

Spatial Demography  
Demography 7263  
Summer 2010

M-R 4:00 – 5:55  
Durango Bldg 2.210

Instructor: Dr. Corey S. Sparks  
Office hours: by appointment  
MNT 2.270  
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**Course description:** Spatial data are ubiquitous in human population research, and the processes in population dynamics (fertility, mortality and migration) all have spatial components to them. The goals of this course are to introduce students to the applications and usage of spatial statistics for population research. This class will have a large analytical component with topics to include global and local spatial autocorrelation, neighborhood statistics, analysis of spatial point patterns, spatially autoregressive models and geographically weighted regression.

By weekly readings and practical in-class examples, students will also be exposed to various ways in which spatial data may be incorporated into demographic research.

**Prerequisites:** This course assumes you have a working knowledge of ArcGIS, or another commercially available GIS software package capable of working with shapefiles and geodatabases and producing maps. I also assume you have familiarity with univariate statistics, including regression, and linear models. Some knowledge of matrix algebra would be good; isn't it always though?

**Computer skills:** We will use several software packages during this course. Some of the main ones are: GeoDa (<http://geodacenter.asu.edu/software/downloads>, which requires you to create a username and login), R (<http://www.r-project.org/>), and ArcGIS. GeoDa and R are both freeware, and you must download them from the appropriate website. R will be the only language used in this course, as it is the language in which most spatial statistical methods are being implemented. We will have many in class examples where we tackle various applications of these software packages, so each student must have access to a laptop computer on which they can run these programs. I also have free 1-year licenses for ArcGIS desktop for all students in the class.

**Requirements:** This class will meet once a week from Tuesday, June 1 to Tuesday July 6 on Monday through Thursday from 4 to 5:55 PM. Students are expected to attend all classes and TO BE ON TIME FOR EVERY CLASS. Since I will be going over the how-to's and practical programming of these methods, any missed classes will impact your understanding of the material. If you miss a class it is YOUR RESPONSIBILITY to get any assignments you might miss: I will not contact you if you don't come to class. Although I will be providing examples and in-class activities so you can learn the programming required, you are expected to do at least as much independent learning of the software as I teach in class, this holds in general for your graduate education.

**Grading:** Grades for this class will follow this protocol:  
A (92-100%), B (82-91%), C (70-81%), D (60-69%), F (<59%)  
Grades will be calculated based on the following weights:

30% Homework

30% Midterm (take home)

40% Cumulative final exam (take home) to be turned in during finals period, right now scheduled for July 6 from 1:30 TO 4PM.

**Homework:** Homework will be assigned frequently, and will typically be an exercise using one or more of the programs to accomplish a given task. They will be due one week from the time they are assigned, unless otherwise noted. Homework is your chance to practice what we do in class and hone your skills with the software. All homework must have the accompanying R code with them.

**Required texts:** There are two required books for this course:

Book 1) Applied Spatial Statistics for Public Health Data (WG)

By Lance Waller and Carol Gotway

2004

PUBLISHER: John Wiley & Sons, Incorporated

ISBN: 9780471387718

Website: <http://www.sph.emory.edu/~lwaller/WGindex.htm>

Book 2) Applied Spatial Data Analysis with R (ASDR)

by Roger S. Bivand, Edzer J. Pebesma, Virgilio Gómez-Rubio

Publisher: Springer

ISBN: 9780387781709

Website: <http://www.asdar-book.org/>

**Optional texts** (for those not as familiar with ArcGIS and R):

Getting to know ArcGIS desktop 2<sup>nd</sup> ed. Ormsby T, Napoleon E, Burke R, Groessl C, and Feaster L. ESRI Press 2008.

GIS tutorial: Updated for ArcGIS 9.3 workbook for Arc View 9, 2<sup>nd</sup> ed. Gorr WL and Kurland SK. ESRI Press 2007.

Data analysis and graphics using R: An example-based approach. John Maindonald and John Braun, Publisher: Cambridge University Press, ISBN: 0521861160

John Braun and Duncan Murdoch 2008 A first course in statistical programming with R. Cambridge University Press. ISBN: 0521694248

**Additional readings:** Throughout the semester, you will be given readings from journal articles that will be examples of methods and provide material for class discussions.

### Course schedule

Week	Topic	Reading
1 T 6-1	Course introduction and use of server	
1 W 6-2	Why spatial demography?	Entwisle 2007, Schuurman et al 2007, Voss 2007, Voss et al 2004
1 Tr 6-3	Exploratory analysis 1: Visual exploration of spatial data (GEODA)	WG ch 1&2, ASDR ch 1-2, Anselin et al 2006
2 M 6-7	Principles of spatial data and spatial autocorrelation	WG ch 4, ASDR ch 3&9, Wise et al 1999
2 T 6-8	Exploratory analysis 2: Descriptive analysis of patterns and clusters (GEODA/ArcGIS)	Dormann et al 2007
2 W 6-9	An application of spatial demography: Residential Segregation	Massey and Denton 1988, Reardon and O'Sullivan 2004
2 Tr 6-10	Random processes and point pattern analysis 1 (Neighbor distributions)	WG ch 5, ASDR ch 7, Gatrell et al 1996
3 M 6-14	Point pattern analysis 2 (Ripley's K and L function)	WG ch 5, ASDR ch 7
3 T 6-15	Point pattern analysis 3 (Marked Point patterns)	WG ch 5, ASDR ch 7
3 W 6-16	Aggregating events and cluster detection, disease mapping	WG ch 4.4.3 & 7, ASDR ch 11.1-11.3
3 Tr 6-17	Geostatistics/Variogram models <b>(Midterm Handed Out)</b>	ASDR ch 8.1-8.4, WG ch 8.1-8.2
4 M 6-21	Spatial regression 1 (Review of OLS/Basics of SRM) <b>(Midterm Due)</b>	ASDR ch 10.1-10.4, Ward ch 2&3, WG ch 9.1-9.3
4 T 6-22	Spatial regression 2 (Model specification and testing)	Anselin 2002
4 W 6-23	Spatial regression 3 (Applications)	Chi and Zhu 2008, Sparks and Sparks (In Press), Voss et al 2006
4 Tr 6-24	Spatial regression of count data: Spatial GLM's	ASDR ch 10.5, WG ch 9.4
5 M 6-28	Geographically weighted regression 1 (Model formulation and fitting)	ASDR ch 10.5.3, Brunsdon et al 1996, 1998
5 T 6-29	GWR 2 (Model diagnostics and testing)	Brunsdon et al 1996, 1998, Leung et al 2000
5 W 6-30	Spatial Regimes	Cahill and Mulligan 2007
5 Tr 7-1	Final Handed out and course wrap up	

**Reading list:**

Anselin L 2002 Under the hood: Issues in the specification and interpretation of spatial regression models. *Agricultural Economics* 27 247-267.

Anselin L, Bera A, Florax R and Yoon M 1996 Simple diagnostic tests for spatial dependence. *Regional Science and Urban Economics* 26: 77-104.

Anselin, L., I. Syabri, et al. (2006). "GeoDa: An introduction to spatial data analysis." *Geographical Analysis* 38(1): 5-22.

Brunsdon C, Charlton M and Fotheringham A 1998 Spatial nonstationarity and autoregressive models. *Environment and Planning A* 30: 957-973.

Brunsdon C, Fotheringham A and Charlton M, 1996 Geographically weighted regression: A method for exploring spatial nonstationarity. *Geographical Analysis* 28:4 281 -298.

Cahill, M and Mulligan G 2007 Using geographically weighted regression to explore local crime patterns. *Social Science Computer Review* 25, 174-193.

Chi G, and Zhu J 2008 Spatial regression models for demographic data. *Population Research and Policy Review* 27: 17-42.

Dormann C, et al 2007 Methods to account for spatial autocorrelation in the analysis of species distributional data: a review. *Ecography*.

Entwisle B, 2007 Putting people into place. *Demography* 44:4 687 – 703.

Gatrell A, Bailey T, Diggle P and Rowlingson B 1996 Spatial point pattern analysis and its application in geographical epidemiology. *Transactions of the Institute of British Geographers*. 21: 256-274.

Leung Y, Mei C and Zhang W 2000 Statistical tests for spatial nonstationarity based on the geographically weighted regression model. *Environment and Planning A* 32: 9-32.

Link B and Phelan J 1995 Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior* 35: 80-94.

Phelan J, Link B, Diez-Roux A, Kawachi I and Levin B 2004 "Fundamental Causes" of social inequalities in mortality: A test of the theory. *Journal of Health and Social Behavior* 45:3 265-285.

Schuurman N, Bell N, Dunn J and Oliver L et al 2007 Deprivation Indices, Population Health and Geography: An Evaluation of the Spatial Effectiveness of Indices at Multiple Scales. *Journal of Urban Health* 84:4 591- 603.

Sparks P and Sparks C (In Press) An application of spatial autoregressive models to the study of U.S. county mortality rates. *Population Space and Place*.

Voss P 2007 Demography as a spatial social science. *Population Research and Policy Review* 26: 457-476

Voss P, Long D, Hammer R and Friedman S, 2006 County child poverty rates in the US: A spatial regression approach. *Population Research and Policy Review* 25: 369 – 391.

Voss P, Curtis White K and Hammer R 2004 The re-emergence of spatial demography. Center for Demography and Ecology, University of Wisconsin Madison Working Paper 2004-04.

Ward MD and Gleditsch KS *Spatial Regression Models*. Sage Publications. Quantitative Applications in the Social Sciences #155.

Wise S, Haining R and Signoretta 1999 Scientific visualization and the exploratory analysis of area data. *Environment and Planning A* 31: 1825-1838.

**Classroom etiquette:** It is expected that all students be on-time for class and behave with courtesy and respect for the instructor and all fellow students during class. Should behavioral disruptions occur which interfere with the general learning environment, the student may be reported to the Office of Student Judicial Affairs in accordance with section 202 of the Student Code of Conduct (<http://www.utsa.edu/OJSA>).

With respect to cell phones, I have a limited patience with them and I ask that you turn yours **OFF** prior to the beginning of class.

**Academic Integrity:**

Part I, Chapter VI, section 3.22 of the Rules and Regulations of the Board of Regents of the University of Texas System provides the following: “Any student who commits an act of scholastic dishonesty is subject to discipline. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, or any act designed to give unfair advantage to a student or an attempt to commit such acts.” Acts of scholastic dishonesty will be referred to the UTSA Office of Student Judicial Affairs (<http://www.utsa.edu/OJSA>). **IN OTHER WORDS DON’T CHEAT; IT ROBS YOU AND OTHERS OF YOUR INTEGRITY, PRIDE, AND THE VALUE OF YOUR EDUCATION.**