

EDS 223: Geospatial Analysis & Remote Sensing

Quarter: Fall 2022

Units: 4

Grading: Letter

Prerequisites: None required (ESM 232 or 244 for MESM students)

Instructor information, meeting times, & materials

Instructor: Ruth Oliver

Email: rutholiver@bren.ucsb.edu

Office: Bren Hall 4512

Student hours: Wednesday 11-12pm PT (NCEAS Sequoia Room 105)

The best way to contact me is: email

Teaching Assistant: Albert Garcia

Email: agarcia@bren.ucsb.edu

Student hours: Wednesday 3:30-4:30 PT (NCEAS Sequoia Room 105)

The best way to contact me is: email

Class meets: Monday/Wednesday 9:30am - 10:45am PT (NCEAS)

Course website: ryoliver.github.io/EDS_223_spatial_analysis

Readings:

- [Geocomputation with R](#)
- [Spatial Data Science with applications in R](#)

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, packages, and APIs 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 some flexibility, as lectures on Mondays and computational labs on Wednesdays. All materials will be posted on the course website.

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

Tentative topics:

Week #	Lecture	Lab
1 (9/26)	Course overview & intro to spatial data models	<ul style="list-style-type: none">• Coordinate reference systems• Map making basics
2 (10/3)	Spatial data models & intro to vector data	<ul style="list-style-type: none">• Intro to 'sf'• Attribute data operations• Assignment 1 due Saturday
3 (10/10)	Vector operations	<ul style="list-style-type: none">• Vector spatial operations• Vector geometry operations
4 (10/17)	Spatial data science expert panel	<ul style="list-style-type: none">• Review• Assignment 2 due Saturday
5 (10/24)	Intro to raster data	<ul style="list-style-type: none">• Intro to 'terra'• Raster spatial operations
6 (10/31)	Intro to remote sensing & electromagnetic radiation	No class
7 (11/7)	RS data collection	<ul style="list-style-type: none">• Displaying multi-band data• Assignment 3 due Saturday
8 (11/14)	RS expert panel	<ul style="list-style-type: none">• Raster geometry operations• Raster-vector interactions
9 (11/21)	Multispectral RS analysis	<ul style="list-style-type: none">• Band math• PCA
10 (11/28)	Active RS & advanced image analysis	<ul style="list-style-type: none">• Spatial stats basics• 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. You will have the opportunity to earn extra credit by turning the assignment of your choice into a blog post on your personal website.

Assignment schedule:

Assignment #	Assigned	Due
1	2022-09-28	2022-10-08
2	2022-10-12	2022-10-22
3	2022-10-26	2022-11-12
4	2022-11-16	2022-12-03

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 and participation in short, in-class activities. 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 activities 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.

Breakdown:

- Assignments (4 total): 90%
 - 1: 15%
 - 2-4: 25% each
 - 2% extra credit for converting assignment into blog post
- In-class participation: 10%

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 an option to participate remotely.

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.

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/>