Term Information

Effective Term	Autumn 2019
Previous Value	*Summer 2017*

Course Change Information

What change is being proposed? (If more than one, what changes are being proposed?)

Change in title, "Intermediate Spatial Data Analysis," to serve now as a second course in spatial data analysis which emphasizes regression-based quantitative modeling techniques widely used in geography.

What is the rationale for the proposed change(s)?

We have identified a program need to better prepare students to work in geospatial data science. We are requesting to add a new course, 4103, that will cover basic spatial data handling and analysis. The existing course 5100 will be modified to cover more applications and advanced topics in spatial data analysis for geographic sciences.

What are the programmatic implications of the proposed change(s)?

(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?

The newly proposed Geog 4103 will now become required for all GIS majors and an elective for all other Geog programs. This class, 5100, will now be a GIS major elective.

Is approval of the requrest contingent upon the approval of other course or curricular program request? No

Is this a request to withdraw the course? No

General Information

Course Bulletin Listing/Subject Area	Geography
Fiscal Unit/Academic Org	Geography - D0733
College/Academic Group	Arts and Sciences
Level/Career	Graduate, Undergraduate
Course Number/Catalog	5100
Course Title	Intermediate Spatial Data Analysis
Previous Value	*Spatial Data Analysis*
Transcript Abbreviation	Int Spatial Data
Previous Value	*Spatial Data*
Course Description	An intermediate class in spatial data analysis for geography. This course focuses on multivariate model building and evaluation, with a special emphasis on multiple regression models commonly used by geographers – spatial regression, conditional autoregressive, and geographically weighted regression.
Previous Value	*An introduction to spatial data analysis in geography: the fundamental statistical and spatial analysis methods used in quantitative geographic research.*
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week, 12 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No

Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq: 4103
Previous Value	*Prereq: Stat 1450 or above.*
Exclusions	
Electronically Enforced	No

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	27.0501
Subsidy Level	Doctoral Course
Intended Rank	Junior, Senior, Masters, Doctoral

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors
The course is an elective (for this or other units) or is a service course for other units

Course Details

Course goals or learning objectives/outcomes

- It will emphasize spatial data handling and hands-on computational skills development and will focus on the use and interpretation of statistical output to answer questions most relevant to geographers.
- Experience with real-world examples
- Introduction to more advanced spatial data analysis methods

Previous Value

- *An understanding of fundamental spatial data analysis in geographic problem solving*
- *Experience with real-world examples,*
- *Basis for understanding more advanced spatial data analysis methods*

Content Topic List

- Geographic data
- Descriptive statistics
- Geographic Information Science
- Probability
- Hypothesis testing
- Analysis of variance
- Regression
- Spatial analysis

Sought Concurrence

No

Attachments

- geog 5100 concurrence.pdf

  (Concurrence. Owner: Munroe,Darla Karin)

- New GEOG5100 Syllabus.docx

  (Syllabus. Owner: Munroe,Darla Karin)

- GIS BS Curriculum Map_updated December 2018.xlsx

  (Other Supporting Documentation. Owner: Munroe,Darla Karin)

- Geog 5100 OLD syllabus.pdf

  (Other Supporting Documentation. Owner: Munroe,Darla Karin)

Comments

- -Please make the title and transcript abbreviation changes on the actual form as well.
  -Please notice that the "course description" is what goes in the course catalog. It would seem that the reference to "introduction" needs to be removed as well as the passage about "this course will now focus on more . . ." (since anyone reading the course catalog is mostly interested in what the course does now--not used to do).
  -It will be useful to the panel to see the "old" (i.e., current) syllabus in order to compare/contrast the new syllabus with what the course used to do.
  - If this change to 5100 entails changes to the curriculum map, please provide the updated map. *(by Vankeerbergen,Bernadette Chantal on 11/26/2018 12:35 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Munroe,Darla Karin	11/15/2018 01:47 PM	Submitted for Approval
Approved	Coleman,Mathew Charles	11/15/2018 02:59 PM	Unit Approval
Approved	Haddad,Deborah Moore	11/15/2018 05:12 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	11/26/2018 12:35 PM	ASCCAO Approval
Submitted	Munroe,Darla Karin	12/20/2018 09:57 AM	Submitted for Approval
Approved	Coleman,Mathew Charles	12/20/2018 09:55 PM	Unit Approval
Approved	Haddad,Deborah Moore	12/21/2018 08:39 AM	College Approval
Pending Approval	Nolen,Dawn Vankeerbergen,Bernadette Chantal Oldroyd,Shelby Quinn Hanlin,Deborah Kay Jenkins,Mary Ellen Bigler	12/21/2018 08:39 AM	ASCCAO Approval

GEOG 5100: Intermediate Spatial Data Analysis

Instructor
Elisabeth Root, Associate Professor, Geography & Epidemiology
Email: root.145@osu.edu
Office: 1160 Derby Hall
Office Hours:

Course Description

Geography is a diverse discipline with a wide variety of subject matter including physical (environmental), human (socio-economic), and integrated (human-physical) topics of inquiry. Even within physical geography, biogeographers study different phenomena than hydrologists and climatologists. Therefore, it is not surprising to learn that there are a variety of advanced analytical methods that geographers can employ in their studies. The course focuses multivariate methods widely used by geographers and other scientists to model both physical and social phenomena. The course is an intermediate course in spatial statistical analysis. You are expected to know how to perform simple descriptive and inferential analysis, including simple linear regression models. The focus of this course will be multivariate model building and evaluation, with a special emphasis on multiple regression models commonly used by geographers – spatial regression, conditional autoregressive, and geographically weighted regression. Theories of spatial thinking and the motivation for spatial modeling are integrated throughout the course.

This course emphasizes hands-on experience and practical understanding. You should leave this course with confidence in the methods we have discussed and an appreciation for how these statistical methods are applied to problems in geographic research. I will emphasize conceptual understanding, how to implement statistical tests in R and interpret the output. By the end of the course, I expect you to know how to select the appropriate statistical method to answer a research question, be comfortable using multiple software packages to analyze data and correctly interpret and write-up the results of your statistical analysis.

Course Objectives

By the end of the course students will be able to:

1. Understand the motivation for using multiple regression, broadly, and spatial regression specifically.
2. Understand the theoretical assumptions behind linear regression models and their importance in conducting proper regression analysis
3. Formulate multiple regression models, carry out hypotheses tests, and validate models.
4. Systematically select important explanatory variable, estimate parameters, and quantify their impact on a dependent variable.
5. Obtain a rich set of statistical tools for data analysis, with an understanding of the how to choose which tool to use and how to implement them in statistical software.

6. Confidently and carefully interpret the results of data analyses and clearly communicate those results.
7. Obtain practical experience in using real geographic datasets addressing meaningful research questions.

Course Website
The course schedule, announcements, lecture notes, assignments, readings, datasets, and other course information will be posted on Carmen (https://carmen.osu.edu).

Prerequisites
GEOG 4103, or consent of instructor. Students should be familiar with basic probability theory, simple linear regression, and basic linear algebra.

Required Textbook
There is no required text for this class. I will provide selections from a variety of text books throughout the semester through e-reserves or the class Carmen website. The books these readings will come from include:

- Trevor C. Bailey and Anthony C. Gatrell. (1995). *Interactive Spatial Data Analysis*, Prentice Hall.
- Fortin, M-J. and M. Dale (2005*). Spatial Analysis: A Guide for Ecologists*. Cambridge: University Press.
- Agresti, A. and B. Finlay. (2008). *Statistical Methods for the Social Sciences*, 4th ed. New Jersey: Prentice Hall.
- Helsel, D.R. and R.M. Hirsch. (2002). *Statistical Methods in Water Resources*. USGS. Available online at: https://pubs.usgs.gov/twri/twri4a3/pdf/twri4a3-new.pdf.
- Ward, M.D. and K.S. Gleditsch (2008). *Spatial Regression Models*. Thousand Oaks, CA: Sage.
- Waller, L.A. and Gotway, C.A., 2004. *Applied Spatial Statistics for Public Health Data*. Chapter 9, pp. 370-409.

Reference Books
Not specifically required, but could be very helpful as we work through the course:

- Roger S. Bivand, Edzer J. Pebesma, and V. Gómez-Rubio (2013). *Applied Spatial Data Analysis with R*, 2nd edition. Springer, New York.
- Dalgaard, P. (2008). *Introductory Statistics with R*. 2nd edition. New York: Springer.

Assessment
You will be assessed on both your individual work in the class and on group work. The importance of each component will be as follows:

Lab write ups (x5)	55%
Final project	15%
Midterms (x2)	20%
Participation and engagement	10%

Lab write-ups

Students are required to complete 5 lab assignments during the semester. I will not be handing you a "script" for how to do a statistical analysis during the labs. I will provide you with a dataset and some programming advice and ask you to figure out how to use the software packages we learn to run models and answer a set of broad questions. Lab write-ups are expected to look very similar to a journal article's Results and Discussion section. I will pass out a grading rubric before the first lab so you understand how labs will be graded.

In general, lab write-up should include:

1) A clear statement of your research question (just state it, no need for a paragraph of prose),
2) A methods section to explain what data you used and what statistical tests you performed and why,
3) A results section including the relevant tables and graphs that best summarize your output and your interpretation of these (MORE IS NOT BETTER - choose wisely), and
4) A discussion of your results (really no more than a few paragraphs). Keep in mind that the discussion section interprets your results, it doesn't just restate them.

This whole write-up should be no longer than 3 pages (single spaced, not including tables/graphs); you will be graded down for excessively wordy write-ups and for including unnecessary tables/graphs. Your annotated R code should be included as an Appendix. You will turn in these lab reports via the Dropbox on Carmen. Labs are due the Monday following the lab exercise.

Final Project

There will be a 5 page project that includes the following components:

1) Description of a spatial dataset to which they potentially could gain access.
2) The research question(s) they wish to address using this data
3) An outline of the methods they will use, based on the material covered in class
4) A statistical analysis of the data, presented in a professional (journal ready) manner
5) A short discussion of findings

The final project is due the last day of class.

Participation and engagement

Students are expected to attend all classes. Attendance, as well as my assessment of how engaged you are in the class, are 10% of your grade.

Midterms

There will be two midterms during the semester – one at the midpoint, and one at the end.

University Policies:

Disabilities:

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue.

Religious observances:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please let me know if you need to miss class for religious purposes.

Classroom Etiquette:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Academic Misconduct:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487).

For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Your Mental Health:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292--5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Week	Class Dates	Lecture Topic/Readings	Readings
1		Introduction to Modeling (four step process of: choose, fit assess, use); Review of simple linear regression	• Agresti, A. and B. Finlay. 2008. Chapters 10: Multivariate Relationships in Statistical Methods for the Social Sciences.
2		Multiple Linear Regression (fitting models, checking conditions, comparing models)	• Human Geographers: Agresti, A. and B. Finlay. 2008. Chapters 11: Multiple Regression and Chapter 14: Model Building with Multiple Regression in Statistical Methods for the Social Sciences. • Physical Geographers: Helsel, D.R. and R.M. Hirsch. 1995. Chapter 11: Multiple Linear Regression in Statistical Methods in Water Resources. • Arheimer, B. and R. Linden. 2000. "Nitrogen and phosphorus concentrations from agricultural catchments – influence of spatial and temporal variables." Journal of Hydrology. 227: 140-159. • Redstone, I. and D.S. Massey. 2004. "Coming to Stay: An Analysis of the U.S. Census Question on Immigrants' Year of Arrival." Demography 41(4): 721-38.
3		Second-order models. Interaction terms and polynomials.	None
4		Generalize Linear Models	• Human Geographers**:** Agresti, A. and B. Finlay. 2008. Chapter 11: Multiple Regression in *Statistical Methods for the Social Sciences.* • Physical Geographers: Helsel, D.R. and R.M. Hirsch. 1995. Chapter 15: Regression for Discrete Responses in *Statistical Methods in Water Resources.* • Qian, S. 2010. Chapter 7: Classification and Regression Tree in *Environmental and Ecological Statistics with R*. • Sherriff, R.L. and T.T. Veblen. 2007. "A Spatially-Explicit Reconstruction of Historical Fire Occurrence in the Ponderosa Pine Zone of the Colorado Front Range." *Ecosystems* 9:1342-1347. • Clougherty, J.E., et al. 2007. "Synergistic Effects of Traffic-Related Air Pollution and Exposure to Violence on Urban Asthma Etiology." *Env Health Perspectives* 115(8): 1140-6.
5		Introduction, Spatial Thinking, and Spatial Data (Analysis);	TEXTBOOK: Ward, M.D. and K.S. Gleditsch (2008). *Spatial Regression Models. Chapter 1*

Week	Class Dates	Lecture Topic/Readings	Readings
		Theoretical Arguments for Spatial Modeling ESDA & Spatial Autocorrelation	• Goodchild, MF, L Anselin, RP Appelbaum and B.H. Harthorn. 2000. Toward Spatially Integrated Social Science. *Int Regional Science Review* 23(2): 139-159. • Loftin, C. & S.K. Ward. 1983. A Spatial Autocorrelation Model of the Effects of Population Density on Fertility. *American Sociological Review*, 48(1):121-128. • Galle, O.R., W.R. Gove, & J.M. McPherson. 1972. Population Density and Pathology: What Are the Relations for Man? *Science,* 176:23-30. • Anselin, L., 1989. What is Special About Spatial Data? *Alternative Perspectives on Spatial Data Analysis* (89-4). • Tobler, W.R. 1970. A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography* 46(June):234-240. • Getis, A. 2008. A History of the Concept of Spatial Autocorrelation: A Geographer's Perspective. *Geographical Analysis* 40:297-309. • Messner, S.F., L. Anselin, R.D. Baller, D.F. Hawkins, G. Deane, and S.E. Tolnay. 1999. The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis. *Journal of Quantitative Criminology* 15(4):423-450. • Tolnay, S.E., Deane, G. & E.M. Beck. 1996. "Vicarious Violence: Spatial Effects on Southern Lynchings, 1890-1919." *American Journal of Sociology* 102(3):788-815. • Poulsen, M, R Johnston, J Forrest. 2010. The intensity of ethnic residential clustering: exploring scale effects using local indicators of spatial association. *Environment and Planning A* 42:874-894.
6		Lab: ESDA & Spatial Autocorrelation	None
7		MIDTERM #1	
8		Spatial Regression Models	TEXTBOOK: Ward, M.D. & K.S. Gleditsch. 2008. *Spatial Regression Models.* Chapters 2, 3 & 4. Waller, L.A. and Gotway, C.A., 2004. *Applied Spatial Statistics for Public Health Data.* Chapter 9, pp. 325-370. • Voss, P.R., D.D. Long, R.B. Hammer, & S. Friedman. 2006. County Child Poverty Rates in the U.S.: A Spatial Regression Approach. *Population Research and Policy Review* 25: 369-391.

Week	Class Dates	Lecture Topic/Readings	Readings
			• Emch, M., M. Ali, J.K. Park, M. Yunus, D.A. Sack & J.D. Clemens. 2006. Relationship between neighborhood-level killed oral cholera vaccine coverage and protective efficacy: evidence for herd immunity. *International Journal of Epidemiology* 35: 1044-50. • Sparks, P.J., & C.S. Sparks. 2010. An Application of Spatially Autoregressive Models to the Study of US County Mortality Rates. *Population, Space and Place* 16:465-481. • Burnett, J.W. & D.J. Lacombe. 2012. Accounting for Spatial Autocorrelation in the 2004 Presidential Popular Vote: A Reassessment of the Evidence. *The Review of Regional Studies* 42:75-89.
		Lab: Spatial Regression	None
10		(More) Spatial Regression Models	TEXTBOOK: Waller, L.A. and Gotway, C.A., 2004. *Applied Spatial Statistics for Public Health Data.* Chapter 9, pp. 370-409. • Wall, M.M. 2004. "A close look at the spatial structure implied by the CAR and SAR models." *Journal of Statistical Planning and Inference* 121(2): 311-324. • Trogdon, J.G. & T. Ahn. 2015. "Geospatial Patterns in Human Papillomavirus Vaccination Uptake: Evidence from Uninsured and Publicly Insured Children in North Carolina." *Cancer Epidemiol Biomarkers Prev*; 24(3); 595–602. • Webster, T., Vieira, V., Weinberg, J. and Aschengrau, A., 2006. "Method for mapping population-based case-control studies: an application using generalized additive models." *International Journal of Health Geographics* 5(1): 1. • Vieira, Verónica, et al., 2005. "Spatial analysis of lung, colorectal, and breast cancer on Cape Cod: an application of generalized additive models to case-control data." *Environmental Health* 4(1): 1.
11		(More) Spatial Regression Models	TEXTBOOK: Waller, L.A. and Gotway, C.A., 2004. *Applied Spatial Statistics for Public Health Data.* Chapter 9, pp. 370-409. • Wall, M.M. 2004. "A close look at the spatial structure implied by the CAR and SAR models." *Journal of Statistical Planning and Inference* 121(2): 311-324.

Week	Class Dates	Lecture Topic/Readings	Readings
			• Trogdon, J.G. & T. Ahn. 2015. "Geospatial Patterns in Human Papillomavirus Vaccination Uptake: Evidence from Uninsured and Publicly Insured Children in North Carolina." *Cancer Epidemiol Biomarkers Prev*; 24(3); 595–602. • Webster, T., Vieira, V., Weinberg, J. and Aschengrau, A., 2006. "Method for mapping population-based case-control studies: an application using generalized additive models." *International Journal of Health Geographics* 5(1): 1. • Vieira, Verónica, et al., 2005. "Spatial analysis of lung, colorectal, and breast cancer on Cape Cod: an application of generalized additive models to case-control data." *Environmental Health* 4(1): 1.
12		Lab: Spatial Regression #2	None Lab Write-up Due 11/10 by 5pm
13		Geographically Weighted Regression	TEXTBOOK: Fotheringham, S.A., C. Brunsdon & M. Charlton. 2002. *Geographically Weighted Regression*. Chapters 1 & 2. • Wheeler, D. & M. Tiefelsdorf. 2005. Multicollinearity and Correlation among Local Regression Coefficients in Geographically Weighted Regression. *Journal of Geographical Systems* 7:161-187. • O'Loughlin, J. & F. Witmer. 2011. The Localized Geographies of Violence in the North Caucasus of Russia, 1999-2007. *Annals of the Association of American Geographers* 101(1): 178-201. • Grillet, M-E., R. Barrera, J-E Martinez, J. Berti & M-J Fortin. 2010. Disentangling the Effects of Local and Global Spatial Variation on a Mosquito-Borne Infection in a Neotropical Heterogeneous Environment. *American Journal of Tropical Medicine and Hygiene* 82(2): 194–201. • Fotheringham, A.S., Charlton, M.E. and Brunsdon, C. 2001. Spatial variations in school performance: a local analysis using geographically weighted regression. *Geographical and Environmental Modelling* 5(1): 43-66.
		Lab: Geographically Weighted Regression	None Lab Write-up Due 12/1
15		MIDTERM #2	None

Reading Materials

Below, I have some suggestions for books and workbooks that may be useful for you, especially if you want more complex "textbook style" readings or step-by-step instructions for how to conduct specific analyses. Some of these focus on R, some focus on ArcGIS. If you need to learn some skills, these are my suggestions.

Workbooks

- Kurland KS, Gorr WL. 2007. *GIS Tutorial for Health*. ESRI Press: Redlands, CA. ($$)

- Parker RN, Asencio EK. 2008. *GIS and Spatial Analysis for the Social Sciences: Coding, Mapping, and Modeling*. Routledge/Taylor & Francis: New York, NY. ($$)

- Anselin L. 2005. *Spatial Regression Analysis in R: A Workbook.* University of Illinois, Urbana-Champaign: Spatial Analysis Laboratory. Available online: http://geodacenter.asu.edu/system/files/rex1.pdf

- Harris R. 2009. Introduction to Geographically Weighted Regression. University of Bristol: School of Geographical Sciences & CMPO. Available online: http://www.bris.ac.uk/cmpo/events/2009/segregation/gwr.pdf. And here's the data: http://www.bris.ac.uk/cmpo/events/2009/segregation/southeastdata.csv.

  The expectation is that if you need to you work thorough these workbooks at your own pace and use these as a way to build up your confidence and abilities in handling geospatial data. If you want, I can identify the "must do" tutorials. There is some duplication of general areas across these workbooks and there is no need to do all exercises (except for honing your own skills). However, one should note that while there is overlap there are also differences.

Book and other materials

- Bivand, R, EJ Pebesma and V Gomez-Rubio. *Applied Spatial Data Analysis with R*. New York: Springer.
  Supplementary material: http://www.asdar-book.org/

- Cromley E and S McLafferty. 2011. *GIS and Public Health* (2nd ed). New York: The Guilford Press.

- Fotheringham AS, Brunsdon C, Charlton M. 2002. *Geographically Weighted Regression*. West Sussex, England: John Wiley and Sons.
  Supplementary material: http://ncg.nuim.ie/ncg/GWR/software.htm

- Singer JD and JB Willett. 2003. *Applied Longitudinal Data Analysis.* Oxford, New York: Oxford University Press.
  Supplementary material: http://gseacademic.harvard.edu/alda/

- de Smith MJ, Goodchild MF, Longley PA. 2006-2008. *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools*. Available online at: http://www.spatialanalysisonline.com/. This is perhaps the most comprehensive single on-line source for material on both concepts and methods available.

- Waller LA and CA Gotway. 2004. *Applied Spatial Statistics for Public Health Data*. New York: John Wiley and Sons.
  Supplementary material: http://www.sph.emory.edu/~lwaller/WGindex.htm

- Ward MD and KS Gleditsch. 2008. *Spatial Regression Models*. Thousand Oaks, CA: Sage Publications.

Spatial Data Analysis

GEOG 5100

Instructor:

Elisabeth Dowling Root, Associate Professor of Geography
Office Hours:
Office Location: Derby 1160
e-mail: root.145@osu.edu

Graduate TA:

Rohit Mukherjee
Office Hours:
Office Location:
e-mail: mukherjee.110@buckeyemail.osu.edu

Class Times:

Days: Monday & Wednesday
Time: 12:45-2:05 PM
Location: Monday – Derby 1080; Wednesday – Derby 135

Course Description:

This is an introductory course in statistical and computational thinking with a special emphasis on problems in the geographical sciences. This course consists of one weekly lecture and one weekly computer lab period.

Course Objectives:

Statistics is the art and science of finding patterns in data. This class teaches you about patterns in data: How to conceptualize patterns and how to use computers to identify them. This is a first course in statistics. Lectures aim to provide an intuitive understanding of statistical concepts. The goal is to teach you how to ***think*** about statistical problems.

The course is taught from ***a computational perspective***. In this class you will develop a fundamental understanding of statistical concepts and tools. And, yes, there will be a few equations involved. However, I don't believe in memorizing formulas or asking you to regurgitate those formulas. Therefore, this course emphasized how to take the statistical concepts you learn in class and use computers to find solutions to real world problems. Computers are machines and they are very good at repetitive tasks like calculating a formula but they're not very good at thinking. In this class we will pair your critical statistical thinking skills with your computer's ability to crunch lots of numbers. ***We will learn how to apply quantitative data to real world problems and accurately state what the data tells us about the problem at hand.***

The objectives of this course are to:

1. Develop "statistical literacy," a working understanding of statistics that can help you to critically evaluate data-driven results in the discipline of geography.
2. Obtain a basic set of statistical tools for data analysis, with an understanding of how to choose which tool to use, how to implement them in statistical software and how to interpret results.
3. Use R to make graphs and maps, and to implement descriptive statistics, conduct hypothesis tests about sample means, and compute regression analysis.
4. Understand problems arising from the use of spatial data

Required Materials:

Statistical Methods for Geography, 4th edition by P.A. Rogerson. 2010, Sage Publications.

This book is very reasonably priced (especially for a statistics book) and is ***required.*** Having good access to the book will be essential to success in this class. Readings will be assigned from the book weekly. Exams will cover material from the book (in addition to lecture material). Lectures will roughly parallel the assigned readings.

There will be a few additional readings available via PDF on the Carmen course website. These are also required and may be discussed in class.

There is an excellent introductory test for R – *Introductory Statistics with R* by P. Dalgaard – that may be helpful throughout the semester. It's available FREE through the OSU libraries: http://osu.worldcat.org/oclc/317883354. Click on the "View eBook" to see the free online version. I will occasionally suggest you read through chapters of this book.

Grading:

Participation:	10%
Labs (8):	40%
R tutorials (2):	5%
Final Exam:	15%
Exams (3):	30%

Participation credit can be earned in two ways 1) participation in class exercises, 2) participation in classroom discussions. I think it goes without saying that you actually have to attend class to earn a solid participation grade.

Labs will be graded for completeness and accuracy. There are 8 lab assignments. We will begin each lab on Friday, and I will provide you with a demo that you can follow. However, it is highly unlikely that you will complete these labs in class. You will need to finish them on your own. Labs are cumulative and missing a lab can have major consequences for your ability to succeed in the class. I do accept late assignments, but a penalty of 10% will be applied to late work.

R Tutorials are an easy way to get a 5% bump in your grade, and a way for you to become more competent with R throughout the semester, which will help with labs and exams. Basically, complete the tutorial and answer a few questions to prove you did it!

Final exam consists of completing a statistical analysis using the R programming language. An example of a final used a few years ago will be posted on Carmen later in the semester.

There will be three **exams** that will test your ability to apply concepts from class. I use smaller exams rather than midterms and a final to see how you're doing throughout the class. Quizzes are short – if you've studied and kept up with the material in class, they should take you no more than 15-20 min to complete. The first quiz will largely be conceptual, but as the semester goes on you will need to use R to answer many of the questions. *This means it is important to study your programming as well as the statistical concepts in class!*

I will use the scale below to calculate final grades. Note that grades are rounded and determined to 1 decimal place.

Grade	Point Range (out of 100)
A	94 - 100
A-	90 – 93.9
B+	87 – 89.9
B	84 – 86.9
B-	80 – 83.9
C+	77 – 79.0
C	70 – 76.9
D	60 – 69.9
E	59 or lower

Attendance:

Attendance in all classes and labs is mandatory. Consistent attendance is absolutely crucial to success in this class. Attendance will be taken at the beginning of each class session. Excused absences require documented evidence (doctor's note, etc.). **Note that after three (3) unexcused absences, your final grade will begin to drop by a percentage point per unexcused absence!**

Expectations and Etiquette:

I expect everyone to be respectful of class colleagues, the instructor and TA. Class disruptions and side conversations should be kept to a minimum. This includes turning off your cell phone ringer when you enter the class. In my view, talking or using an electronic device in class shows a lack of respect for me but more importantly the people sitting near you who are paying tuition to learn (about things other than your personal life). **Laptops and mobile devices should not be used in the classroom (except on specific dates)**. I will work very hard to make sure that the class operates smoothly but computers sometimes misbehave, please be patient. I understand that this is a difficult class and that sometimes life is even less cooperative than computers. If you have a personal emergency, I will do my best to help you through the class, however ***under no circumstances can you excel in this class without doing ALL of the work it requires***.

University Policies:

Disabilities:

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: **slds@osu.edu**; 614-292-3307; **slds.osu.edu**; 098 Baker Hall, 113 W. 12th Avenue.

Religious observances:

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please let me know if you need to miss class for religious purposes.

Classroom Etiquette:

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Academic Misconduct:

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct http://studentlife.osu.edu/csc/.

Ohio State Department Course Review Concurrence Form

The purpose of this form is to provide a simple system of obtaining departmental reactions to proposed new courses, group studies, study tours, workshop requests, and course changes. A letter may be substituted for this form.

Academic units initiating a request which requires such a reaction should complete Section A of this form and send a copy of the form, course request, and syllabus to each of the academic units that might have related interests in the course. Initiating units should allow at least two weeks for responses.

Academic units receiving this form should response to Section B and return the form to the initiating unit. Overlap of course content and other problems should be resolved by the academic units before forwarding this form and all other accompanying documentation to the Office of Academic Affairs.

A. Information from academic unit *initiating* the request:

Initiating Academic Unit: **Geography** Date:

Registrar's Listing:

Course Number: **5100** Level: U ☑ P ☑ G ☑ Credit Hours: **5**

Course Title:

Type of Request: ☑ New Course ☐ Group Studies ☐ Workshop ☐ Study Tour ☐ Course Change

Academic Unit with related interests asked to review the request (use a separate form for each unit while requesting concurrences from multiple units): **Statistics, Political Science, Sociology**

Date responses are needed: **12/7/18**

B. Information from academic units *reviewing* the request:

☐ The academic unit ***supports*** the proposal
☐ The academic unit ***does not support*** the proposal.
Please explain:

☐ The academic unit suggests:

Signature of Department Chair Signature of Graduate Studies Chair (if applicable)