

Syllabus - Principles of Ecology (BIOL 203)

Spring 2016

Gregg Hartvigsen

Course item	Details
Lectures	MWF 8:30 - 9:20am; 9:30 - 10:20am, Schrader 1
Gregg's contact info	Office = ISC 360 Office phone = 245.5448 Email = hartvig@geneseo.edu (best)
Gregg's office hrs	MWF 10:35 - 11:50, Tues. 2-3:45pm
TA Office Hr	Sarah Becker: TTh 7:00 - 8:30pm, ISC 343
TA Office Hr	Maggie Luce: W 1:00 - 4:00pm, ISC 343
Textbook	<u>The Science of Ecology</u> (SoE), PDF chapters provided on MyCourses, along with other readings.
Software	R, RStudio, and Excel

1 Overview

Ecology is the study of the interaction of organisms with other organisms and their physical environment. I will work to provide you an introduction to this broad area of science. If you read any news source and you're likely to quickly find something on an environmental challenge facing humanity (e.g., global climate change), or you might hear of a new species or the emergence of a disease, or even the spotting of a Bigfoot. There will be information confirming imminent catastrophe to those claiming it's all a hoax. My hope is that you successfully complete this class with knowledge about the state of the natural world **and** enhance your desire and ability to seek out the primary information regarding these topics and gain the ability and skill to better assess the data.

2 Expected Learning Outcomes

After successfully completing this class you will be able to

1. **apply** the principles of evolutionary theory to explain the formation of ecological patterns seen over broad temporal and spatial scales in nature;
2. **explain** the relevance of dozens of fundamental principles of ecology;
3. **interpret** complex relationships found in data (e.g., tables and graphs);
4. **quantitatively test and evaluate** hypotheses and ecological theories using data, statistics, and mathematics using R;
5. **create** publication-quality visualizations using R;
6. **apply** basic ecological principles and the general process of scientific inquiry to critically evaluate ecological phenomena that you see and hear about on a day-to-day basis (e.g., stuff you see as you walk, drive, or hear about in the news).

3 Resources

1. **Textbook.** The book is under construction. I will provide chapters on MyCourses before lecture. I'm doing my best. Your patience is much appreciated!

2. **Online notes.** These come in two forms and will be available in the Course Materials section on myCourses:

- (a) **Pre-lecture notes.** I try my best to provide these by 10PM the night before lecture. They represent what I hope to cover. These are provided in relatively **low** resolution pdf files (six slides per page).
- (b) **Post-lecture notes.** These are the slides that were presented and discussed in lecture. You are responsible for this material. These are provided in relatively **high** resolution pdf files (two slides per page) within 24 hours of the lecture. I encourage you to save trees by simply viewing these electronically at your leisure. They will remain on MyCourses for your viewing pleasure.

One approach to dealing with notes might be to bring the pre-lecture notes to class. If you don't understand something in the notes mark it with a "?" and look online at the post-lecture notes for clarification and/or stop by my office to chat about the material. Another approach is to not print the pre-lecture notes but just come and take notes. Soon after lecture you should look at the post-lecture notes and clean up your notes.

3. **Software.**

- (a) Excel (or a look-alike). Free for matriculated students (you!).
- (b) R. Free. Go to <http://cran.case.edu/>.
- (c) RStudio. Free front-end for R. Install after you install R. Go to <http://www.rstudio.com/ide/download/desktop>.

4. **Teaching Assistants.** Their primary goal is to help with R and the Ecology Module assignments. I recommend you be nice and bring gifts.

5. **Email.**

- (a) You are responsible for information provided to you via your Geneseo email account from me and the TAs.
- (b) You must email me from your Geneseo account, otherwise it may go to my spam folder and be missed. This has happened.

6. **Old exams.** Every exam I've ever given in this class since 1998 is available in my Geneseo "Outbox." For help on boxes see <https://wiki.geneseo.edu/display/cit/In+and+Out+Boxes>.

7. **"What's new?"** Each lecture begins with this question. Please check out the news and share. Here are several great sources:

- (a) <http://www.sciencedaily.com/>,
- (b) <http://news.sciencemag.org/>,
- (c) <http://www.scientificamerican.com/>, and
- (d) <http://news.nationalgeographic.com/news/>.

8. **SOFI comments** from previous semesters.

9. **Let's do lunch!** This is a good chance to chat about anything - the course, life, jobs, juggling, hitchhiking, motorcycling, music, tennis, racquetball, squash, nature, cycling, the next exam, whatever. Please gather a group of two or more. The venue is your choice. We each pay for ourselves. Note: I'm a vegetarian.

4 Grading stuff

The following table shows the breakdown for points. Assignments may be added or subtracted if demands change, including pop quizzes ("pop opps") and extra credit opportunities.

Item	Number	Points for each	Total pts
“Ecology modules”	4	12	48
Pop opps	N	5 pts ea.	5N
Exams	3	75	225
Final exam	1	100 - 250 (default = 150)	(see section 6 below)
Total			$373 \leq \text{total} \leq \approx 550$

“Pop opps” are unplanned assessments to reward you for keeping up on the material. Probability of occurrence increases with decreasing attendance.

Your final grade will be converted from a numerical value to a letter grade using the following rules. I will round **UP*** to three decimal places using Excel’s function CEILING(number, 0.001). The values below are proportions of possible points earned.

Score	Letter Grade	Score
0.933 \leq	A	$< \infty^{**}$
0.900 \leq	A-	< 0.933
0.867 \leq	B+	< 0.900
0.833 \leq	B	< 0.867
0.800 \leq	B-	< 0.833
etc.		

* The college rounds down (truncates) the average “quality points” you earn for each semester before calculating the GPA for each semester. In the 2014-2015 Bulletin’s example (pages 38-39) they show a student earning a GPA of 2.728571, which then becomes 2.72! They probably round down your GPA for your cumulative GPA, as well! To help counter this I will take a grade of, say, 0.832105, which would be a B-, and round it up to 0.833, making it a B.

** Extra credit points may lead to scores > 1.0 .

5 Ecology Modules

Galileo wrote “It [nature/universe] is written in the language of mathematics.” We are studying nature and it is best understood using quantitative approaches. Fortunately, you’ve been studying mathematics for years and this will help you understand complex biological systems. In particular, the “Ecology Modules” will help you to further develop your quantitative skills to help you better understand nature.

If you find computer programming, math, and/or statistics intimidating and/or challenging recognize this about yourself and plan accordingly. Solving problems using software like R is a similar skill to computer gaming, using a cell phone, figuring out Facebook, playing guitar, juggling, or riding a unicycle. You can do all of these if you have desire and put in the time.

General instructions for completing Ecology Modules

1. For credit you need to hand in a paper version **anytime before the beginning of class on the day they are due.**
2. It must be stapled (-2pts for no staple).
3. You may slide assignments under my office door anytime before I leave for class (usually 8:15am) on the date due. If I return from class and find it under my door your assignment is late and 3 pts will be deducted from points earned.
4. No assignments are accepted after 5:00pm on the day they are due. No assignment will receive credit if put in my mailbox in the biology office.

5. Emailing me the assignment before the due date/time so I can print it for you will cost 3 pts.
6. Module descriptions will be available in the course materials section on MyCourses.
7. Each Module will have its own set of instructions. Read these, complete the module, then re-read the instructions before handing it in or risk losing points.
8. Your write up should be as short as possible while completing all required tasks.
9. Your primary goal is to tell the reader what you found.
10. Use only complete sentences, except for your R code!
11. Include your name, date, and assignment name at the top of the front page.
12. Do NOT use a title page.
13. Use single-spacing for your write up.
14. You must staple multiple sheets together before handing it in. If you do not staple your assignment you will receive a look of grave disappointment, or worse.
15. Your report should be structured in numerical order with each question answered and any graphs included in each section before starting the next question. Random arrangements of pages, figures, and answers has been tried before without success.
16. Include only R code you wrote or modified that creates your answer (assume I know code from the Module description). Feel free to refer to code that you have provided in a previous answer to avoid including the exact same code twice. Do not include screen shots of your code!
17. Your answers and included graphs will demonstrate that your code worked fine. I will read the code to verify consistency with the results you provide.
18. The points for each question are found in the description. This represents the rubric that will be used to evaluate your work.
19. **ALL WORK MUST BE YOUR OWN.** I have found the same mistakes in multiple reports. This generally implies plagiarism has occurred. Such problems result in at least receiving a zero for the assignment. Please be mindful to avoid this.
20. **Finally, know yourself and accept yourself!** You probably know if it's hard for you to use R, hard for you to write up a paper, whether you tend to procrastinate (e.g., you've handed assignments in late in other classes), you get sick a lot in the middle of the semester when assignments are due, and/or family challenges seem to happen often to you. If this is you then get these done early or you will be frustrated with yourself! Be sure to use your resources - see TAs and me right away and get going! Your helpers (me and TAs) are not likely to answer questions the night before these are due.

Getting help on Ecology Modules

TAs Sarah and Maggie and I are eager to *help* you to be able to solve problems. When you come for help we'll ask you to show us what you have done that did not work. Be sure to read the directions in the modules carefully and refer to the appendices of your book to get started. You can send us the code that didn't work. We will run it and see the error message ourselves and try to help through email. Be sure to include all the code so we can reproduce the error(s).

Know your computer

To understand and complete work in the field of ecology you must be able to complete basic operations on *your* computer. This includes the following:

1. create a folder for this class, such as "PoE Spring 2016";
2. download a file from the internet and place it in your PoE folder;

3. install, run, and use **Excel**, **R**, and **RStudio**;
4. search for help on the internet (e.g., search “make folder on mac” or “read data from file using R”).
5. backup your work! I often will have a student who lost their hard-drive and all their work. If you learn to use (and actually use!) your Google Drive the death of a computer will be an inconvenience but will not be a problem or, more importantly, affect your grade.

6 Exams (these are all cumulative)

Below is the schedule for the three exams and one final. These all are held in Schrader 1 (our regular classroom).

Date	Exam	Time	Section
Wed., 2/17/16	I	during class	8:30 and 9:30
Wed., 3/23/16	II	during class	8:30 and 9:30
Wed., 4/13/16	III	during class	8:30 and 9:30
Fri., May 6	Final	8:00 - 10:30am	8:30
Tues., May 10	Final	8:00 - 10:30am	9:30

Here are some thoughts on my exams for this class.

1. **How I write them.** When I write the exams I use the readings, post-lecture notes, and the Ecology Modules. Stuff I discuss (e.g., “what’s new?” stuff) is also material you can be rewarded for knowing. I never look at the pre-lecture notes to write questions. I also write questions based on meetings where no notes were provided (e.g., the trip to the Arboretum and when only the board is used).
2. **No computer. No R!** You will not use **R** during the exams nor be expected to include R code. You will be expected to have a working knowledge of material from Ecology Modules for which the due date has passed at the time of the exam.
3. **What to bring.**
 - (a) Probably bring a pencil so you can erase. Crossing out gets messy. You have just enough room to answer questions once.
 - (b) Bring a calculator with fresh batteries. You may borrow these from people before exams but NOT during exams.
4. **No breaks?** During exams there are no rest breaks (you won’t have time). Prepare yourself to be comfortable for 50 minutes. This has evolved out of prior experiences where folks have created unfair advantages for themselves.
5. **Weighting the final exam.** The default value of the final exam is 150 points. Therefore, it is worth two times the other, 75-point, 50-minute exams. It’ll be about twice the length of those exams. Therefore, it should take about 100-minutes but you have 150 minutes if you like. Also, you decide the weight of the exam (number of points) after you complete it but before you hand it in.
6. **Missing an exam.** Missing an exam is a big deal. I must have **email notification** 24 hours before the exam and have a *valid* excuse. But what if you can’t make it because you’re barfing that morning? Go to the health center instead. Notify me by email before the exam starts. The email must be sent from your **Geneseo email account**. I once had a student email me from their Gmail account but not their Geneseo account. The email was flagged as spam by my Geneseo email account and I missed it (it also was sent 20

minutes before the exam). It is your responsibility to find out that I know your excuse. Appropriate excuses include death notices in newspapers or evidence of visits to medical professionals. Unacceptable excuses include “I wasn’t feeling well” and my latest favorite: “I stayed up all night studying for your exam but then feel to sleep at 8:00am. Can I make it up?”

7. **Past exams** are provided in my OutBox (see [CIT’s wiki](#)). I am opposed to providing keys because they seriously inhibit learning. However, a few of the exams are keys. I create questions based on readings, lectures, and assignments. You will be rewarded for your understanding of what happened in this class.

7 “What are the four easily-observed characteristics of natural selection?”

This is a question that will be on the first exam. It’ll reappear on each exam thereafter until everyone has gotten it completely right. Sounds easy, right? Since I began teaching in 1998 there’s never been an exam given on which everyone got this question right, even on the final exam! These also are known as “Darwin’s Postulates.” The answer does not rely on genetics, of which Darwin was completely ignorant.

1. Individuals within a species have high reproductive potential and are generally capable of producing more offspring than are needed for replacement ($r_{\max} > 0$).
2. A trait is often variable among individuals within a population (e.g., the variance of a quantitative trait is usually greater than zero ($s^2 > 0$)). This phenotypic variability often results in a bell-shaped histogram for the trait. These traits might be physical, such as height or timing of reproductive activities, or behavioral.
3. The traits that individuals exhibit are often heritable, such that the heritability coefficient is greater than zero ($h^2 > 0$). h^2 is the slope of the line for the offspring trait graphed as a function of the mean for the trait for the two parents. The positive, statistically significant slope means that traits are passed from parent to offspring. These heritable traits are now known to be genetically determined. This excludes the passage of behavioral traits that are taught, but traits such as the ability to learn can be heritable.
4. Within a species some individuals reproduce more than others, referred to as “differential reproduction,” which leads to phenotypic changes within species over time (evolution). In natural selection differential reproduction can be due to an individual’s particular suite of traits conferring an advantage for survival and reproduction. This results in a change in the species trait distribution, meaning that the distribution of a trait will move or change shape over time. The changes in distribution of phenotypes are usually categorized as directional, stabilizing/balancing, or disruptive selection.

Common mistakes made when answering this question:

- Forgetting one or more of the characteristics.
- “species (or populations) have high reproductive potential” (only individuals reproduce).
- “species have differential reproduction” (individuals reproduce, species evolve).
- “traits are inheritable” (they’re heritable). “Inheritance” is something you get if you’ve been kind to your relatives.
- “all individuals reproduce a lot” (no, but something about individuals having a high reproductive *potential*).
- “a trait is variable among a population” (it’s “within” a population; “between” is used if there are two groupings, and “among” is used for more than two groupings).

- “some individuals will survive better than others” (survival sure is important but it must result in reproduction).
- “survival of the fittest” (see previous).
- “traits within an individual are often heritable (or variable)” (this is within a population, or among individuals).
- Some description of *artificial* selection instead of *natural* selection.
- My favorite response to date: “You sure got me, Dr. H.! How was I supposed to know these????” I actually got this!

8 Electronic distraction devices, drugs, and other disabilities

In my classes we both agree not to text, chat, “do Facebook,” recreationally watch YouTube videos, message, or do similar electronic gaming or distracting activities during class (laptops can be used for taking notes but please don’t violate the expectations above). Why? It’s respectful and these activities are distracting to those around you. I think we both deserve respect in the classroom. If you ask me a question you certainly expect and deserve my full attention.

We also agree not to consume alcohol or other recreational drugs during class or come to class impaired by such activities. If either of us finds scheduling these activities (e.g., texting or doing drugs) around class time difficult then we should seek professional help (e.g., through the [Lauderdale Center for Student Health & Counseling](#)).

Additionally, those of us who teach at SUNY Geneseo will do our best to make reasonable accommodations for students with documented physical, emotional, or cognitive disabilities. In addition, we will do our best to accommodate challenges brought about through pregnancy, parenting, or care giving. Students should contact Assistant Dean Buggie-Hunt in the [Office of Disability Services](#) (tbuggieh@geneseo.edu or 585-245-5112) and me to discuss needed accommodations as early as possible in the semester. Note that changes in exam scheduling times and locations must be made at least one week in advance for each exam.

9 Schedule

The following is the plan. I will work to provide the readings as pdf documents on MyCourses one meeting before they are to be covered in class.

Data	Day	Topic	Prep for day (chapt)	What’s due
1/20/2016	Wed	Introduction to Ecology	Preface + 1	
1/22/2016	Fri	Adaptations in the Field. Meet at gazebo in the Roemer Arboretum. Wear appropriate clothes!		
1/25/2016	Mon	Evolutionary ecology	2	
1/27/2016	Wed	Evolutionary ecology		
1/29/2016	Fri	The physical environment	3	
2/1/2016	Mon	More on the physical environment		
2/3/2016	Wed	EM1 - bring laptop with R installed		Be sure to have installed R and know how to use it

2/5/2016	Fri	Organisms living in the physical environment	4	
2/8/2016	Mon	More on orgs in the env.		
2/10/2016	Wed	Introduction to population ecology	5	Place new batteries in your calculator
2/12/2016	Fri	Changing Populations - Unregulated Growth	6	
2/15/2016	Mon	More unregulated growth	7	EM1
2/17/2016	Wed	Exam I		
2/19/2016	Fri	The Growth of Age-Structured Populations		
2/22/2016	Mon	Changing Populations - Regulated Growth	8	
2/24/2016	Wed	EM2: Population growth (bring computer)		
2/26/2016	Fri	Behavioral ecology	9	
2/29/2016	Mon	Game theory		
3/2/2016	Wed	Metapopulations	10	
3/4/2016	Fri	Competition	11	
3/7/2016	Mon	Modeling competition (no lecture notes)		EM2
3/9/2016	Wed	Herbivory	12	
3/11/2016	Fri	Predation	13	
3/14/2016	Mon	SPRING BREAK		
3/16/2016	Wed	SPRING BREAK		
3/18/2016	Fri	SPRING BREAK		
3/21/2016	Mon	Modeling predation		
3/23/2016	Wed	Exam II		
3/25/2016	Fri	Parasites, Parasitoids, and Pathogens	14	
3/28/2016	Mon	EM3 - Interacting populations		
3/30/2016	Wed	Mutualism, commensalism, amensalism	15	
4/1/2016	Fri	Trophic interactions (food webs)	16	
4/4/2016	Mon	Spatial and Temporal Community Dynamics	17	EM3
4/6/2016	Wed	Ecosystem ecology	18	
4/8/2016	Fri	Assessing Diversity Patterns	19	
4/11/2016	Mon	EM4: Synthesizing complex ecological systems		
4/13/2016	Wed	Exam III		
4/15/2016	Fri	Biogeography	20	
4/18/2016	Mon	Biogeographical models (TIB)		
4/20/2016	Wed	Humans and the environment	21	
4/22/2016	Fri	Conservation biology	22	EM4
4/25/2016	Mon	Disturbance ecology	paper	
4/27/2016	Wed	In-class exercise		
4/29/2016	Fri	Catch-up		
5/2/2016	Mon	Review		
5/6/2016	Fri	Final exam for 8:30 section (8:00 - 10:30)		
5/10/2016	Tue	Final exam for 9:30 section (8:00 - 10:30)		

