EOS 872L Environmental Data Analytics
Spring 2020

Meeting times: Tuesday and Thursday 11:45-1:00
Classroom: A153 LSRC
Course resources: sakai.duke.edu

Professor: Kateri Salk	**Teaching Assistant:** Njeri Kara
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Office hours: Th 3:00-4:00, F 10:30-11:30	

Course Texts and Readings
R for Data Science
Garrett Grolemund and Hadley Wickham
Open source online textbook: https://r4ds.had.co.nz/
Hard copy available on Amazon

Additional texts and articles available on Sakai

Course Description
Given the growing focus of environmental disciplines on quantitative approaches, students entering the environmental workplace have a need to face new challenges related to data. Data analytics encompasses not only statistics and data visualization but also puts those practices in context of the acquisition, exploration, processing, and reporting of data. In this course, we work through contemporary data analyses while developing skills to integrate software applications, manage data, and effectively report results. Students will develop reproducible workflows to analyze real environmental datasets from start to finish. The setting of this course is a hands-on lab, where students will work through a series of lessons, assignments, and a final course project.

Course Objectives
1. Gain proficiency in the language and application of R software
2. Synthesize information from datasets, working from start to finish in the "data pipeline"
3. Develop skills to identify and apply appropriate statistical and graphical approaches for environmental datasets, incorporating the guidelines of experimental design and interpretation of output
4. Integrate multiple technological applications involved in contemporary data analysis, workflow, and management

Disability Accommodation
Students with disabilities seeking special accommodations must contact Emma H. Swain (eswain@duke.edu, 668-1267) at the Student Disability Access Office (SDAO) to obtain appropriate support. See also http://www.access.duke.edu/

Expectations

This course has a fairly steep learning curve, meaning that most of us will encounter technical and conceptual difficulties on our way to developing proficiency. This is not meant to discourage you but to help you be prepared to face challenges in the best way possible. With that in mind, the expectations for this course include:

- If you are using your own computer, software installations and upgrades must be completed before class. Most applications require updated software systems to operate correctly, and we do not have time to dedicate to this in class.
- If you run into an issue, please attempt to diagnose the issue and do some troubleshooting on your own before asking an instructor. We are not expecting you to know how to fix all problems on your own, but taking time to understand the issue will (1) help us to fix the issue with you faster and (2) help you develop independence.
- If you miss class, contact a classmate for an update on the lesson and work through the lesson on your own. We will gladly answer any questions or help to fix any troubleshooting issues with you afterword.
- Data analytics is an extremely collaborative field. We will replicate this environment in our classroom, where you will actively participate and cooperate with one another. We will do our best to cultivate this collaborative environment.

Grading

Assignments 75%

Each major unit of the course will be accompanied by an assignment, which should be completed individually (with help from classmates if needed). Each assignment will be graded for successful completion (on time, correct format), application of concepts and code, and discussion of topics.

Late work: Assignments will be accepted up to two weeks late for a maximum of 75 % of possible points. It is important that you develop your skills through assignments, regardless of whether you can complete the work by the deadline. This also affords you the flexibility to complete an assignment even if you run into a coding barrier or troubleshooting issue. If you do turn in an assignment after the due date, please email me and Njeri so that we are aware of your submission.

Grade appeals: Coding and data analysis are creative fields, often with multiple paths to a desired outcome. With that in mind, you are welcome to appeal a score on an assignment if you can provide justification for receiving a higher score. Appeals must be submitted in writing (via email) to me and Njeri within one week of receiving your assignment score.

Project 25%

Students will choose one of the example datasets from class and pose a question that can be addressed with the data analysis tools learned in class. Students will then create a data workflow protocol to answer this question and create a report that details methodology and findings. These components will be detailed in a report, a template for which will be supplied. More details and a grading rubric will be supplied in a separate instructions document.

Course Schedule

Date	Topic	Due (Tuesdays)
January 9	Introduction and software	
January 14, 16	Reproducibility and coding basics	Assignment 1
January 21, 23	Data exploration	Assignment 2
January 28, 30	Data wrangling	Assignment 3
February 4, 6	Data visualization basics	Assignment 4
February 11, 13	Generalized linear modeling & visualization	Assignment 5
February 18, 20	Generalized linear modeling & visualization	Assignment 6
February 25, 27	Time Series	Assignment 7
March 3, 5	Spatial visualization and analysis	Assignment 8
March 10, 12	SPRING BREAK – NO CLASS	
March 24	Databases • Zoom intro • Synchronous discussion • Activity: database search, post to forum	Assignment 9
March 26	Data Scraping • Zoom check-in • Synchronous guided coding (can be completed asynchronously)	
March 31	Data Documentation • Short synchronous discussion • Activity: start on assignment 11 (can be done in groups in Zoom breakout rooms)	Assignment 10: Data scraping
April 2	MP SYMPOSIUM – NO CLASS	
April 7	Crafting reports • Synchronous guided coding (can be completed asynchronously) • Zoom breakout rooms	Assignment 11: Data documentation for project
April 9	Dashboards • Synchronous guided coding (can be completed asynchronously)	
April 14	Dashboards • Activity: create a dashboard • Zoom breakout rooms	
April 16	Guest speaker panel • Synchronous discussion	
April 21	Virtual project showcase • Activity: visit and post to forum	1 project visualization + caption of findings (Due 11:59 pm April 20)
April 24	NO CLASS	Reports due 11:59 pm
NO EXAM DURING FINAL EXAMS WEEK		

Details of this syllabus, including but not limited to grading and schedule, are subject to change at the instructor's discretion. Students will be notified of any changes in advance and in writing.

The Duke Community Standard
Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity. To uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors;
- I will conduct myself responsibly in all my endeavors; and
- I will act if the Standard is compromised.

If a student engages in academic dishonesty (e.g., cheating, plagiarism), they will receive an automatic zero on that assignment. Additional incidences of academic dishonesty will result in automatic failure of the course. We will also report incidences of academic dishonesty to the Office of Student Conduct, who may choose to impose additional consequences.

Campus Resources for Students
Your mental and physical wellbeing is integral to your ability to be academically successful. Below, I have compiled a list of resources around campus that are available to support you. If there is something going on in your personal life that is preventing you from participating fully in this or other courses, please feel free to speak with me. You are welcome to share as much or as little as you are comfortable sharing, and I am more than happy to arrange to get you the support you need.

Academic Resource Center
http://arc.duke.edu/
At the Academic Resource Center, we work with you to create a comprehensive approach to your learning, so you can reach your highest academic potential. Some of the services we offer include:
- Peer Tutoring: One-on-one meetings and walk-in tutoring for select courses
- Study Groups: Facilitated group learning opportunities for specific math and science courses.
- Learning Consultations: Any Duke undergraduate student can meet with an ARC learning consultant to enhance your academic skills and learn strategies tailored to how you learn and the courses you are taking. This includes strategies for time management, how to balance study, work and extra-curricular activities, how to take effective notes, and more
- ADHD/LD Support: Students with a diagnosed learning difference, including ADHD, can receive individualized academic support including academic and ADHD coaching, time management support, tutoring, and compensatory learning strategies

Graduate Career Services
Duke Career Center

Mental Health Resources
Counseling and Psychological Services: CAPS helps Duke Students enhance strengths and develop abilities to successfully live, grow and learn in their personal and academic lives. We offer many services to Duke undergraduate, graduate, and professional students, including brief individual and group counseling, couples counseling and more. CAPS staff also provide outreach to student groups, particularly programs supportive of at-risk populations, on a wide range of issues impacting them in various aspects of campus life.

Duke Reach: DukeReach directs students, faculty, staff, parents, and others to the resources available to help a student in need. DukeReach is located in the Dean of Students Office and works with departments and groups across campus and in the community, including Housing, CAPS, Student Health, community health providers, the Academic Resource Center, and more.

DuWell: DuWell helps students focus on their individual wellness by looking at the integration of many areas of their life through areas of wellness promotion and risk mitigation.We engage students through a variety of wellness experiences across campus in an effort to reduce stress and anxiety while emphasizing self-care.

Sexual Assault Resources
If you have experienced sexual assault, sexual harassment, gender violence, relationship violence, or stalking, please reach out for help. There are several resources around campus to support you:
The Women's Center: 919-684-3897. Services are available to all genders, not just women.
Office of Student Conduct: 919-684-6938
Duke Police: 919-684-2444

My door is always open if a student needs someone to listen or to connect them with resources. As an employee of Duke, I am a mandatory reporter, meaning that if I receive a report of sexual assault, I am required to confidentially report this to the Office of Student Conduct (OSC). The OSC will follow up with the student to provide further information, but the student is not required to respond and the conversation will not be shared beyond myself and the OSC. The following resources around campus are are not mandatory reporters: The Women's Center, medical providers, campus clergy, and CAPS counselors.

Recreation and Exercise Opportunities
Duke Recreation Website: Information about exercise facilities, intramural sports, and fitness services

Al Buehler Trail: A hiking and running trail south of Duke's west campus, free for use. The main trail is 3 miles long with beautiful scenery, and a separate 0.58 mile "fitness loop" includes bodyweight training stop points for a guided workout. Emergency phones are placed at 7 locations along the trail.

Duke Gardens: Free admission and inexpensive parking. Located on the east side of Duke's west campus.

Food Insecurity
As part of our community care, we have a food exchange available for students, faculty and staff who find themselves on campus without the means to eat. The Nicholas School understands there may be times when financial situations may make it difficult to provide a meal for yourself and we want to make sure we can help minimize these situations. As such, the first floor kitchen in Environment Hall and the second floor kitchen in LSRC have been stocked with non-perishable single-serve food items that you are invited to take if you need it.