University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Spatial Ecology in R

3 credits

MEES 698C
Fall 2022

Course Description

Many questions in ecology originate from the observation that organisms and the ecological processes that influence them vary in space. This course emphasizes the study of spatial ecological patterns, the processes that generate and maintain them, and the use of the R statistical language to analyze, simulate, and understand the interplay between spatial pattern and ecological processes. The objective of the course is to introduce students to key theories and concepts relevant to the study of spatial patterns and processes in different ecosystems, while developing the R skills necessary to work with spatial data and answer related research questions.

Classes will incorporate a mix of lectures, implementation of major analytical methods using R, including species distribution models and animal movement analyses, and some student-led discussions of journal articles. In addition, the course will incorporate tools such as *GitHub* and *Slack* to teach collaborative research and reproducible science. The course takes a hands-on, student-directed approach to learning, and uses lectures, coding assignments, literature discussions, and a capstone project to reinforce concepts.

Prerequisites

Consent of instructors required for registration. Required: General Ecology and **basic proficiency in R programming**. The minimum R skills include: (i) read / write datasets, (ii) manipulate common data formats (indexing, subsetting, etc), (iii) plotting, (iii) use packages and functions to perform analyses, (iv) independently debug / error-check scripts. Recommended: Courses in GIS and statistics.

Textbooks

Required: *Spatial Ecology and Conservation Models: Applications with R.* Fletcher R & Fortin MJ. Springer.

INSTRUCTORS:

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CLASS MEETING DETAILS:
Day: Monday & Wednesday
Time: 11:00 - 12:30 PM
Location: AL 315 and Zoom
Zoom Details:
Meeting Link
Meeting ID: 856 9511 7506
Passcode: 4589

CURRICULUM FULFILLMENT:
MEES 698C fulfills an **Elective** MEES requirement.

Course Communication

We will use *Google Drive* to distribute materials and *GitHub* to store / share code and submit homework assignments. We will use *Slack* for class communication. Instructors will respond promptly during working hours and will be available for phone and Zoom calls with students, as needed and when coordinated in advance.

Upon completion of this course, the student will be able to:

1. Prepare, manipulate, and analyze geospatial (vector and raster) datasets in R.
2. Describe how biotic and abiotic processes generate spatial patterns and how these interact across scales.
3. Develop and interpret species distribution models using species occurrence records and environmental predictors.
4. Analyze spatial point patterns to make inferences regarding ecological processes and spatial patterns.
5. Analyze animal movement patterns and apply process-based models to make inferences about how moving animals interact with their environment.
6. Evaluate the use of species distribution data and models for informing management and conservation.

Course Assessment and Grading

Performance in each of the learning outcomes will be reinforced and evaluated through a combination of class participation and journal discussions (10%), homework assignments (45%), and a final project (45%). Performance of the instructors will be assessed through anonymous course evaluations. 25% will be deducted per day from late homework assignments. We do not grant exceptions to this policy, though the homework assignment receiving the lowest score will not be used in assigning final grades. Missed project deadlines will be excused only in the case of an emergency with supporting documentation.

1. *Discussions (10%)* - We will hold several in class discussions of current or key papers. Before class, each student will submit a brief statement summarizing one aspect of the paper they really liked and one point of criticism, for example highlighting how the study could be improved or something they may have done differently. Students will be evaluated on their preparation, which includes (1) leading discussions, (2) their submitted pros/cons summary statements, and (3) in class participation.
2. *Homework (45%)* - Concepts learned in the course and proficiency with R programming will be practiced and reinforced through the completion of in-class and take home assignments.
3. *Capstone Project (45%)* - We will end the course with presentations of final projects that incorporate the use of spatial analyses to explore spatial patterns / processes in a system of their choosing. We will discuss the specifics of the final project a few weeks into the semester. Students will be required to meet with the instructors several times throughout the semester to encourage progress on the final project.

Course Expectations

Our goal is to help you meet the learning objectives listed above and students that are active in learning will be most successful. Students are expected to (1) attend all class meetings; (2) complete all HW assignments and readings; (3) actively participate by asking questions; and (4) contribute to / lead in-class activities. **Zoom Expectations:** (1) wear proper attire; (2) video on at all times (as internet connection allows); (3) mute your microphone when not speaking. Students at the Appalachian Laboratory and FSU are expected to attend the course in-person unless remote attendance has been pre-arranged with instructors.

This class strives to be an inclusive environment with the understanding that we learn from the many perspectives that come from having differing backgrounds and beliefs. We reject all forms of prejudice and discrimination, including but not limited to those based on age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status. Faculty, students, and guests are expected to commit to creating an environment that facilitates inquiry and self-expression, while also demonstrating diligence in understanding how viewpoints of others may be different from their own. We encourage you to speak up and share your views, but also understand that you are doing so in a learning environment in which we all are expected to engage respectfully and with regard to the dignity of all others.

Campus Policies

The University of Maryland Center for Environmental Science has drafted and approved various academic and research-related policies by which all students and faculty must abide. Please visit the following website for more information on the University of Maryland Center for Environmental Science Code of Academic Integrity and Policy III-1.00: Policy on Faculty, Student and Institutional Rights and Responsibilities for Academic Integrity.