ENR 8600 – INTRO TO R FOR ENV SCIENCES

Autumn 2021 (full term)
2 credit hours, Pass/Fail Option Only
Wednesdays 1:45 – 3:45pm, 116 Kottman Hall
(A zoom option is available, but we are strongly encouraging students to attend in-person)

COURSE OVERVIEW

Instructors

Steve Culman, 130 Williams Hall, Wooster, culman.2@osu.edu, 330-263-3787

Kai Zhao, 131 Williams Hall, Wooster, zhao.1423@osu.edu, 330-263-3722

Bob Gates, 383 Kottman Hall, Columbus, gates.77@osu.edu, 614-292-9571

Office Hours: By Appointment

Prerequisites

Students should be familiar with basic concepts of data management, manipulation and analyses. Students will need to bring a laptop with the current version of R and R Studio already installed. R installation instructions can be found here: https://cran.r-project.org/

R Studio can be found here: https://www.rstudio.com/

Course description

This is a practical, hands-on course intended to give students a broad overview and introduction to R, a language and environment for statistical computing and graphics. This course is not a statistical course in R, but rather an introduction to the R environment and how to work with R efficiently. It will only provide a brief overview of some statistical analyses, but will complement the Quantitative Methods for Environment and Natural Resources course (ENR 8780), which covers many common statistical analyses in environmental science.

Course learning outcomes

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

- Import data to and export data from R
- Manipulate, subset, reformat and aggregate data in a variety of ways in R
- Generate a range of graphs to illustrate data
- Understand how to perform common statistical procedures in environmental sciences
- Understand basics of R programming
- View, manipulate, and process spatially-referenced data in R (an introduction)

HOW THIS ONLINE COURSE WORKS

Mode of delivery: This course is in-person every Wednesday at 1:45 – 3:45pm. We will also have a zoom option for those distance-based students and to record lectures. We strongly encourage attendance in-person. In some weeks, lecture content will be recorded and posted to Carmen ahead of time to supplement the lecture. This will typically reduce the 2-hour meeting time. However, we ask that you hold this 2-hour slot throughout the semester. All lectures will be recorded and posted to Carmen.

Pace of online activities: This course is divided into **weekly modules** that are released at least 48 hours before class meets. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

Credit hours and work expectations: This is a **2-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 2 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 2-4 hours of independent learning.

Attendance and participation requirements: We expect students to attend most classes and participate each week. We understand you might not be able to make every class, so lectures will be recorded and posted to Carmen if you need to miss class.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

Required

- No required textbooks.

Recommended/optional

- R for Data Science: https://r4ds.had.co.nz/

- State 545: https://stat545.com/

- R for beginners: https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

- An Introduction to R: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf

- Quick-R: https://www.statmethods.net/

- The Art of R programming: http://heather.cs.ucdavis.edu/~matloff/132/NSPpart.pdf

Course technology

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)
- Recording a slide presentation with audio narration (go.osu.edu/video-assignment-guide)
- Recording, editing, and uploading video (go.osu.edu/video-assignment-guide)

Required equipment

- Computer: current Mac (MacOs) or PC (Windows 10) with high-speed internet connection with administrative privileges and Rstudio installed
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Carmen access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (go.osu.edu/add-device).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (go.osu.edu/install-duo) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated

Grading will be pass/ fail only. Problem sets will be assigned at the end of most classes, giving students the opportunity to become more familiar with functions learned that week. Problem sets are due before the start of class the following week. In case of extenuating circumstances, please reach out to the instructors as soon as possible (before assignment is due) to make arrangements.

At the end of the semester, students will present a new package or set of tasks and solutions using their own data or data they will soon collect. Presentations will last 15-30 minutes (depending on class size) and must include a new method or novel approach not covered in previous classes. The presentation would ideally be relevant to the student's own research and data situation. A passing grade will be given to students that have fulfilled the following criteria:

- 10 homework assignments posted to Carmen

- Participation in 10 weekly lectures/ zoom sessions

- Passing grade on end-of-semester presentation

Instructor feedback and response time

- **Email:** We will reply to emails within **48 hours on days when class is in session**.

OTHER COURSE POLICIES

Academic integrity policy

See **Descriptions of major course assignments**, above, for my specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious or overwhelmed, on-demand resources are available at go.osu.edu/ccsondemand. You can reach an on-call counselor when CCS is closed at 614- 292-5766, and 24-hour emergency help is also available through the 24/7 National Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)

COURSE SCHEDULE

Refer to the Carmen course for up-to-date information on the schedule.

Week	Date	Topics	Instructor
1	Aug 25	**Intro to R** Installing R, packages, CRAN; R studio; other resources	Culman
2	Sept 1	R basics; Importing and exporting data; Defining classes of R objects	Gates
3	Sept 8	Indexing and subsetting data frames; missing data; R framework; concatenating, appending, and merging data	Zhao
4	Sept 15	The reshape package	Culman
5	Sept 22	The dplyr package	Culman
6	Sept 29	**Graphing in R** Getting started with base R; Intro to ggplot2	Culman, Gates
7	Oct 6	ggplot2: geoms, layers, aesthetics	Zhao
8	Oct 13	ggplot2, GGalley, gridExtra and other graphic add-on packages (special topics due)	Culman
9	Oct 20	**Statistical analysis in R** Preparing your data for statistical analyses; inspecting distributions, t-tests, linear and generalized linear models,	Gates
10	Oct 27	Non-parametric and simple multivariate methods; Visualizing statistical results with graphics	Gates
11	Nov 3	**Spatial data in R** (special topics finalized)	Zhao
12	Nov 10	More on R programming and functions	Zhao
13	Nov 17	Student-lead special topics	Students
14	Nov 24	Thanksgiving break – no class	
15	Dec 1	Student-lead special topics	Students
16	Dec 8	Student-lead special topics	Students