GIS 4424C: Applications in GIS for Zoonoses and Disease Ecology

Instructor: Dr. Jason K. Blackburn

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Office: Geography 3133
Office hours: Via Zoom Monday's 2 – 3 PM and Wednesdays 2 – 3 PM

This is an online class with asynchronous course delivery. We will only meet live during pre-arranged office hours or scheduled one-on-one meetings.

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. Throughout this course we will explore the use of geographic information systems, spatial statistics, and ecological models (e.g. logistic regression and ecological niche models) to in examining disease distributions, frequency, and environmental conditions. These explorations are completed using software available in the computer lab or UF Apps (many apps are open source and can be downloaded). We will complete lab assignments using GIS software or code. We will focus on zoonotic systems. 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 and Ord's G statistics, 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, with an emphasis of ecological processes and environmental relationships between diseases and their hosts (and vectors). 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 will be expected to (course objectives):

1) Define diseases and relate spatial processes to disease outbreak dynamics
2) Map disease and map statistical outputs (graphically and with maps)
3) Perform basic R functions for statistics and graphing in epidemiology

4) Map and manage environmental data (e.g. climatic data)
5) Employ global measures of spatial autocorrelation
6) Employ local measures of local spatial autocorrelation
7) Understand the basic theory and application of ecological niche modeling
8) Compose GIS related methodology and results sections for manuscripts using laboratory write-ups a practice
9) Publicly present GIS-related data and analyses to scientific audiences, particularly non-GIS or non-epidemiology audiences
10) Evaluate and train a group on the basics of spatial statistical techniques not taught by the instructor

Prerequisite

Students should have had an undergraduate course equivalent to GIS 3043 or GIS 3420C (GIS Models for Public Health).

Student Evaluation

This course will use a variety of methods to evaluate student performance. For all graded work in the course, *rubrics are provided ahead of grading through the online system (currently Canvas)*.

(8) Laboratory practical GIS exercises with short lab write-ups (25 pts each x 8 = 200 points)

(12) Quizzes on course content knowledge (10 pts each x 12 = 120 pts)

(1) First draft of written paper on a GIS project of the student's choice (with instructor approval) (40 pts)

(1) Peer review of classmate's paper following a specific (provided) rubric (30 pts)

(1) Revision of GIS project paper based on peer review (30 pts)

(1) Presentation on the final paper (15 minutes with PowerPoint) (75 pts)

Student participation in class specifically for participation in group discussions (30 pts), attendance to lectures/lab (20 pts), and collegiality and timeliness of peer review efforts for the final project (30 pts). There is a rubric provided in Canvas for participation grading. (80 pts)

Total points in class = 575 **The graduate version of this course has an additional 100 points and a teaching requirement

Grading Policy

This course will employ the A – E grading scale, with 95≥A, 89-94 A-, 86-88 B+, 83-85 B, 79-82 B-1, 76-78 C+, 73-75 C, 72-69 C-, 68-66 D+, 63-65 D, 59-62 D-, <59 E,. http://www.isis.ufl.edu/minusgrades.html

Text

This course has a reading list updated regularly and PDF of all readings are provided ahead of time by the instructor.

Brunsdon, Chris, and Lex Comber, *An Introduction to R for Spatial Analysis and Mapping* (Sage, 2015) is a required text for this course. It is available as an eTextbook.

As an optional reference text, look at Stevenson et al. (2008). *Spatial Analysis in Epidemiology*. Oxford Press. 208 pages.

Class attendance, make-up exams, and late work

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

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.

For more information visit: http://www.dso.ufl.edu/drc/

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.

Recording of live meetings via Zoom

Our group office hours sessions, or any meetings where I answer questions, may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voice recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording, and unauthorized sharing of recorded materials by students or any other party is prohibited.

COVID-19

Our class meetings are asynchronous. However, if you are on campus, please be sure to follow COVID-19 guidelines. You can find the most up-to-date information on COVID-19 and the UF response here:

https://coronavirus.ufl.edu/

WEEK	Topic	Readings	Lab	Lab due
1	Introduction to GIS epidemiology and disease ecology; Basic spatial statistics: spatial means, standard distance; bandwidths	TBD		
2	Mapping cases: points- density; polygons- choropleth maps; bandwidth estimation techniques; Kernel Density Estimation	Assigned: Thrusfield ch 2 – 4*	1	
3	Applying GIS to spatial epidemiology questions: applying what we've learned so far	Fotheringham et al. 2003;	**2**	**1**
4	Global measures of spatial autocorrelation: Ripley's K plots; Average Nearest Neighbor Index	Blackburn et al. 2014; Nelson and Boots 2008	**3**	**2**
5	From Global to local -finding clusters: Point Pattern Analysis and Aggregation – *Defining local;* Getis Gi*(d) and hotspot analysis	O'Brien et al.	**4**	**3**
6	LISA with Local Moran's I and GeoDa; Bayes empirical smoothing with GeoDa	Getis et al. 2003;		**4**
7	Rate estimate issues: Bayes empirical smoothing with GeoDa	Anselin 1995;	**5**	
8	SaTScan and space-only clusters with point pattern analysis	Anselin 1995; Abdullayev et al. 2012; Hu et al. 2010;		**5**
9	SatScan and space-time clustering	Kulldorff et al.; Root et al.	**6**	**5**
10	Ecological modeling 1 - linking disease with environment using R; preparing data and using basic R code in R Studio	Kulldorff et al; Blackburn et al. 2015	**7**	**5**
11	Ecological modeling 2 - linking disease with environment using logistic regression; Draft 1 of term paper due	Lyons et al. 2013; Bagamian et al al. 2013; Blackburn 2010		**7 pt 1**
12	Ecological niche modeling: predicting a distribution with a genetic algorithm – Presence Only tools	Blackburn et al. 2014; Mullins et al. In Review (TBP*)		**7 pt 2**
13	Ecological niche modeling with boosted regression trees – best practices in modeling species distributions	Blackburn 2010	**8**	
14	Grad student presentations to the class (uploaded; all will watch); Draft 1 of paper due and peer review to complete	TBD		**8**
15	***Final presentations & Final draft of term paper due electronically***			**Final paper**