Geography 6938: Applications in GIS for Spatial Epidemiology and Disease Ecology

**Instructor:** Dr. Jason Blackburn

**Contact:** 392-0494 x207 jkblackburn@ufl.edu

**Office:** Geography 3124
**Office hours:** Mondays 1 – 230 pm & *appointments via email

*appointments can be made in Geography or EPI

**Class meetings:** Monday 3-5 period (935am – 1235 pm)
**Meeting location:** Room 3018 Turlington GIS Laboratory

**Background**

This is a 3 credit-hour course focused on the application of exploratory spatial data analysis, local spatial statistics, and ecological modeling to disease ecology with an emphasis on zoonoses - those diseases that affect both animals and humans. It has been suggested recently that global public health is one of the fastest growing areas of study across American universities. Toward this, UF is on the forefront of disease ecology with the opening of the Emerging Pathogens Institute to compliment its long history in public and veterinary health. As part of this effort, the Geography department now offers a variety of courses in medical geography and disease modeling. Throughout this course we will explore the use of geographic information systems, spatial statistics, and ecological niche models to in examining disease distributions, frequency, and environmental conditions. We will focus on zoonotic systems. Specifically, we will investigate the geography of spillover, when disease in one population (such a wildlife herd) spills over to infect another species, such as humans or domestic cattle. Students will have an opportunity to learn and apply several popular GIS and spatial statistical techniques to disease and climate data sets. These will include the use of Anselin's local Moran's I, Getis' Gi*(d), Rushton's DMAP spatial filter, and the spatial scan statistic to explore spatial and spatio-temporal patterns of spatial data. Students will also explore ecological niche theory and its application to disease modeling, such as genetic algorithms and logistic regression. The course is setup to allow students the opportunity work with data sets of their choice for a final project, and graduate students are encouraged to use thesis/dissertation related data. The goal of the course is to introduce students to the many and varied opportunities for GIS and spatial analysis in GIS, with an emphasis of ecological processes and environmental relationships between diseases and their hosts. Readings are provided and there is no required text for this course. Students from across campus are encouraged to enroll to foster cross training that will bridge the skills of geographers, epidemiologists, modelers, and public health.

In this course, students can expect to learn (course objectives):
1) How to define zoonoses and spillover and relate spatial processes to spillover dynamics
2) How to map disease and visualize statistical outputs (graphically and with maps)
3) How to map and manage environmental data (e.g. climatic data)
4) How to employ global measures of spatial autocorrelation
5) How to employ local measures of local spatial autocorrelation
6) Spatial filtering for disease mapping
7) A primer on ecological niche modeling
8) How to compose GIS related methodology and results sections for manuscripts using laboratory write-ups a practice
9) How to publically present GIS-related data and analyses to scientific audiences, particularly non-GIS or non-epidemiology audiences

Prerequisite

Geography majors are required to have GIS 3043 or GIS 3xxx (GIS Models for Public Health) and Geography 4167C (Intermediate Quantitative Analysis). Graduate students should have had an undergraduate course equivalent to GIS 3043 or GIS 3xxx (GIS Models for Public Health) and Geography 6161C or equivalent or consent of the instructor. Students from public health backgrounds can inquire about course equivalents.

Student Evaluation

This course will use a variety of methods to evaluate student performance:

(6) Laboratory practical exercises with short lab write-ups (20 pts each x 7)
(5) Written homework assignments aimed at understanding the fundamentals of zoonoses and spillover dynamics (20 pts each x 5)
(1) Written paper on a GIS project of the student's choice (with instructor approval) (100 pts)
(1) Presentation on the final paper (10 minutes with PowerPoint) (100 pts)
(1) Student participation in class (100 pts)

Undergraduate term papers and final projects will differ from those of graduate students enrolled in GEO 6938 by length, scope of analysis, and use of peer reviewed references to preface analyses and discuss results. Undergraduate oral presentations will be of equal time to present, but require a less rigorous introduction and discussion than graduate students. All students will participate in the classroom peer review process for final papers.

Grading Policy

This course will employ the A – D grading scale, with the 90>A, 80 – 89 B, 70 – 79 C, 60 – 69 D, <60 failing grading scale.

Text

Class attendance

Please be prepared to come to class for the entirety of the class and the semester. We meet only once per week, so attendance is vital to success. This is a small class group, so non-participation will be noticed and addressed by the instructor early. Class begins at 9:35 am, and it breaks at 12:35 pm, not 12:15. Please be sensitive to others, as you will be asked to present and to watch their presentations, absence will be noticed and if excessive punished by a lack of participation points towards the final grade.

Make-up exam and late work

Life happens and circumstances exist where you may not be able to make it to every class or turn in work on-time. If I do not know the circumstances for late work, I cannot make that judgment. Communication on late work is essential. If you cannot attend class, notify me via email or phone. If you require a make-up exam, notify me ahead of time to sort out an arrangement. Failure to notify and approve a missed exam or laboratory due date may result in a 0 for that activity.

Students with disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

UF grading policies

Please see the UF Registrar’s grading policies for current guidelines not discussed in class. http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html

Honor Code

Students are expected to abide by the UF honor code and ethical conduct, listed on the following website: http://www.dso.ufl.edu/stg/

Other Concerns

Please be aware that the University Counseling Center (392-1575), the Student Health Care Center (392-1161) and Student Mental Health (392-1171) can assist students as they work through personal, academic and social issues. Please take care of your health and watch for swine flu symptoms. Provide advance notice and obtain documentation for excused absences where possible. Please keep your cell phones off and do your best to not distract other students during class time.
<table>
<thead>
<tr>
<th>WEEK</th>
<th>Topic</th>
<th>Readings</th>
<th>Lab/HW</th>
<th>Lab due</th>
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<tbody>
<tr>
<td>1 (9 Jan 12)</td>
<td>Introduction to GIS for zoonoses &amp; Disease Ecology</td>
<td>Ch 1 &amp; Ch 2</td>
<td>HW1</td>
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<td>2 (16 Jan 12)</td>
<td>NO CLASS Martin Luther King, Jr Day</td>
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<td>3 (23 Jan 12)</td>
<td>Mapping cases: points- density; polygons- choropleth maps;</td>
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<td>HW1</td>
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<td>4 (30 Jan 12)</td>
<td>Basic spatial statistics: spatial means, standard distance; bandwidths; Spatial filtering techniques</td>
<td>Fotheringham et al. 2003; Curtis and Lee 2010;</td>
<td>L1</td>
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<tr>
<td>5 (6 Feb 12)</td>
<td>Global measures of spatial autocorrelation: Ripley's K plots</td>
<td>Ch 3, 4;</td>
<td>HW2</td>
<td>L1</td>
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<tr>
<td>6 (13 Feb 12)</td>
<td>From Global to local -finding clusters; Spatial clustering with SaTScan</td>
<td>Getis et al. 2003; Ch 4</td>
<td>L2</td>
<td>HW2</td>
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<td>7 (20 Feb 12)</td>
<td>Getis Gi*(d) and hotspot analysis</td>
<td>Ch 5</td>
<td>HW3</td>
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<td>8 (27 Feb 12)</td>
<td>LISA with Local Moran's I and GeoDa</td>
<td>Kracalik et al. 2011; Ch 5</td>
<td>L3</td>
<td>HW3/L2</td>
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<td>9 (5 Mar 12)</td>
<td>NO CLASS SPRING BREAK</td>
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<td>10 (12 Mar 12)</td>
<td>Bivariate LISA with GeoDa; Bayes empirical smoothing with GeoDa</td>
<td>Hu et al. 2010; Ch 6</td>
<td>HW4/L4</td>
<td>L3</td>
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<td>11 (19 Mar 12)</td>
<td>Spatio-temporal modeling with SaTScan;</td>
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<td>HW4</td>
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<td>12 (26 Mar 12)</td>
<td>Climate data: interpolating values across space; Zonal statistics; variable plots</td>
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<td>HW5</td>
<td>L4</td>
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<td>13 (2 Apr 12)</td>
<td>Ecological modeling - linking disease with environment</td>
<td>Ch 7, 8</td>
<td>L5</td>
<td>HW5</td>
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<td>14 (9 Apr 12)</td>
<td>Introduction to ecological niche modeling with openModeller</td>
<td>Blackburn et al. 2007; Blackburn 2010; Joyner et al. 2010; Rogers 2006;</td>
<td>L6</td>
<td>L5</td>
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<td>15 (16 Apr 12)</td>
<td><em>Final presentations &amp; DRAFT 1 TERM PAPERS DUE (MUST DO)</em></td>
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<td>REVIEWS</td>
<td>L6</td>
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<td>16 (23 Apr 12)</td>
<td>Revised draft of term paper due electronically</td>
<td><strong>FINAL TERM PAPER DUE 5 PM 30 APRIL ELECTRONICALLY</strong></td>
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