

EDS 223: Geospatial Analysis & Remote Sensing

Quarter: Fall 2023

Units: 4

Grading: Letter

Prerequisites: EDS 221 or equivalent (ESM 232, ESM 244 or equivalent for non-MEDS students)

Instructor information, meeting times, & materials

Instructor: Ruth Oliver

Email: rutholiver@bren.ucsb.edu

Office: Bren Hall 4512

Student hours: Friday 1-2pm PT

The best way to contact me is: Slack

Teaching Assistant: Alicia (Allie) Caughman

Email: acaughman@bren.ucsb.edu

Student hours: Tuesday 12:30-1:30pm PT (Pine Room 3526)

The best way to contact me is: Slack

Class meets: Tuesday 9:30 - 12:15 PT (Bren 1424)

Discussion section meets: Thursday 11:30-12:20 or 12:30-1:20 PT (Bren 3526)

Course website: ryoliver.github.io/EDS_223_spatial_analysis

Computing requirements:

- [Minimum MEDS device requirements](#)
- R version 4.2.0 (or higher)
- RStudio version 2022.07.01 (or higher)
- GitHub account

Basic course information

Course description: This course introduces the spatial modeling and analytic techniques of geographic information science to data science students. The emphasis is on deep understanding of spatial data models and the analytic operations they enable. Recognizing remotely sensed data as a key data type within environmental data science, this course will also introduce fundamental concepts and applications of remote sensing. In addition to this theoretical background, students will become familiar with libraries and packages that support spatial analysis in R.

Learning objectives: The goal of EDS 223 (Geospatial Analysis and Remote Sensing) is to prepare students to solve environmental problems using spatial approaches and remote sensing data. To accomplish this goal, we will aim to achieve the following learning objectives:

Foundational knowledge -

- Knowledge of basic spatial data structures
- Understanding of physical processes underpinning remote sensing data collection
- Comfort with vector and raster operations in R

Application -

- Develop critical thinking to creatively solve problems using spatial data
- Manage and integrate multiple types of spatial data
- Effectively communicate approach and results

Integration -

- Effectively connect approaches and questions across courses
- Efficiently find resources to troubleshoot issues
- Work collaboratively

Course details

Course components: This course will be structured with class on Tuesdays covering foundational lectures and computational labs and discussion section on Thursdays providing additional applications. All materials will be posted on the course website.

Important dates: Over the course of the quarter, we will periodically host experts to discuss topics relevant to the course material. Please note that we will not meet during the final examinations period.

Tentative topics:

Week #	Topics
1 October 2	Course overview & intro to spatial data models <ul style="list-style-type: none">• Coordinate reference systems• Map making basics
2 October 9	Intro to vector data <ul style="list-style-type: none">• Intro to 'sf'• Attribute data operations• Assignment 1 due Saturday
3 October 16	Vector operations <ul style="list-style-type: none">• Vector spatial operations• Vector geometry operations
4 October 23	Intro to raster data <ul style="list-style-type: none">• Intro to 'terra'• Raster spatial operation• Assignment 2 due Saturday
5 October 30	Guest speaker(s)
6 November 6	Intro to remote sensing & electromagnetic radiation <ul style="list-style-type: none">• Active vs. passive RS• Energy transfer
7 November 13	RS data collection <ul style="list-style-type: none">• Displaying multi-band data• Assignment 3 due Saturday
8 November 20	RS of vegetation <ul style="list-style-type: none">• Band math

9 November 27	Multispectral RS analysis <ul style="list-style-type: none"> • Landcover classification
10 December 4	Active RS <ul style="list-style-type: none"> • LiDAR & RADAR • Assignment 4 due Saturday

Assignments: To reach our learning objectives of understanding how to leverage spatial analysis and remote sensing data, assignments will focus on exploring real-world environmental questions. We will have 4 assignments in total, building in complexity over the course of the quarter. Assignments will build on concepts and skills developed in Wednesday lab sessions, but will apply them to new questions, tasks, or datasets. Assignments will be posted by 5pm and due by midnight on the dates listed below.

Assignment schedule:

Assignment #	Assigned	Due
1	2023-10-03	2022-10-14
2	2023-10-17	2022-10-28
3	2023-10-31	2022-11-18
4	2023-11-21	2022-12-09

How to be successful in this class

There are many ways for you to demonstrate your learning, including through your effort, interaction, integration of concepts, and application to real world situations. To be successful in this course, I expect students to come with a shared understanding that learning is a process and difficulty with material simply indicates opportunities for growth.

Grades:

Learning objectives will be assessed through homework assignments, short, in-class assessments, and a final portfolio. Homework assignments will primarily assess learning objectives related to technical proficiency, problem solving, and

collaboration. The rubric for each assignment will be provided when it is assigned so you know what to prioritize. You make work with up to 2 classmates, but must list your collaborators' names on your assignment. You are encouraged to collaborate on code, but must respond to conceptual questions individually. All assignment dates will be posted in advance. Late assignments will receive 10% deduction per day, up to a maximum of 3 days. You may request a 48-hour extension if extenuating circumstances arise.

In-class assessments will primarily assess conceptual understanding and will typically be asked to be completed independently. The goal of these activities is to identify where more instruction is needed, so will not be graded for correctness, just completeness. If you miss class, there will be opportunities to make-up missed activities.

During finals week, you will be asked to create a “spatial data science portfolio” based on your work throughout the quarter. The purpose of this is to help you develop a way to showcase your data science and communication skills to potential employers.

Breakdown:

- Assignments (4 total): 80%
 - 1 - 10%
 - 2 - 20%
 - 3 - 25%
 - 4 - 25%
- Assessments: 5%
- Portfolio: 15%

Absences: Please reach out if you are planning to miss class for travel etc. so we can work out appropriate accommodations. If you feel ill, we urge you to please stay home and we will provide opportunities to catch up on missed material.

Getting extra help: Come to office hours! Please let me know if you are struggling with course material or assignments and I will help you create a plan. Your fellow classmates are your great resource, so I highly encourage group work and discussion. Take advantage of the course Slack channel to troubleshoot and ask questions.

Course policy on generative artificial intelligence:

(adapted from policy for EDS 220, developed by Dr. Galaz Garcia)

Generative AI tools are increasingly being used to assist in a wide variety of tasks, including developing code. While this can be beneficial, it should not serve as a substitute for understanding our code, including what we are trying to accomplish, why we select certain approaches, and how it works. In this course, using generative AI tools (such as ChatGPT) is strongly discouraged based on the following considerations:

- The core competencies we are hoping to build in this class require the ability to critically dissect programming challenges, which must be built through practice.
- ChatGPT is not a replacement for expert coding and in many cases requires advanced knowledge to debug its output. Even if your eventual goal is to rely heavily on generative AI tools, you will still need to build your own programming proficiency to engage within them productively. For example, ChatGPT is known to “hallucinate” false information.
- Many generative AI tools are likely to become subscription based and may not be accessible to all students.

As such, you should adhere to the following guidelines:

- Feel free to use spell check, grammar check, and synonym identification tools (e.g. Grammarly and Microsoft Word).
- Be prepared to explain each line of code in your assignments and exercises.
- If you use generative AI in completing assignments, include a copy of the prompts and outputs.

Uncritical uses of generative AI in assignments will receive lower scores. Not acknowledging use of generative AI in assignments will result in a zero for the assignment.

Access, accommodations and conduct

Course conduct: All students are expected to read and abide by the [UCSB Code of Conduct](#). In this course, I will work to create an inclusive environment for all students. I recognize that discrimination can be direct or indirect and operate at many different levels, which I might not be aware of. To ensure an equitable classroom, I am committed to eliminating any discrimination, harassment, or bullying either in person or online. I encourage students to share and/or update their name and pronouns by reaching out to me directly. If you feel this course is not an inclusive environment, please reach out to me or the Program Coordinator Jamie Montgomery (jmontgomery@bren.ucsb.edu)

Access and Accommodations: Please submit requests for accommodations often and early. It is never too late to apply for DSP accommodations. If you have any kind of disability, whether apparent or non-apparent, learning, emotional, physical, or cognitive you may be eligible to use formal accessibility services on campus. To arrange class-related accommodations, [please contact DSP](#). DSP will initiate communication about accommodations with faculty. By making a plan through DSP, appropriate accommodations can be implemented without disclosing your specific condition or diagnosis to course instructors.

COVID-19 precautions: While masks are not required, Santa Barbara County continues to recommend that masks be worn indoors. Free masks can be picked up at many locations around campus, including the UCEN Campus Store Customer Service Desk, the A.S. Pardall Center, and [other locations around campus](#). Please respect one another's choices regarding whether or not to wear masks.

Additional student resources

The text below is provided by the UCSB Disabled Students Program.

Counseling and Psychological Services (CAPS). 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 your ability to participate in daily activities. CAPS is available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus. They can be reached by phone at 805.893.4411, or online at <http://caps.sa.ucsb.edu>. The CAPS building is the pink building next to the Humanities and Social Science building (HSSB)

Food insecurity: <http://food.ucsb.edu/> includes the Cal Fresh Program <http://food.ucsb.edu/calfresh> and the Associated Students food bank <https://foodbank.as.ucsb.edu>

Resource Center for Sexual and Gender Diversity (RCSGD) in the SRB, offers a host of services for LGBTQI+ students including a library and many events throughout the year. <http://rcsgd.sa.ucsb.edu/>

Dream Scholars/Undocumented Student Services Program offers workshops, helps students find scholarships and financial support as well as providing community for our undocumented students. <http://www.sa.ucsb.edu/dreamscholars/home>

Campus Learning Assistance Services (CLAS) helps students grow academically by offering workshops, walk-in and pre-scheduled tutoring, and writing help both for native and non-native (ESL) English as a second language speakers. Over 50% of students will stop by CLAS at one time or another. <http://clas.sa.ucsb.edu>

Student Resource Building (SRB) houses many campus resources offices, including the African Diasporic Cultural resource Center, the American Indian Resource Center, the Asian Resource Center, the Middle Eastern Resource Center, the Non-Traditional and Re-Entry Student Resource Center. <http://www.sa.ucsb.edu/student-resource-building/home>

Multicultural Center (MCC), located in UCEN, hosts a wide variety of cultural events and educational programming throughout the year, including film showings, lectures, musical performances, and more: <http://mcc.sa.ucsb.edu/>

Campus Advocacy, Resources, & Education (CARE) offers 24/7 confidential support and advocacy in situations of sexual assault, dating and domestic violence, and

stalking. Located in the SRB, they can be reached at 805.893.4613 or <http://wgse.sa.ucsb.edu/care/home>

Financial Crisis Response Team: If you are experiencing issues of housing insecurity contact the Financial Crisis Response Team at financialcrisis@sa.ucsb.edu to begin application for assistance.

Health and Wellness: Student well-being is integral to academic success, student development, and life satisfaction. On this website, students will find links to a range of services related to well-being such as: assistance with basic needs (food, housing, finances); counseling and physical health resources, daily wellness centers and programs; social connection, and personal safety. <https://wellbeing.ucsb.edu/>