ESM 206: Introduction to Statistics and Data Analysis in Environmental Science and Management (Fall 2021)
Bren School of Environmental Science & Management

**Instructor:** Allison Horst (Office: Bren Hall 4406 - note my office hours are in the Oak Room)
**Email:** ahorst@ucsb.edu
**Student Hours:** Wednesdays 11am - 12:15pm (Oak Room, Bren Hall 1520)*
*Except the Week of 10/4 - I will hold office hours that week Friday 10/8 12pm - 1:15pm instead, in my office (Bren 4406)

**TA:** Casey O’Hara
**Email:** cohara@ucsb.edu
**Student Hours:** Monday 2:30 - 4:00 (Bren Hall 4324)

**TA:** Erin Winslow
**Email:** winslow@ucsb.edu
**Student Hours:** Tuesday 8-9:30 am (Bren Hall 1306)

**Overview:** In ESM 206, you will build conceptual, technical and communication skills to investigate and answer environmental questions using data. Topics include: data wrangling, exploratory data analysis, descriptive statistics, regression, hypothesis testing, describing uncertainty, and data visualization. Skills for data exploration, analysis and project management will be developed through analysis of real-world datasets using R, RStudio and GitHub, while building tools for and understanding of computational reproducibility and collaboration.
COURSE COMPONENTS:

All course materials will be posted to GauchoSpace. Enrolled students should refer to GauchoSpace as the primary course resource.

Weekly learning is through:
- **Lectures**: 2 weekly 75 minute lectures (MW 8am in Bren 1414)
- **Computer labs**: 1 weekly 2-hour lab (MT 12:30pm - 2:20pm in Bren 1414)
- **Slack workspace**: The go-to place for questions, discussion, feedback, suggestions, etc.
- **Assignments and readings**: ~6 total assignments

Remote option:
This course has been designed as an in-person course and that is how students are expected to participate (i.e., in-person attendance for lectures and labs). However, it is likely that at times some students will have to call in remotely (i.e. if they receive a positive Covid test result). I will Zoom stream (but not record) lectures and labs at this Zoom room (with passcode tidydata). Do not share the link or passcode. The room is open to authorized UCSB users only. They will **not** be recorded and posted.

*Note: as the course is designed to be in person, there will be activities we do in class (group discussions, think-pair-share, problems written on the board, etc.) we do in class that are not possible for students calling in virtually.*

Additionally, I will:
- Post all lecture slides
- Share all lab materials and keys
- Post selected recorded lectures on relevant topics (not required - additional resource only)

BEFORE THE FIRST WEEK OF CLASS:

You need to install R and RStudio, and the tidyverse package, before the first week of class. **All software for this class is free and open source.**

[Click here](#) for instructions on installing R, RStudio and the tidyverse

ACCESS & ACCOMMODATIONS:

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.
STUDENT SUPPORT:

We understand that ongoing crises impact students differently based on experiences, identities, living situations and resources, family responsibilities, and unforeseen challenges. We encourage you to prioritize your well-being. We are here to help you reach your learning and career goals. You are always welcome to reach out to our teaching team so that we can best support you. Please see the UCSB Campus Resource Guide for campus student support and services. Additional resources are included at the end of this syllabus.

GRADE BREAKDOWN:

Assignments: 55%
  ● Assignments are created to help you practice conceptual, computational, and critical thinking skills needed for environmental data science. You will submit your assignments via GauchoSpace or as GitHub repositories.

Course participation: 5%
  ● Slack participation, lab and lecture attendance / participation

Quizzes (x2): 20%
  ● Two 40-minute in-class quizzes (during your lab session, *probably* in Weeks 4 and 7)

Final exam: 20%
  ● You will complete an individual, take-home final exam (think of this as a final assignment that aggregates everything you've learned during the quarter).

CODE OF CONDUCT:

All students are expected to read and comply with the UCSB and 206/244 course code of conduct.

All enrolled students, auditors, and course visitors are expected to comply with the following code of conduct. We expect cooperation from all members to help ensure a welcoming and inclusive environment for everybody. We are determined to make our courses welcoming, inclusive and harassment-free for everyone regardless of gender, gender identity and expression, race, age, sexual orientation, disability, physical appearance, or religion (or lack thereof). We do not tolerate harassment of class participants, teaching assistants, or instructors in any form. Derogatory, abusive, or demeaning language or imagery will not be tolerated.

GETTING AND GIVING HELP:

The best way to get help is in office hours. See our times & rooms above, and come give us a visit!

We also have a course Slack workspace. You are welcome to post questions and responses for your peers, e.g. on the #code-help channel. We will not always respond quickly to Slack questions. Do not expect responses after normal work hours or on weekends. Weekdays 9am - 5pm we will try to check in on Slack several times throughout the day to see if questions have been answered sufficiently.
If you are helping your peers on Slack, great! Please be specific in your response, using an example that is not a solution on an assignment whenever possible. For example, you might post “I think you need a == within filter() instead of a single =” instead of writing “My code for this part looks like this: filter(species == “Chinstrap”)."

GAUCHOSPACE PRIVACY:

GauchoSpace logs student interaction information (e.g. last login-time). In ESM 206 we have a policy of NOT looking at GauchoSpace user logs or using logged information in assessments or final grades, but you should know that the data is stored and made available to instructors & TAs and may be used in other courses.

COURSE POLICIES:

- You are expected to read and comply with the ESM 206/244 Code of Conduct
- While we do encourage collaboration and peer teaching, cheating/plagiarism (including code) will result in 0 points awarded for the assessment or activity and disciplinary action according to UCSB policy
- If you are worried about your overall grade and/or passing the class, please reach out to us to discuss your concerns

WHAT DO WE CONSIDER CHEATING WITH CODE?

While you will look at others’ code for examples and ideas, you should not directly copy and paste code. This is likely to result in less learning and more mistakes. Even if you are using someone else’s code as guidance, you need to manually type it all out yourself for your assignments and exams. It is also cheating if you submit code that you do not understand. You should be able to explain (even at a surface level) what each line of code you submit actually does.

TENTATIVE COURSE SCHEDULE AND TOPICS:

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture topics</th>
<th>Lab skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Course intro and motivation; what is data science?; computational reproducibility &amp; reproducible workflows; introduction to R, tidy data structure</td>
<td>Meet R/RStudio; project management in R projects; creating organized, well-annotated and reproducible scripts; reading in CSVs; basic data wrangling with {dplyr}; {ggplot2} intro</td>
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<tr>
<td>2</td>
<td>Exploring data; “Good enough practices” in data science; engaging and responsible data visualization</td>
<td>R Markdown intro; initial cleaning for messy(ish) data; data wrangling with {dplyr} and {tidyr} continued; exploratory data analysis; dataviz with {ggplot2} continued</td>
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<td>3</td>
<td>Version control with Git &amp; GitHub, metadata, population, sampling, bias, basic summary statistics (central tendency &amp; data spread)</td>
<td>Basics of working between GitHub and RStudio; wrangling and data viz continued; {lubridate} for dealing with dates and times</td>
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<tr>
<td>#</td>
<td>Topic 1</td>
<td>Topic 2</td>
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<td>4</td>
<td>Exploring differences between populations (effect size, actual differences, difference in context, intro to null hypothesis statistical testing)</td>
<td>Frequency tables with {count}, {tally} and {n}; summary statistics; exploring normality; t-tests; project management with GitHub and R projects</td>
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<td>5</td>
<td>Hypothesis testing pros &amp; cons, t-tests, ANOVA, pitfalls of null hypothesis statistical testing, errors, risk &amp; bias, communicating outcomes of hypothesis tests (and why the p-value should be the least interesting thing you present)</td>
<td>GitHub continued; t-tests; ANOVA; responsibly visualizing differences between groups; reading in data from different sources/file types (URLs, .xlsx, etc.)</td>
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<td>6</td>
<td>Ordinary least squares, correlation, thinking critically about relationships</td>
<td>Linear regression</td>
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<td>7</td>
<td>Types of bias; chi-square; multiple linear regression</td>
<td>Chi-square; advanced wrangling and cleaning; dataviz customization; exporting graphs and tables; GitHub collaboration intro; multiple linear regression intro &amp; assumptions</td>
</tr>
<tr>
<td>8</td>
<td>Multiple linear regression continued; interpreting coefficients; interaction terms; communicating regression outcomes</td>
<td>Tidy model outputs; diagnostics; assessing fit; reporting results; {broom} and {stargazer};</td>
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<tr>
<td>9</td>
<td>Logistic regression intro; rank-based tests</td>
<td>Binary logistic regression, ordinal logistic regression intro; Mann-Whitney U; Wilcoxon Signed-Rank</td>
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<tr>
<td>10</td>
<td>Intro to spatial data viz in R; thinking beyond R; course review</td>
<td>Spatial data viz and exploration with {sf}, {tmap}</td>
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**ADDITIONAL STUDENT RESOURCES:**

Graduate school is exciting, challenging, and rewarding - and can also be very stressful. Your health and wellness is my top priority. I encourage you to reach out if you need support (or if you aren’t sure if you need support). Below are some of the many UCSB resources available to you while you’re here at the Bren School with us.

*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](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/