

## **GIS 6456C: Applications in GIS for Zoonoses and Disease Ecology**

**Instructor:** Dr. Jason Blackburn

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**Office:** Geography 3121

**Office hours:** Tuesday 2 pm – 4 pm & \*appts via email

*\*appts can be made in Geography or Emerging Pathogens Institute (if meeting at EPI, you MUST have a photo ID to get into the building)*

**Class meetings:** Tuesday (T) 3-5 period (10:40 am – 1:40 pm)

**Meeting location:** Room 3006 Turlington GIS Laboratory\*\*

*\*\*please expect to meet for the entire class period.*

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### **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 3xxx (GIS Models for Public Health) and Geography 6161C or equivalent.

### **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)

(1) Review of a technique not taught by the instructor. Each graduate student will provide an overview presentation (10-15 minutes) on a technique and appropriate readings describing the test (1x reading) and at least 1x paper applying the technique. (100 pts) *\*Undergraduates do not have this course requirement or these points*

Student participation in class accounting for participation in discussions, attendance, and collegiality and timeliness of peer review efforts. There is a rubric provided for participation grading. (100 pts)

**Total points in class = 725**

## **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.

WEEK	Topic	Readings	Lab	Lab due
1	Techniques and software: Programming geospatial data in R, using Q-GIS, using ArcGIS	TBD		
2	Introduction to GIS epidemiology and disease ecology; Basic spatial statistics: spatial means, standard distance; bandwidths	Assigned: Thrusfield ch 2 – 4*	1	
3	Mapping cases: points- density; polygons- choropleth maps; bandwidth estimation techniques;	Fotheringham et al. 2003;		
4	Kernel Density Estimation	Blackburn et al. 2014; Nelson and Boots 2008	2	1
5	Global measures of spatial autocorrelation: Ripley's K plots; Average Nearest Neighbor Index	O'Brien et al.	3	2
6	From Global to local -finding clusters: Point Pattern Analysis and Aggregation – <i>Defining local</i> ; Getis Gi*(d) and hotspot analysis	Getis et al. 2003;	4	3
7	LISA with Local Moran's I and GeoDa;	Anselin 1995;		4
8	Bayes empirical smoothing with GeoDa	Anselin 1995; Abdullayev et al. 2012; Hu et al. 2010;	5	
9	SaTScan and space-only clusters with point pattern analysis	Kulldorff et al.; Root et al.	6	5
10	SatScan and space-time clustering	Kulldorff et al; Blackburn et al. 2015	6	5
11	Infected here, infected there: analyzing spatio-temporal animal movement data; Thinking about programming in R	Lyons et al. 2013; Bagamian et al. 2013; Blackburn 2010	7	
12	Infected here, not infected there: linking animal movements to environmental sources of disease; modeling with R	Blackburn et al. 2014; Mullins et al. In Review (TBP*)		
13	Ecological modeling 1 - linking disease with environment using R; preparing data and using basic R code in R Studio	Blackburn 2010	8	7
14	Ecological modeling 2 - linking disease with environment using the Rattle Package in R; Draft 1 of term paper due	TBD		8
15	<b><i>Final presentations &amp; Final draft of term paper due electronically</i></b>			