Spatial Methods for Health and Population Research
GEOG 8104: Special Topics in Quantitative Geography

Mondays 2:15 – 4:50
Derby Hall Room 1116
Prof. Elisabeth D. Root

General Introduction
This course is a graduate-level seminar which surveys current topics in health and population research with a focus on theoretical/conceptual motivations and technical approaches for analyzing spatially explicit data for social science research. Throughout the seminar we will review the broad field of spatial data analysis and the range of issues that arise when analyzing georeferenced data. We will read and discuss selections from the current literature and critique how spatial data and statistical methods are being integrated into population and health research. We will also gain hands-on experience with a variety of spatial statistical methods such as spatial regression, geographically weighted regression, and cluster analysis.

Course Objectives
By the end of this course, students will be able to:
1. Critique spatial analytic methods in selected papers,
2. Present arguments about appropriate and inappropriate spatial research methods for a given research problem,
3. Recognize the complexities inherent in using spatial data and choose appropriate methods for data analysis, and
4. Implement spatial statistical methods using simple population or health datasets.

I have not designed this as a GIS course but throughout the semester you will have plenty of opportunity to learn ArcGIS and other software, namely SatScan (cluster analysis) and R (spdep) for spatial analysis. R is an extremely flexible program that facilitates exploratory spatial data analysis, spatial regression modeling, geographically weighted regression, cluster methods and much much more. All of these software packages are free, so we don’t need to do any specific work in the lab. You may use any other software you wish (such as Stata or SAS).

Prerequisites
Some prior experience with GIS software is useful but not a prerequisite. What is a prerequisite for this course is a solid understanding of multivariate statistics and some experience with advanced regression analysis. It is also important to have some experience with the mathematical notation typically used for statistical learning.

What I Think About Teaching & Research
My philosophy of teaching is that students need to learn to learn. This may sound strange, after all haven’t we been in school a really long time? Don’t we already know how to learn? The answer to this question is yes, we do know how to learn in some ways but college should require greater depth and breadth of thinking, especially as a graduate student. What I found
out during my PhD is that I needed to teach myself a great deal because there were often no
classes on the methods or subjects in which I became interested. So, I think it’s very important
for graduate students to learn how to find the information they need through research and
how to apply it to real world problems.

The other thing I found out after working in both the private sector and at a University is that
very little research is done by one person. Most of the best science is conducted by teams of
researchers who brainstorm and discuss and learn together. In fact, many of the big federal
funding agencies (NIH, NSF, EPA) are increasingly looking to fund multidisciplinary research
collaborations. Learning in this class will therefore focus on research, reading, listening,
communication and collaboration with other students.

As graduate students, many of you plan to continue on to academic positions. In these
positions, you will be expected to teach! So, I have also added a component to this class where
you will have the opportunity to teach your peers.

Course Format
Our class meetings will be organized around three rotating activities: lecture (by me), student
paper presentations and discussion (by you) and lab or hands-on exercises (in groups).
Typically, graduate seminars don’t have much professor-led lecture. I have experimented in the
past and have found that for this class, where a significant amount of technical material is being
presented, some lecture is appropriate and useful.

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:

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<tr>
<th>Component</th>
<th>Weight</th>
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<tr>
<td>Group lab write ups</td>
<td>60%</td>
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<tr>
<td>Individual paper presentation</td>
<td>15%</td>
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<td>Discussion lead</td>
<td>15%</td>
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<td>Participation and engagement</td>
<td>10%</td>
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Group lab write-ups
Students are required to complete 4 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. I expect that you will work in groups of 2 to get the lab done, which
means that you should turn in one lab report per group.

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.

**Individual presentation**

Students will individually present a paper of their choosing once during the semester. You will sign up for a presentation day, and then conduct a literature search for a peer-reviewed journal article that reflects the topics discussed the prior week. You will submit this paper to me for approval at least 6 days prior to your in-class presentation. Once you have received approval for your selected paper, you will prepare a 10-15 minute presentation, with PowerPoint slides, that “teaches” the article to the other students in the class. This presentation must consist of:

1) A presentation of the research question
2) An explicit explanation of the methods used by the author, presented in a way that you are “teaching” the methodology to the students in the class
3) A short presentation and discussion of the results
4) Some discussion questions for the class which:
   a. explore the assumptions in the author’s argument(s), research question(s), and methodology,
   b. evaluate the validity of the methodology used to answer the research question(s) and discuss if there were other “better” ways to conduct the research, and
   c. examine the implications of the argument for other substantive topics.

**Discussion Lead**

One week out of the semester, you will be asked to prepare for and lead discussion of the assigned readings. I will help, but you must come prepared to help lead discussion and goad your peers into helping you discuss the assigned papers.

**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.
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<tr>
<th>Week</th>
<th>Class Dates</th>
<th>Lecture Topic/Readings</th>
<th>Readings</th>
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<td>3 9/11</td>
<td>ESDA &amp; Spatial Autocorrelation</td>
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<td>4 9/18</td>
<td>ESDA &amp; Spatial Autocorrelation</td>
<td>Student Papers</td>
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<td>Week</td>
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<td>5</td>
<td>9/25</td>
<td>Lab: ESDA &amp; Spatial Autocorrelation</td>
<td>None Lab Write-up Due 10/6 by 5pm</td>
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<td>7</td>
<td>10/10</td>
<td>Spatial Regression Models</td>
<td>Student Papers</td>
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<td>9</td>
<td>10/23</td>
<td>Lab: Spatial Regression</td>
<td>None Lab Write-up Due 11/3 by 5pm</td>
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<td>Week</td>
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<td>11</td>
<td>11/6</td>
<td>Geographically Weighted Regression</td>
<td>Student Papers</td>
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| 12   | 11/13       | Lab: Geographically Weighted Regression | None  
Lab Write-up Due 11/27 |
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<td>15</td>
<td>11/27</td>
<td>Lab: Spatial Cluster Analysis</td>
<td>None</td>
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<td>Lab Write-up Due 12/8</td>
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<td>14</td>
<td>12/4</td>
<td>Spatial Cluster Methods</td>
<td>Student Papers</td>
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**FINAL PROJECT DUE 12/4**
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**


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**


