form of a scientific paper in a format suitable for publication in a peer-reviewed journal. Total length of the text is 8 double-spaced pages, including abstract and main manuscript. Bibliography, tables, and figures can take additional pages. In addition, all programming statements used and any related analyses not part of the main article are to be provided as supplementary material.

Your project must be approved by me, so please submit a short proposal of your intended research **no later than Thursday 24 February**. The proposal should be in the form of an extended abstract with a bibliography attached. I would also like to arrange a meeting with you individually to go over your proposed topic preferably before spring break, so please indicate when you are available to meet. The final report is due, **Wednesday 27 April**, but sooner is acceptable as well.

Computing: It is assumed that students have access to the internet and to statistical computing resources. Homework will require familiarity with software that does statistical computations and spatial analyses. Examples include SAS, R, S+, or MATLAB. My examples will be mostly in SAS and R but you may use whichever software you are familiar with. ArcGIS is a good product for mapping and display.

Policies and Additional Information:

1. **Office Hours** are listed above. Help outside these times are *by appointment only*. Call or email to schedule an appointment.

2. Occasionally, additional **materials** or other notes (interesting websites, pointers to recent interesting articles, etc.) will be placed on the class web site. The homework answers will be posted to the website. I will try to post answers quickly.

3. The **class Email account** will be used occasionally to answer questions or possibly to send out additional information to everyone. Be sure your campus email address is current in the system because I will be using the listserv created by ISIS.

4. All homework is due one week after assignment. Late **homework** will not be accepted and will be recorded as a 0 grade. If you are going to miss a class or have a scheduling conflict, return the assignment before the due date!

5. It is the responsibility of the student to work all of the assigned **homework** problems independently (which means by yourself, on your own). The experience gained from doing these problems is invaluable and necessary for the understanding of the material we shall be covering. Please note that obtaining help from fellow students or others on a homework assignment can be considered cheating by the University and is not allowed unless I explicitly state that the work is to be done in groups.

University Policies:

Academic Dishonesty:
All members of the University Community share the responsibility to challenge and make known acts of apparent academic dishonesty. Acts of academic dishonesty will not be tolerated and will be referred to the Student Honor Council. Information regarding University policies about academic dishonesty and the University's honor code may be found at: http://www.dso.ufl.edu/judicial/procedures/academicguide.html

Academic accommodations:
If you have a documented disability and wish to discuss academic accommodations with me, please contact me as soon as possible. Information on Disability Resources can be found at http://www.dso.ufl.edu/drp/services/

Tentative Schedule:

Week	Chapter	Topic
6 January	1.1 – 1.5, 2.1 – 2.4	Introduction, Random Fields
13 January	4.1 – 4.4, 4.8	Semivariograms and Covariance
20 January	4.5 – 4.6	Estimation of Semivariograms
27 January	5.1 – 5.3	Spatial Prediction
3 February	5.4 – 5.6	Kriging and Sampling for Prediction
10 February	5.6 – 5.8	Nonlinear Prediction and Change of Support
17 February	6.1 – 6.2	Spatial Regression
24 February	6.3 – 6.4	Bayesian Hierarchical Models
3 March	Handout	Sampling for Semivariogram Estimation
10 March	SPRING BREAK	
17 March	8.1 – 8.3	Non-Stationary Covariance Models
24 March	3.1 – 3.4	Point Pattern Analysis I
31 March	3.5 – 3.7	Point Pattern Analysis II
7 April	Handout	Introduction to Lattice Models
14 April	Handout	Estimation Methods
27 April	NO CLASS	FINAL REPORT DUE