University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Spatial Ecology in R

3 credits

MEES 6xx
Fall 2022

Course Description

Many ecological questions in terrestrial and marine systems 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 construction of models in R to analyze, simulate, and understand the interplay between spatial pattern and ecological processes. The objective of the course is to introduce students to ecological theories and concepts relevant to the study of spatial ecological patterns in terrestrial and marine systems, while providing the R skills necessary to articulate and answer scientific questions by confronting models with data.

In addition to programming in R, 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, readings, journal discussions, coding assignments, exams, and a capstone project to reinforce concepts.

Prerequisites

Consent of instructors required for registration. Required: General Ecology and **basic proficiency in R programming**. Recommended: Courses in GIS and statistics. 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.

Textbooks

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

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.

INSTRUCTOR DETAILS:

Matt Fitzpatrick
mfitzpatrick@umces.edu
(240) 803-7826 (cell)
Website

Emily Cohen
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(601) 447-5332 (cell)
Website

CLASS MEETING DETAILS:

Day: Tuesday & Thursday
Time: 12:30 - 1:50PM
Zoom Details:
Meeting Link
Meeting ID: 941 7642 7231
Passcode: 842272

CURRICULUM FULFILLMENT:

MEES 614 fulfills an **Elective** MEES requirement.

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.

Expectations

Our goal is to help you meet the learning objectives listed above, but students must be active in this process. Students are expected to (1) attend all class meetings; (2) complete all readings and HW assignments; (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.

Course Assessment

Performance in each of the learning outcomes will be reinforced and evaluated through a combination of participation in class discussions (10%), homework assignments (20%), two examinations (20% x 2 = 40%), and a final project (30%). Performance of the instructors will be assessed through anonymous course evaluations.

1. *Discussions (10%)* - Most weeks we will hold an in class discussion of one or more journal articles. To help kick off the discussion, a student discussion leader will **briefly** summarize (~2 mins.) the paper and lead the discussion. Each student will lead the discussion of two papers throughout the semester. In addition, before class, each student will submit to the discussion leader 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 (20%)* - 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. *Exams (40%)* - There will be two exams that will assess understanding of course concepts.
4. *Capstone Project (30%)* - We will end the course with presentations of final projects that incorporate the use of spatial analyses to explore spatial patterns / processes in terrestrial or marine systems. 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.

Grading policy

25% will be deducted per day from late homework assignments. We do not grant exceptions to this policy. Missed exams or late final projects will be excused only in the case of an emergency with supporting documentation.

Campus Policies

UMCES has drafted and approved various academic and research-related policies by which all students and faculty must abide. Please visit this website for a full list of campus-wide academic policies.