EAS 509: Ecology: Concepts and Applications Fall 2019

Primary Instructor: Dr. Sheila K. Schueller schuel@umich.edu
Office Hours (4556 Dana): Tues and Wed 1-3pm
Office Hours in the Commons: Mon 1-2:30pm, Tues 4-5:30pm, Thurs 4-5:30, Fri 1:30-3pm
All Instructors are also available by appointment.

Lecture: Monday/Wednesday 11:30-1, 1040 Dana
Lab: G556 Dana, except for Wednesday section: 2556 Dana
Lab Coordinator: Sara Steenbergh ssteenb@umich.edu
002 - Monday 2-6 pm: Kevin Bosma kebosma@umich.edu
003 - Tuesday 10-2pm: Kate Laramie laramiek@umich.edu
004 - Tuesday 2-6pm: Edie Juno ejuno@umich.edu
007 - Wednesday 2-6pm: Alison Bressler asbressl@umich.edu
005 - Thursday 10-2pm: Charlie Ramsey ccramsey@umich.edu
006 - Thursday 2-6pm: Kirk Acharya vacharya@umich.edu

What to do if you are lost, confused, behind, don’t get it, and/or can’t find it:
- Read this syllabus!
- Go to the Canvas site. Use Piazza, instead of email, within Canvas to check announcements, ask questions, get updates, etc.
- Go to the Office Hours in the 1st floor Commons or meet with an instructor
- Read suggested pages in the textbook – a copy is on reserve in 1520 Dana.
- Use other resources on Canvas (lecture and lab notes, supplementary biology background, Statistics & Excel help, and more!)
- Ask your peers/ create a peer study group

Syllabus Contents
1. Course Goals: What should you walk out of this course with? (See **Outcomes Tracker** on course home page for more detail)
2. What is this course about?
3. What will you need for this course?
4. Grading Breakdown and Rationale
5. Important Course Policies and Expectations
6. Student Support, Resources, & Accommodations
7. Key Advice & Tips for Students: From experience and research
8. Schedule of lectures, readings, assignments, and labs

Course Goals: What should you walk out of this course with? (See **Outcomes Tracker** on course home page for more detail)
1. A basic understanding of the key parts and processes of ecological systems relevant for evidence-based design, planning, and decision-making in the real, changing, and diverse world.
2. Skills in communication (the ability to use and understand a variety of ecological sources of information), research process and quantitative literacy (field observation, experimental design, data analysis, and interpretation), systems thinking (use of frameworks and logic models), and collaboration (team problem-solving and cooperative learning).
3. Inspiration and preparation to take more natural science courses in SEAS.
Overview of Course Content: What is this course about?
Through interactive lectures, discussions of real-world cases, and inquiry-based guided and independent field labs we will study the basic parts and processes of ecological systems – how organisms respond to their physical environment, interact with each other in populations and communities across the landscape, and affect the movement of energy and nutrients through terrestrial and aquatic ecosystems. This will include topics and questions relevant to global change, such as:

- **Evolutionary Ecology**: What is a species? What is the time scale of evolution? How is genetic variation important in conservation, restoration, agriculture, and public health?
- **Physiological Ecology**: How can organisms tolerate or respond to changes in climate, salinity, or acidity? How can indicator species inform citizen-science site assessments?
- **Population Ecology**: How can hunting-related changes in age distribution affect population growth? How can we estimate maximum sustainable yield to inform fisheries management?
- **Community Ecology**: How do species compete for limited resources? Why are some species invasive? How can restoration ecologists change the direction of a community over time?
- **Landscape Ecology**: What are organisms’ patterns of migration and movement? What are the consequences of connecting or fragmenting habitats in the landscape?
- **Ecosystem Ecology**: What are the fluxes and pools of nutrients in a system and how do they affect productivity? How can salmon feed forests and fertilizing crops lead to fish kills?
- **Assessment of Ecological Systems**: What is the indirect impact of one species on many others? How can I test a possible cause? What are appropriate measures of ecosystem “health”?

Course materials: What will you need for this course?
1. **Your 509 Canvas site** ([https://umich.instructure.com/courses/311447](https://umich.instructure.com/courses/311447)) will have all course info and resources, including assigned readings, assignments, and lecture notes.

2. **Piazza** is an online forum within the 509 Canvas site.
   - Use Piazza instead of email to ask any questions or share resources.
   - Share ideas!
   - Get answers to questions quickly and efficiently from classmates and instructors!
   - You can opt to send messages publically, privately, and/or anonymously.
   - You can change your notification settings to allow you to get every Piazza message in your email or not. When I send once weekly course announcements these will over-ride your settings and go to your email inbox.

3. **Required SIMUTEXT Chapters**: See your first Simutext Assignment details in Canvas for how to purchase and use your Simutext package ($52).

4. **Recommended (not required) Textbook**: Stiling, Peter. 2014. *Ecology: Global Insights and Investigations*. Second Edition. McGraw Hill. [ISBN 9780073532509](https://isbn-look-up.com/). Two copies will be on reserve in the SEAS OAP office for you to borrow, or you can buy a used copy (1st edition) for as little as $10. Recommended page numbers for both editions are provided in the lecture schedule on Canvas. Many students find that the textbook can be very useful to quickly define a term, find an appropriate graph, or be reminded of a particular example.

5. **Appropriate outdoor clothing for field labs**: Dress for being OUTDOORS on lab days. This means solid, comfortable walking shoes (no flip flops or high heels), long pants (no business suits), rain gear, and warm layers. We WILL go out even if it is WET and/or COLD!!!
Grading Breakdown and Rationale (600 pts total)

1. **Simutext Assignments** (6 x 20pts, drop the lowest = 100 pts): What? Online interactive chapters with questions on particular topics. Why? Opportunity to engage (including using simulations) with some important topics/skills on your own.

2. **Research skills assignments** (180 pts): What? Exercises related to the research process. Details are provided on Canvas. Why? Practice finding and interpreting primary literature, doing statistical analysis and creating graphs (basic excel skills), drawing conclusions, communicating research in abstracts and presentations, and designing and executing your own research based on your interests and the needs of local practitioners. These skills are useful for being able to use and interpret scientific sources in your career, as well as work in interdisciplinary teams.
   a. **Comparing and Relating Data** (35 pts)
   b. **Field Notebook** (30 pts)
   c. **Independent Project** (115 pts): Proposal (15 pts), Plan (20 pts), Presentation (65 pts), and Abstract (15 pts)

3. **Exams** (3 – 60pts, 100pts, 120pts = 280pts) – What? Set of questions to be completed over at least a week. All exams are take-home so you have an opportunity to think on your own without time pressure AND to then discuss/debate questions with your peers. Why? Integrate, apply, and process lecture and lab material, and benefit from collaborative learning. Though the focus is conceptual understanding and application, you do have to memorize (own) some facts in order to create your own meaningful chunks of information that you can then apply and transfer.

4. **Contribution & Engagement** (40pts) – What? Different modes to connect with the material more informally. Why? To guide and incentivize your immersion in the content and create good habits of learning and engagement. **You choose which of these you do, and you do not have to do all to get full credit.** Doing all can result in 12 extra points. Points will be tallied for the first and second half of the terms separately (1st = Sept. 1- October 31, 2nd = November 1 – December 19)

<table>
<thead>
<tr>
<th>What to do within that half of the term</th>
<th>1st</th>
<th>2nd</th>
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<tbody>
<tr>
<td>Speak up in lecture and/or lab more than twice (ask or answer a question)</td>
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<td>2</td>
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<tr>
<td>Post at least one relevant comment, source, or question on Piazza (e.g. a link to other studies, news, or organization related to a recent lecture or lab, with a note on how it is relevant OR a question on course content or an assignment, including your thoughts or confusion.)</td>
<td>4</td>
<td>2</td>
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<tr>
<td>Answer a question on Piazza (any answer, even on a logistics)</td>
<td>6</td>
<td>4</td>
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<td>Hand in a 1/2 page response to a Quick Reads prompting question at least twice.</td>
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<tr>
<td>Meet ~ weekly with a study group of 2 or more people (hand in list of names and dates).</td>
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<td>6</td>
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**Graded activities are designed to help you learn.** We are not aiming to weed you out, but for everyone to achieve mastery in basic concepts, and exposure beyond basics. (See *Let’s teach for mastery not test scores*). There are lots of regrade and extra point opportunities in this course to make up for lost points, so **please do not be a point gruber (arguing over minor point adjustments).**

Percentage point letter grade cut-offs will be set to close to standard cut offs at the end of the term to maximize fairness and accuracy (e.g. adjust for any grading discrepancies among sections).

You come to SEAS with diverse academic backgrounds. For some, the course may feel too fast, for others parts will feel too basic. You need to either:

a) Share your knowledge/expertise with others if parts of this are what you already know, and/or
b) Be a self-directed graduate learner and use supplemental resources as needed.

Regularly attending office hours and reading the text will be necessities for some – and all can benefit from using all the resources you have available to you while you are here!
Important Course Policies and Expectations

- **Expectations & Time.** To get the most out of this class and your tuition dollars, you are expected to:
  
  - **Attend all lectures** (see student advice below!) and all labs. An unexcused absence from lab section will result in a 30pt deduction from your grade. If necessary, and only if you make appropriate arrangements with all relevant instructors IN ADVANCE, you can make-up a lab by attending another section within the same week.
  
  - **Spend 3-5 hours per week outside of lab and lecture on coursework.** (About 70% of students agree with this estimate, but given varied backgrounds, some will need to spend more time.)

Here is a **sample schedule** for the week to help you plan and to clarify expectations for this course:

<table>
<thead>
<tr>
<th>When</th>
<th>How Long</th>
<th>What</th>
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<tbody>
<tr>
<td>Sunday pm or Monday am</td>
<td>15-30 min</td>
<td>Review lecture “Quick Reads” and write down brief answers to prompting questions. Print or download lecture outline.</td>
</tr>
<tr>
<td>Monday 11:30 pm or am before your lab</td>
<td>1.5 hours</td>
<td>Attend and participate in Lecture</td>
</tr>
<tr>
<td>pm or am before your lab</td>
<td>15-30 min</td>
<td>Review lab page enough to become familiar with the topic, its relevance, our site, and key terms. Write down the big question and your predicted answer to the question in your field notebook. Check out at least 2 of the links or references of interest to you, noting what might be useful for your Independent Project.</td>
</tr>
<tr>
<td>Lab section</td>
<td>3.5 – 4 hours</td>
<td>Attend and participate in Lab, including making entries in your field notebook.</td>
</tr>
<tr>
<td>Tuesday pm or Wednesday am</td>
<td>15-30 min</td>
<td>Review lecture “Quick Reads” and write down brief answers to prompting questions. Print or download lecture outline.</td>
</tr>
<tr>
<td>Wednesday 11:30 am</td>
<td>1.5 hours</td>
<td>Attend and participate in Lecture</td>
</tr>
<tr>
<td>Thursday or Friday</td>
<td>1.5-3 hours</td>
<td>Work on weekly assignment (Simutext, IP, exam, etc.)</td>
</tr>
<tr>
<td>Thursday or Friday</td>
<td>30 min – 1 hour</td>
<td>View the complete color ppts together with your notes to fill in gaps and check out additional resources. Don’t just reread your notes. Annotate, recreate, re-organize them. Meet with a regular study group and/or instructors to review lecture notes, try “Self-Assess” Questions in the lecture file, and discuss assignments.</td>
</tr>
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- **Late Policy for Assignments:** A 5% loss of points per day will be assessed to all assignments handed in after the date and time they are due. Unless there are extenuating circumstances, assignments will not be accepted more than one week past the due date.

- **Technology and attention:** While in lecture and lab please do not use a cell phone or laptop or other device in any way that is not directly related to class. Not only is it disrespectful, but your assumed productive multi-tasking is wasting your time!

- **Academic integrity:** The point of group work and discussions are to exchange ideas with others and refine your own, however, you must not hand in someone else’s words or ideas as your own. You are expected to understand what plagiarism is, both accidental and deliberate, and to be familiar with the University of Michigan standards on professional academic behavior, as stated here: http://www.rackham.umich.edu/current-students/policies/academic-policies/section10. Plagiarism is grounds for expulsion from the program and includes copying material from another student or source and/or writing the same thing as your friend on an assignment you turn in separately. If you are at all unclear about what constitutes plagiarism or cheating, especially with group work, please ask one of the instructors before you hand in work with your name on it!!!
**Student Support, Resources, & Accommodations**

SEAS students represent a diversity of individual academic and cultural backgrounds, beliefs, and experiences. A diverse, equitable, and inclusive classroom is essential to your professional training. I do not wish to exclude anyone from a positive and productive learning environment. Your 509 instructors use a variety of teaching approaches and examples, and in every activity we expect every member and instructor of this class to show respect for others. Please approach me, another instructor, and/or other resources on campus to voice concerns or suggestions about an event, comment, or course content that affects your own or another student’s comfort or learning experience. Here are some excellent on campus resources to optimize your experience and performance:

- If you think you need an accommodation for a disability, let me know as soon as possible, so that we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate and helpful academic accommodations. 734-763-3000;

- If English is not your first language and you may find it challenging to either understand or communicate well in this course. Please meet often with instructors and definitely use both the English Language Institute, which provides a variety of resources for international students.

- The Sweetland Center for Writing is a great place for anyone to receive feedback to improve clear communication in your written work.

- The UM Library provides a wealth of free primary literature at your fingertips, you just need to make sure you do your searches while logged in or via the library home page, even if you are using Google Scholar to reach the source for free (look for MGet IT links).

- The Scholar Space is an excellent resource for doing anything digital – image manipulation, citation management, web publishing, doc formatting, multimedia creation, text mining, etc.

- Consulting for Statistics, Computing and Analytics Research (CSCAR) provides consulting services and training in data science, statistics, and advanced research computation.

- Counseling and Psychological Services (CAPS) provides free and confidential support options for any issue including experiencing stress, mood changes, problems with eating and/or sleeping.

- CEW+ provides immediate, ongoing services and financial support, especially to women and nontraditional students, but also to any students who encounter education and career obstacles based on their non-linear paths to, and experiences within, the University community.

- The Students with Children website is dedicated to the needs of student caregivers at the University of Michigan who juggle parenting, other family care, work, and study.

- Students of Color of Rackham (SCOR) is a network for graduate and professional students dedicated to the social, cultural, and academic well-being of students of color.

- Spectrum Center works toward enhancing the campus climate and support services for LGBTQ+ students, staff, and faculty at the University through education, advocacy, and community building.

- For additional resources see also the Diversity, Equity, and Inclusion offices of the University of Michigan and of SEAS.
Key Advice & Tips from Students for Students
Here is a summary and some examples of how students responded to: What advice would you give a future student about how to get the most out of this class and/or use their time effectively?

1. Prepare for class by printing & reviewing notes and resources: “Take at least 15-30 mins to prep for each class by reading the articles, journals, textbook, or anything else to give you some insight into the day's material and to help you generate relevant questions.” “read the lecture notes before class and try to answer the questions by yourself and then check the answer during lecture.”

2. Attend and take good notes in lecture: “Definitely attend all lectures to get the most out of this class.” “Go to every lecture, no matter what. If you miss a lecture, visit with a GSI who was in that lecture and go over the slides.” “It's hard to get what you need to understand power point slides from other people's notes.” “Be engaged during lecture, … take rigorous notes.” “One tool that I've found extremely helpful is the application I use to take notes, called Notability. This has allowed me to record lectures and take notes, and then later when I want to review, I can playback the recording.”

3. Don't procrastinate: “Start assignments early – if you rush through them, they aren't very valuable.”, “Keep up with the work.” “It is well worth putting the time into the assignments. All of the material is carefully crafted to help the students be successful, so if you put the time in, you will get a lot out of the class.” “Take the time to look over assignments early! Some require much more time than others!” “I wish I had spent more time engaging and reviewing in course material between classes. … It's tempting to take as many courses as you can stand in order to expose yourself to as many appealing classes as possible. There are so many interesting courses! But, is it better to stick to fewer classes and get as much out of them as you can?”

4. Review as you go: “review the material periodically and discuss ecological topics with classmates on a regular basis" “I would recommend going over the lectures and writing down a quick sheet of every one with the key concepts and ideas. This really helped me pull together knowledge for the quizzes and exams." “review with friends every weekend.” “I use a computer software (space repetition software), and enter all the content of the lecture in flash card form by date (i.e. electronic stacks of cards by topic). I use these to review every week, and it is really good for helping to remember those concepts that just won't stick”

5. Ask questions & converse with your classmates and instructors: “meeting regularly with instructors for asking questions is the most important thing for this class for students who did not have ecology before.” “Do the assignments in groups - when you can - and argue with your friends.” “Work together with a group of students (5-6 ideally) on take home exams - I learned so much doing this.” “Do the take-homes on your own, in full. THEN, work in a group.” “Go meet with the instructors whenever you have any problems, they are always glad to help. That can make things much easier.”

6. Use all the available resources: “Extra readings are helpful in understanding better.” “Check out the additional materials. When I had a chance to look at them they were always really fascinating and further expanded my knowledge of a topic.” “I would recommend reading the textbook after the lecture, and going through the questions at the end of the chapter. This helps in absorbing concepts taught in class, and the textbook is super interesting. Secondly, the student should read everything (including the extra links) in the simutext assignments, as they are very helpful and are extremely fun.”

7. Enjoy it!: “Have fun during labs" “Enjoy it, breathe it in" “Don't lose sight of how FUN it is to learn about bugs and stuff, go outside and experience nature!”

“Take it seriously and absorb as much as you can even if you don't think you're going to be a "scientist." The concepts will build fundamental knowledge that will definitely help you approach whatever environmental career you choose, and will give you tools to engage in conversations with decision-makers, skeptics, etc.”
More ways to get the most out of this course: 7 Evidence-Based Tips for Better Learning

1. **Take notes in class and then re-structure them.** You learn more (and improve your grade) if you (a) take notes by hand, not with your laptop during lecture, and (b) take time soon after lecture to not just re-read your notes, but generate something new by actively re-structuring and re-organizing your notes (combining the slides, your notes, memory, and other sources) into a coherent product (Cohen et al. 2013; Generation Effect).

2. **Recall what you know from memory:** To best assist your long-term memory retention, instead of re-reading your notes or text, try recalling from memory or elaborating/explaining what you know – that is, test yourself and each other! See: Research finds practicing retrieval is best tool for learning and a very useful book by Brown et al. (2014) called Make it Stick (for video on key lessons see https://www.youtube.com/watch?v=lyHAjVJIFo).

3. **You are learning for the long-term when learning feels slow & difficult,** not when you can improve your short-term retention through rote repetition. Fumbling, grappling, and unsuccessful attempts to solve a problem are actually good for your learning! You also do not necessarily learn better when the style of teaching fits your preference (Brown et al. 2014; Oakley 2014).

4. **Be an active vs. a passive learner:** “One must learn by doing the thing, for though you think you know it--you have no certainty until you try. “ (Sophocles, 5th c. B.C.); “Learning is not a spectator sport. Students do not learn much just by sitting in class listening to teachers, memorizing pre-packaged assignments, and spitting out answers. They must talk about what they are learning, write about it, relate it to past experiences, and apply it to their daily lives.” (Chickering and Gamson 1987)

5. **Collaborate (but do not free ride or be a leech):** Teach others, learn in groups, quiz & explain to each other! Students working in teams tend to learn, understand, and remember more, and acquire critical thinking as well as teamwork and communication skills that are key for the workplace (Marzano et al. 2001, Hanson 2006).

6. **Organize your thoughts, facts, concepts into mental models, diagrams, hierarchies or structures:** Working memory is limited to 9 slots. Chunking or clustering information into structures increases the amount of information that can be held in working memory (Brown et al. 2014). Graphically organized notes and creating nonlinguistic representations increase higher order thinking and have strong positive effects on learning (Marzano et al. 2001, Oakley 2014).

7. **Alternate between periods of intently focusing on a task or problem without distraction (try 25 minutes – see the Pomodoro Technique) and then diffuse, relaxed time** (Oakley 2014), such as taking a walk or even a nap.

- Hanson, D. 2006. Instructor’s Guide to Process-Oriented Guided Inquiry Learning, Pacific Crest, Lisle, IL.
- Oakley, B. 2014. A Mind for Numbers: How to Excel at Math and Science (Even If You Flunked Algebra). See also the related very popular massive open online course: https://www.coursera.org/learn/learning-how-to-learn
### Course Schedule: One-page overview

See Canvas for the complete and up to date course schedule which includes required reading and prompting questions for each lecture, and links to lab background and assignment details.

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<tr>
<th>Lecture topics</th>
<th>Weekly Assignment DUE</th>
<th>Lab</th>
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| W, 9/4         | **UNIT 1: Origin, study & state of biodiversity**  
1. Intro to ecological systems | No lab first week |
| M, 9/9         | 2. Experimental Approaches in Ecology | 1. Insect Patterns |
| W, 9/11        | 3. Life, death & change on earth | Evolution for Ecology Assignment (Simutext) - NOT ALL, See assignment details |
| M, 9/16        | 4. Biodiversity continued to Biomes | 2. Tree ID & Herbivory |
| W, 9/18        | **UNIT 2: Physiological Ecology**  
5. How and why does the physical environment vary? | 3. Water quality |
| M, 9/23        | 6. Organisms vary in their tolerance of conditions | * Take-home Exam 1 [online]: Due Friday 9/20 |
| M, 9/30        | 7b. How do organisms respond to change? continued | 4. Forest succession  
* Independent Project Preliminary Proposals |
| W, 10/2        | **UNIT 3: Population Ecology**  
8. Demographics | 5. Agroecology  
Independent Project Meetings |
| M, 10/7        | 9. How do populations change over time? | Understanding Population Growth Models Assignment (Simutext) - ALL |
| W, 10/9        | 10. Life History Traits | 6. Independent project data collection |
| M, 10/14       | NO CLASS M/T Fall Study Break | 7. Wetlands |
| M, 10/21       | **UNIT 4: Community Ecology**  
12. Communities | 9. Concept mapping from tick data & IP Analysis and Presentation Prep |
* IP Presentations & Abstracts due |
| W, 10/30       | 15. Mutualism | Revised Abstracts due Dec. 11 |
| M, 11/4        | 16. Indirect interactions | 12. Relationship between Biodiversity and ecosystem function & services |
| W, 11/6        | **UNIT 5: Landscape Ecology**  
18-19. Metapopulations, fragmentation, and reserve design | 13. Climate Change Causes and Consequences  
* Climate Change Assignment (Simutext) - Sections 8, 2 & 5 only |
| M, 11/11       | **UNIT 6: Ecosystem Ecology**  
NO LAB (Thanksgiving recess 5pm, Nov 27) |
| M, 11/18       | 22. Cycles in the landscape and watershed context, cont. | 16. How do we assess whole ecosystems? |
| W, 11/20       | 22b. Cycles in the landscape and watershed context | Take Home Exam 3 due (hand in 4-6pm in room 1040 Dana, or earlier) |
| M, 11/25       | **UNIT 7: Maintaining & measuring changing ecosystems**  
23. Succession | 17. Research Symposium  
* IP Presentations & Abstracts due Dec. 11 |
| M, 12/2        | 24. Relationship between Biodiversity and ecosystem function & services | 18. Climate Change Assignment (Simutext) - Sections 8, 2 & 5 only |
| W, 12/4        | 25. Climate Change Causes and Consequences | Revised Abstracts due Dec. 11 |
| W, 12/11       | 27. How do we assess whole ecosystems? | Take Home Exam 3 due (hand in 4-6pm in room 1040 Dana, or earlier) |
| Thursday, 12/19| Take Home Exam 3 due (hand in 4-6pm in room 1040 Dana, or earlier) | Draft Abstracts due Dec. 11 |