

Biology 5050: “Spatial Analysis”

Instructor: Corey Devin Anderson, Ph.D. (Preferred salutation: “Dr. Anderson”)

Lecture location: Bailey Science Center, Room 1024

Day and time: MWF 10:00 to 10:50 AM

Lab location: Bailey Science Center, Room 3018

Day and time: M 12:00 to 2:50 PM (section A); M 3:00 to 5:50 PM (section B)

Final Exam/Last unit exam: Friday, 12 December (8:00 to 10:00 AM)

Office: 1208 Bailey Science Center

Office Hours: Friday 3:00 to 5:00 PM

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*Policy on appointments and drop-ins: I always prefer that students come to office hours, use e-mail, or make an appointment; if these avenues are not feasible, unscheduled drop-ins are permitted (if I am available).

Course description:

A survey of key concepts and statistical methods for the statistical analysis of spatial data, designed for environmental and life sciences but open to all relevant disciplines. The course is intended to complement existing courses in Geographic Information Systems (GIS) and biostatistics, which do not cover the statistical analysis of spatially dependent data.

Some overlap exists between the present course and GEOG 4710 (Statistics for Geoscientists); however, the purview of the present course extends beyond geostatistics.

The lecture part of the course explores the basic theory and equations underlying the various statistical methods/models, supplemented by examples from the scientific literature and outside readings from a textbook. Mastery of lecture concepts will be assessed via three in-class unit examinations and five problem sets. The laboratory part of the course is intended to extend and reinforce the methods presented in lecture by providing hands on experience and assistance with data acquisition and analysis.

Standards

Education outcomes for MS Degree in Biology: 2

Topics covered:

- Introduction to spatial processes and patterns.
- Data structures, coordinate systems, and map projections.
- Spatial variance, covariance, and autocorrelation.
- Scattered Data analysis.
 - Spatial autocorrelation functions and correlograms: Moran's I, Geary's c, Join-count analysis, Mantel test.
 - Variography and interpolation.
 - Modeling and removing autocorrelation.
- Nonstationarity and local spatial statistics.
 - LISAs, Local Geary's c, Getis-Ord statistics.
- Anisotropy analysis.
- Contiguous unit analysis.
 - Quadrat variance/covariance analysis; spectral and wavelet analysis.
- Point pattern analysis.
 - Dispersion indices; nearest-neighbor analysis; second-order analysis (Ripley's K function).
- Boundary and cluster analysis.
 - Wombling, agglomerative clustering, K-means clustering.

Book

Required text:

- 1) *Spatial Analysis A Guide for Ecologists* by Marie-Josée Fortin and Mark Dale; the publisher is Cambridge University Press.

Computing

Access to a PC with a Windows operating system is required for this course. Apple Macintosh computers may be used, but are limited to command line and batch modes for some of the software we will be using.

You will need to download the following freeware:

- PASSaGE 2
 - <http://www.passagesoftware.net/download.php>

This and other software required for the course will be available in the Biology Computing Center.

Grading

Because the point distribution for most classes is not normally distributed, I use a nonparametric grading system, based on ranks. In other words, students will be evaluated based on how well they perform relative to other students in the class. If the number of graduate students in the course is limited, I will compare scores for graduate students to the point distribution for undergraduates, where I typically expect graduate students to perform at a higher level than undergraduates.

There are a total of 700 points that can be earned in this course: 300 points from lecture exams, 300 points from problem sets, and 100 points for attendance.

- The unit exams are worth 100 points each. The third unit exam will be on the date of the final.
- There will be six problem sets (worth 50 points each). Late problem sets will be docked 5 points/day.
- I will randomly sample attendance 10 times; each time you are present you will receive 10 points (for a possible total of 100 points).

Cheating policy

Do not cheat on an exam. You will receive a zero on the exam and will be reported to the Office of Student Affairs.

Cell phone and computer policy

Please turn your cell/smart phones off (or on silent) when you enter the classroom. If you want to use your computer in class you will need special permission. Cell/smart phones are strictly prohibited during exams; any student who has a cell/smart phone out during an exam will receive a zero on that exam.

Students with disabilities

Students requiring classroom or testing accommodations because of documented disabilities should discuss their needs with the instructor at the beginning of the semester.