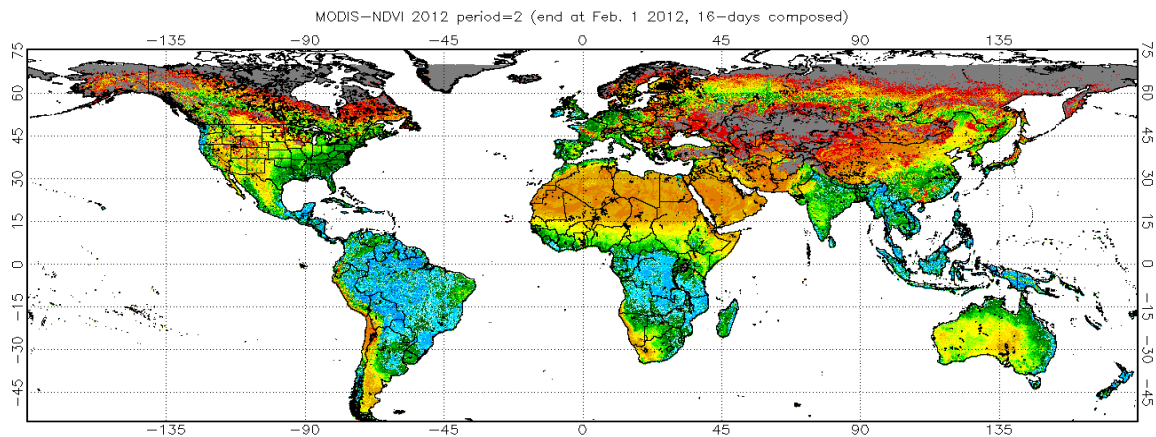


BIG DATA IN ECOLOGY

BIOL/ENVI 359 - Fall 2024 - Macalester College



Disclaimer: Please consider this syllabus a living document! Moodle will serve as the formal record in this course, and we look forward to building a dynamic learning environment with you.

KEY COURSE INFORMATION

- Instructor: Martha Torstenson (she/her), mtorsten@macalester.edu
- Class: MWF 2:20 PM – 4:30 PM; OLRI 253 (with a break an hour in)
- MT's Student Time/Office Hours: 11:00-12:15 Mondays, 9:45-11:00 Fridays (My office is OLRI 220)
- Texts: All readings will be available through Moodle
- Course Prerequisites: BIOL/ENVI 170 and STAT 112 or STAT 155, or permission of instructor

LEARNING GOALS

The practice of Ecology in the 21st century relies heavily on the analysis, modeling, and synthesis of diverse and broad datasets. In this course, we will learn how data is collected, organized, and handled in these fields, with the goal of becoming 'data stewards'. *This *NOT A STATISTICS* class - Macalester offers many wonderful upper-level statistics classes that deal with how to quantitatively analyze datasets of all kinds. I encourage you to take them!* We will focus more on how ecological data emerges from experiments and observational measurements, and how we can use it to learn more about ecosystems and how they are changing.

Our learning goals for the semester are to:

- Learn how data is collected, stored, and shared in current ecological research
- Become comfortable and confident using R/RStudio to analyze ecological datasets
- Develop effective practices for data organization
- Practice data manipulation using dplyr using packaged and novel datasets
- Develop & practice data visualization using ggplot2
- Apply basic analysis to ecological topics that span biomes and taxa

- Communicate findings effectively via writing, RMarkdown code, and visual displays
- Work productively in groups and create supportive, effective communities based on open communication, engagement, and sharing of responsibilities.
- Discuss and critique primary literature
- Identify limitations, potential drawbacks of data and where to focus additional measurements
- Learn about jobs in ecology and data science and how to prepare for the job market
- Integrate Environmental Justice issues into environmental and ecological data analysis
- Build a community of learning where challenges are met with thoughtful, open discussion and collaboration

ASSESSMENTS

Our class aims to model data-heavy work that you might experience in graduate school or a post-college job. These often entail [mid-length reports, group and individual work, analyses of the literature, and presenting your findings.](#)

Your grade and assessments can be put into broad categories:

Participation and Reading Engagement (20%): A large portion of this class relies on students participating in large and small groups, which requires people to be prepared and focused for class time, supportive of each other and engaged with the material. In order to ensure that we get as much as possible out of class time, please read all “required” readings, many of which will be accompanied by a low-stakes reading response assignment on Moodle. This grading category will include Mini-Quizzes, Reading Responses, and other low-stakes means of measuring participation.

MiniQuizzes (MQ): MQs will occur ~weekly and test understanding from the previous class meetings. After completing each quiz during synchronous class time, students will confer in small groups and resolve answers together. We will go over answers as a class after the paired discussions. MQs are graded Credit/No Credit. Some MQs will be offered as homework and reviewed in class together.

Reading Responses: Prior to each reading discussion, students will write a reading response. The first paragraph will summarize the motivation, questions, methods, and findings. The second paragraph will focus on how the paper could be improved (2-3 reasons), identify ‘sticky’ areas, and propose 1-2 future directions for the research. These will be submitted prior to class discussions.

Attendance, Preparation, Participation, and Group Work - A large portion of this class relies on students participating in large and small groups, which requires people to be prepared and focused for class time, supportive and helpful, good listeners, note-takers, and volunteers. You will be evaluated and self-evaluate on these aspects of the class regularly. While not every participation activity will include a graded component, think of how you can improve your practice as a class member.

Eco-Topic Presentations (group) (15%): Our course will be broken into four mini data exploration and analysis units, centered around four ecological datasets/topics. During each unit, you will work with a group to use a big data approach to ask and answer a question in ecology. For each EcoTopic section, groups will present their findings to the class in 10 minute

presentations. These will highlight challenges, methods, findings, similar studies, and future directions.

Eco-Topic Reports (ETR; individual) (40%): For each of the EcoTopics, students will create an original RMarkdown file describing their findings. These reports are comprised of

- 250-300 word introductions to the topic that includes a social/environmental justice (or otherwise "so what/broader impact") tie-in,
- at least 4 peer-reviewed references,
- hypotheses and research questions addressed by the data analysis
- a description of the dataset and how it was collected.
- your code and at least 4 figures with annotations and explanations.
- a 250 word summary of your findings and suggestions on next directions in terms of analysis and new research questions.
- a short reflection on your ETR and how it could be improved/what its strengths are

Final Report & Presentation (individual) (25%): Your final report and presentation will follow similar guidelines as the Eco-Topic Reports, but be on a novel topic using a dataset of your choosing. Guidelines are on moodle.

COURSE NORMS AND EXPECTATIONS

Minute Mingle!

At the start of each class, we will practice some silly and topical chit chat (which is a skill in itself!). Please contribute to the topic selection!

Office/Student Hours and supporting each other's learning

You are busy with activities, clubs, jobs, family and friend responsibilities, and figuring out who you are and what you want to be. We expect you all to be respectful, and kind to each other and use this course as an opportunity to model best practices of student interactions. I want to make sure I am able to support your learning. Please check in to chat during student hours or by appointment.

Communicating with me

Aside from reaching me in person during class/ office hours, the best way to get in touch is via email. I aim to respond to emails within 24 hours on weekdays.

Out of class work expectations

Readings and daily assignments should take ~1-2 hrs. Longer assignments will require more time to be scheduled. If you are having trouble due to work or class scheduling conflicts, let me know as soon as possible.

In class attendance

Attendance plays an essential role in learning; you are warmly invited, encouraged, and expected to attend all synchronous class meetings. I recognize that there are unavoidable circumstances that sometimes make it impossible for you to attend class, including health issues and family emergencies and sporting events.

If you know you will miss class due to an unavoidable reason, please email me at least 12 hours prior to class. This counts as an 'excused absence'. You are still responsible for work covered that day, but can get extensions as needed.

Late work policy

The submission dates for ETRs and other individual assignments are posted. If you need extra time to do your best work, please request at least 48 hours prior to the submission date. An extension allows you 3 days extra time. You must alert the professor when the late work is submitted so it can be graded promptly and you can receive feedback. Group presentations cannot have extensions, nor can end-of-semester submissions.

Artificial intelligence (AI) use policy

In this course, in light of the fact that generative AI will be a tool available to you throughout your careers, you may mindfully use AI tools (such as Bard or ChatGPT). However, you should note that the material generated by these tools may be inaccurate, incomplete, or otherwise problematic. Beware that overuse of AI may stifle your own independent thinking and creativity, and use any tools (for generating text, code, video, audio, images, or translation) wisely and carefully. Further, I encourage you to be mindful of the ethical and environmental challenges associated with generative AI. (See <https://libguides.macalester.edu/ailiteracy> for an excellent overview).

You may not submit any work generated by an AI program as your own. If you include material—including both *ideas* and *language*—generated by an AI program, it should be cited like any other reference material, both in this course and at Macalester College in general. If you have any questions, please feel free to contact me.

Developing your voice in science

Science requires a balance of courage and humility – this is as true for undergraduates as it is for researchers at leading institutions. You need courage and confidence to pursue and develop new ideas and approaches, confidence to critique others' ideas, confidence to follow your curiosity. But science also requires humility – identifying limitations, asking for advice, help and guidance, accepting appropriate criticism from others, and reflecting on potential improvement. Science is a process of realizing you don't have all the answers, seeking information from other sources, and developing new questions to build on existing experience.

SAFETY AND HEALTH AND WELLNESS

On our first day, we will be discussing our class community norms around community health and what this means for group work and attendance. Discussion outcomes will be posted on Moodle.

COURSE ENVIRONMENT AND RESOURCES

Learning environment and inclusivity. Our goal is to promote an inclusive learning environment where diverse perspectives are recognized, respected, and contribute to our strength as a

class. If something in or about this class makes you feel unwelcome, please see me or a college administrator you trust.

Names and pronouns. You should be addressed in the manner that you prefer. If you want to make sure we address you with a particular name and/or pronoun please let us know through the first-week survey.

Title IX. Macalester College is committed to providing a *safe learning environment* for all students that is free of discrimination, sexual harassment, sexual assault, domestic violence, dating violence, and stalking. Further details are explained in the college's Title IX regulations (<https://www.macalester.edu/titleix>). If you, or someone you know, experiences a Title IX violation, know that Macalester has staff trained to support you. Macalester faculty members are "responsible employees," which means that if you tell me about a Title IX violation, I must share that information with the Title IX Coordinator. Still, you will control how your case is handled, including whether or not you wish to pursue a formal complaint. Our goal is to make sure you are aware of the range of options available to you and have access to the resources you need (Title IX Office, 651-696-6258) including, if you wish, confidential sources on campus who are not subject to the mandatory reporting requirement (see list of "Confidential On-Campus Support" at <https://www.macalester.edu/violenceprevention/support/>).

Accessibility. I am committed to ensuring access to course content for all students, including those with disabilities. If you have a disability, please meet with me early in the semester to discuss your accommodation plan. If you have not yet obtained a plan or are unsure if you have a disability that requires accommodation, please contact Disability Resources: disabilityresources@macalester.edu, or call 651-696-6275. Furthermore, I know that at times personal issues, stress, health problems or life circumstances may impact your ability to perform academically. Please contact the Office of Student Affairs at 651-696-6220 (studentaffairs@macalester.edu) for support and ask them to get in touch with your instructors.

Recording policy. In order to accommodate students who will not be able to attend synchronous class meetings during this module, we plan to record our synchronous class sessions in a manner consistent with Macalester's classroom recording policy. I will share these recordings in a password-protected (and not public) place. If you download any class recordings, you must store them in a password-protected location or on a password-protected site. Please note that the recording policy clearly states that you may not share, replicate, or publish any class recording, in whole or in part, or use any of the recordings for any purpose besides knowing what happened during the class period, without my written approval. If I use any recorded content from any of our classes for purposes beyond our class, I will – in accordance with the policy – obtain your written permission to do so.

Other helpful information to support your experience in the class:

- Concerns on content or experience in the class -> contact me before/after class; attend office hours (group or solo by appt); email to set up a time to meet over Zoom.
- Need additional writing support -> Check out MAX Center for writing tutors or Works in Progress peer review program

- Are you unable to attend synchronous activities due to an unexpected event (sickness, family issue, schedule) -> Contact me by email as soon as possible to set up a time to talk about options.
- Absence due to religious observance -> Please let me know you will be observing ahead of time, so that you can obtain course materials ahead of the absence.
- Do you need to sleep? Of course you do. Take care of yourself. If you are feeling overwhelmed about the scheduling or pace of this course, please let me know.

Many additional questions will be addressed on Moodle.

Big Data in Ecology is still a new-ish class and I envision it as a place to grow and experiment with new approaches and ideas. For everyone to do that successfully, the class needs to be a welcoming, supportive, and inclusive environment grounded in mutual respect of the individuals that comprise the class and their ideas.

If you at any point feel there is something about the class that is keeping you from success, I encourage you to reach me by email, in person, or through a designated student 'ombudsman'.

I also encourage you to take care of yourselves through the semester - eat well, sleep well, and take breaks as needed. If you are feeling overwhelmed, need academic or mental health support, prioritize those needs.

Academic support: Works in Progress peer-support or MAX Center
Disability Services: 651-696-6275 or disabilityservices@macalester.edu
Student Support: Office of Student Affairs at 651-696-6220
studentaffairs@macalester.edu