Geographic Information Systems in R: Fundamentals and applications for ecologists
CONS 697-DL4

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Dates, Meeting Times, and Location:
21 October – 15 December 2024

All content will be provided through Blackboard.

Two optional, hour-long virtual weekly meetings will be held each week.

Mon 10:30-11:45 am ET

Fri 10:45-11:30 am ET

Office Hours (Zoom):

Thu 8:00-9:30 am ET

Fri 1:30-2:45 pm ET

Format and logistics will be provided during the first week.

This is an asynchronous online course. Each week, students are expected to work through a set of instructional videos and associated exercises. Weekly problem sets are also required. Two optional live weekly sessions will provide time for: 1) discussion about content and assignments with the instructor and other participants and 2) instructor-led review of previous week's assignment.

Course Overview

This asynchronous online course aims to provide graduate students with an introduction to the increasingly powerful and flexible range of tools for working with both vector and raster spatial data in the R environment. The course will review core GIS concepts and the basics of R programming and build skills in raster and vector import and manipulation. The course closely integrates tidyverse functions with GIS tools to develop efficient and intuitive coding. Special emphasis will be placed on visualizing spatial data through developing static and interactive maps. The first few weeks will be spent honing R coding skills, ensuring that you have the necessary understanding of modern data science workflows in R.

Credits: 3

Prerequisites: Prior experience with the R coding environment

Student Learning Outcomes

By the end of this course, students will be able to:

- Use tidyverse functions for data manipulation and visualization
- Read, project, and write shape & raster files in R
- Conduct spatial joins, geometric operations, and data extraction with geospatial files
- Understand and transform coordinate reference systems and projections
- Conduct geospatial analyses (e.g., point pattern analysis)
- Create informative & visually appealing static and interactive maps
- *Optional*: Create interactive web applications for exploring geospatial data

Format and Pacing
As an asynchronous course, there is no set mandatory meeting time. However, students **are** required to submit weekly problem sets by a specified due date. Aside from this requirement, students may view the instructional videos and work through associated exercises (see below) at their own pace.

Instructional Videos and Exercises
Learning content will be provided via weekly "learning modules" that are comprised of html tutorials, instructional videos, commented R scripts, and self-assessment exercises. A new module will be posted every Monday morning (ET) on Blackboard. The total length of instructional videos will vary by week but is generally in the range of 1-1.75 hours. Students should expect to devote approximately 4-8 hours per week to this content (Note: This estimate does not include time spent on external readings or assignments). The time required may be more or less, depending on your pace working through exercises and previous experience with R.

Online Discussion Board
A discussion board will be hosted on Blackboard for students to discuss the week's assignment, seek advice on approaches to a given question, and provide mutual assistance. *Engagement on the discussion board is the basis for the participation portion of your grade.* It is expected that students will post on the discussion board *at least once week* – either seeking or providing information, feedback, etc. This discussion board is a great place to find help with a problem, or to help out a classmate!

Weekly Virtual Meetings
Each week, two *optional* meetings will be hosted virtually. The first meeting (Mondays, 10:30-11:45 am ET) will be a review of the previous week's assignment, led by the instructor. Answer keys to the problem sets will be posted each Monday by 12am ET, giving participants time to review the key before the Monday review session. The second optional virtual session (Fridays,10:45-11:30 am ET) will serve as an open question & answer period. For those that learn better by interacting with others, this "virtual classroom" provides an opportunity to do so. There will be time to ask questions on lecture content as well as the current week's assignment during this time. Questions addressed will be on a first come, first served basis. A thread on the Discussion Board will be used for submitting questions prior to the meeting, though time for oral questions during the meeting will be provided. Meetings will be recorded and posted on Blackboard for those that are unable to attend.

Office Hours
There will be opportunities to interact one-on-one with the instructors during virtual office hour sessions (Thursdays, 8:00-9:30 am ET, and Fridays 1:30-2:45 pm ET). A weekly sign-up sheet for office hours will be provided. Each office hour time slot will be 15 minutes. Students must sign up for time slots a minimum of 24 hours prior to the office hours session and no more than one week in advance.

Readings
Required and suggested readings will be associated with each week's topic. Readings will be listed in the introduction section of each module.

Pre-course Work
Exercises in R will be assigned one month prior to the course and are required for all participants. These are designed to assist R beginners in getting a baseline familiarity with key R programming concepts. These also serve an important refresher for those already working regularly in R.

Weekly Problem Sets
During weeks 1-7, we will post weekly problem sets to Blackboard on Monday mornings. These problem sets are due the following Sunday by 11:59pm ET and will be submitted through Blackboard. Assignments will be posted as html and R script files. Solution keys will be provided as R script files and will be posted at 12:00

ET on Monday morning. ***Because problem set solutions will be posted immediately after the submission window is closed, late assignments will NOT be accepted.***

Final Problem Set

In addition to the weekly assignments, students will be required to complete a final problem set. This open-book exercise will be focused on wrangling a real-world dataset and generating useful data products using those data. Students will be provided with a dataset and will receive an html file and R script with prompts for necessary wrangling steps, analysis, and output. The final week of the course will be devoted to this work.

STUDENT AND INSTRUCTOR EXPECTATIONS

Time Expectations

Depending on previous experience with R, students should expect to spend 4-8 hours per week on instructional videos, analysis demonstration code scripts, interacting on discussion boards, and virtual meetings. Completion of readings and problem sets are not included in this estimate but are expected to take an additional 8-10 hours per week. Note that for a 3-credit half semester course, George Mason University's suggested time expectation for students is 18 hours per week.

Computing Requirements

Students will be required to conduct all analyses in Program R using RStudio – both programs are free and open source. Students are expected to install these programs on their personal computers.

Individual Work

Collaboration (through the discussion board on Blackboard or by other means) is encouraged and will be highly beneficial in completing the problem sets. However, each student is expected to produce their own code and assignment submission. When posting to the discussion board, keep this in mind: providing support or answering a question is different from providing the answer to a problem. *Posts deemed to provide too much information will be removed.*

Communication

Announcements and reminders posted on Blackboard will be the primary form of communication for material relevant to the whole class. ***For personal communication, email is the best means to reach us***. Emails received during the work week will be returned within 24-48 hours. Emails received over the weekend may not be returned until the following Monday.

Assignment Expectations and Submission

All problem sets consist of a series of questions in an html document and R script. Each assignment will be submitted as a well-organized and neatly formatted R script with any relevant code. You will be provided with a list of functions that may be used to complete the assignment – only the provided functions may be used. The points allotted to each question will be provided in the html document and include code formatting. Problem sets will be returned no later than three days after they are due. ***As noted above, assignments submitted after the due date will not be accepted.***

Grading

Letter grades will be assigned according to the following scale:

A	> 93%	**C+**	77% - 79%
A-	90% - 92%	**C**	73% - 76%
B+	87% - 89%	**C-**	70% - 72%
B	83% - 86%	**D**	60% - 69%
B-	80% - 82%	**F**	< 60%

Final course grades will be based on the following:

Weekly Problem Sets:	60%
Final Problem Set:	30%
Participation (Online Discussion, see above):	10%
Total:	100%

UNIVERSITY POLICIES

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using MLA or APA format. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

Disability Accommodations

If you are a student with a disability and you need academic accommodations, please see me and contact Disability Services at 703-993-2474, http://ds.gmu.edu. All academic accommodations must be arranged through Disability Services.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

George Mason University is committed to providing a learning, living and working environment that is free from discrimination and a campus that is free of sexual misconduct and other acts of interpersonal violence in order to promote community well-being and student success. We encourage students who believe that they have been sexually harassed, assaulted or subjected to sexual misconduct to seek assistance and support. University Policy 1202: Sexual Harassment and Misconduct speaks to the specifics of Mason's process, the resources, and the options available to students.

Notice of mandatory reporting of sexual assault, interpersonal violence, and stalking: As a faculty member, I am designated as a "Responsible Employee," and must report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1412. You may seek assistance from Mason's Title IX Coordinator, Jennifer Hammat, by calling 703-993-8730 or email cde@gmu.edu. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychology Services (CAPS) at 703-993-2380. The 24-hour Sexual and Intimate Partner Violence Crisis Line for Mason is 703-380-1434.

Privacy

To preserve student privacy, students must use their MasonLive email account to receive important University information, including communications related to this class. I will not respond to messages sent from or send messages to a non-Mason email address. Also, I will not share or reveal, and students must not share or reveal, student email addresses with others inside or outside this class without students' express permission.