Syllabus* for Principles of Ecology (BIOL 203)

Spring 2022
Gregg Hartvigsen
version: January 19, 2022

* Assumes that we're mask-to-mask (as opposed to online). In the event of a change the syllabus will be updated to reflect the new learning environment.

Course item	Details
Meetings	Tues/Thur 11:30 - 12:45 and 1:00 - 2:15, Schrader 1
Contact me	ISC 360, 245.5448, hartvig@geneseo.edu
Office hrs†	Mon. 8-10am. Zoom. See section 8 on page 10
	Tues. 2:30 - 4:00. Zoom or in person in ISC 343.
	Wed. 2:30 - 3:30 Zoom or in person in ISC 343.
Textbook (free)	The Science of Ecology (SoE). PDF on Canvas
Optional textbook	Hartvigsen (2021) (in case you want more details for using $\mathbf{R}$)
Laptop computer (Mac, Windows, or Linux)	A few times you will be asked to bring this in
Software (free)	$\mathbf{R}$ (version 4.1.2 or later), RStudio (version 2021.09.1 or later), Excel or Office Calc (Linux), and a PDF reader.
Calculator	Must do $ln()$ and e^x. Can be $\leq$ \$10. New batteries. You will be disappointed if your calculator is DOA at an exam.
Mask, worn properly	Please comply - we all need to feel safe in the classroom.
Refreshments	Unfortunately, no refreshments can be consumed in class since masks are mandatory
Cloud storage (free)	You are expected to keep all files from this class in a folder that automatically syncs in the cloud. This can be through "Google Drive" (recommended and included with your SUNY Geneseo account), Dropbox, OneDrive, or iCloud. Cloud storage means never having to say "I lost my work because my computer died."

† Note that Monday morning office hours are on Zoom (see section 8 on page 10). The other office hrs are likely to begin online, as well, due to COVID-19. For further information on how this works see section 8 on page 10.

> ***definition***: Ecology is the scientific study of the interactions between organisms and their biotic and abiotic environment.

1   Overview

I will work to provide you an introduction to this broad area of science. If you read any news source you're likely to quickly find an ecological challenge facing humanity, such as global climate change, the risk of an interesting species in decline, human conflict over limited resources, or the emergence and spread of a new disease. All of these are problems of ecology. My goal is to help you enhance your interest and understanding in ecology and gain the ability to better assess scientific information.

As a heads up to you I received this on a recent SOFI: "Hartvigsen just shows data and math and nothing else." Well, that's not true but it might seem that way. Below it's nice to recognize that the image is of a bald eagle (*Haliaeetus leucocephalus*) but you probably knew this. Now it's time to ask, and answer, more complicated questions like "how is the population changing?" "Is it's rate of increase *significant* (which means it's different than just bouncing around randomly)?" "If it's changing, what is the *annual rate of change*?" And "can we predict what the population will be in the future?" These questions are answered with data, math, statistics, and an understanding of the principles of ecology. The answer is that the number of breeding pairs is increasing exponentially in NY State. And, instead of asking you to believe me, I support this conclusion with a beautiful graph and some objective math and statistics (F = 3656; df = 1, 16; p < 0.001; R^2 = 0.9954; $N_t = 13 * e^{(0.1285 \cdot (yr-1990))}$). That's about 13.7% year^{-1} since 1990! Note that $e^{0.1285} = 1.137$.

Eric Frommer, Creative Commons
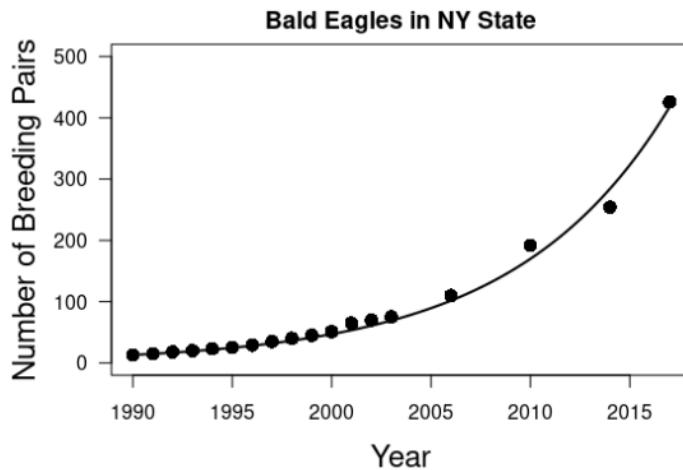
Ecologists might be accused of missing the beauty of nature, such as the bald eagle, by reducing it to some numbers. I hope you see that, as an ecologist, you are able to enjoy the beauty of nature just as well as any poet or artist. However, knowing more about it, such as the evolutionary history, the role the eagle plays in food webs, and how the number of breeding pairs change over time, greatly extends one's appreciation of nature, and does so far beyond what any poet or artist can enjoy.

2   Expected Learning Outcomes

If you work effectively and succeed in this class you can expect to be able to:

1. **explain patterns in nature** using a broad array of ecological principles, including how organisms deal with the physical environment, how species evolve over time, particularly via the process of natural selection, the dynamics of populations over time, how species interact with each other, and problems in conserving species and habitats. These patterns may be seen as you travel around, that you read about in scientific literature, and/or are reported in the news;

2. **explain how science is conducted** in order to understand and explore ecological phenomena;

3. **use quantitative methods**, including the **R** statistical and programming language and mathematics, to understand the empirical and theoretical underpinnings of ecological phenomena;
4. **correctly interpret scientific results**, usually presented as graphs, as well as ecologically-related information you encounter on a day-to-day basis (e.g., stuff you see as you walk, drive, or hear about in the news);
5. **further your understanding of your role in affecting Earth** through your use of ecological systems and its resources;
6. **correctly explain the difference between evidence-based information from evidence-free conspiracy theories, beliefs, and opinions**;
7. **actively engage with fellow students** in discussions involving ecological principles.

3   Resources

1. **Dr. H.** Please consider me a member of your academic success team. It's not you against me. It's you and me working to understand the principles of ecology. I do write the assessments so you should ask me how I do it (and read about this below in section 6 on page 7). Join me for office hours.
2. **Your teaching assistant**. Laura Zopf, survivor of PoE, previous TA, and previous research student in my lab, will be helping out this semester. Her role is specifically to help with the Ecological Applications assignments (see section 5.2 on page 5).
3. **This syllabus**. It's long and detailed. It has dates, expectations, helpful advice, and guidance for assignments. It is meant to help *you* succeed.
4. **Lectures**. These are generally important to catch. I try to present information that will be useful to you (on the Assessments and instructions for assignments). Not everything will be on the exam – there's too much. I will work to provide on Canvas "pre-lecture notes" that you can pull up at the beginning of class. There will be "post-lecture notes" within 24 hrs (if not, send me an email!). The slides are NOT self-explanatory. They will mostly only make sense if you attended the lecture. Recent SOFI: "The [post-lecture note] slides don't have any words on them so they don't make sense if you miss lecture." Fortunately, there's the next item:
5. **Textbook**. The latest draft is available on Canvas. There may be updates as we go so read it from Canvas. Note the textbook has three appendices supplying help with **R**. There's a fourth that lists "Principles of Ecology." You're responsible for those.
6. **Office hours**. These are times set up so I can help you. If you're having trouble others are probably have challenges, too. Join us.
7. **Software**. Here are the software programs you'll need to succeed in this class. All are free. If you already have **R** and/or `RStudio` then <u>install the latest versions</u> of these – they change monthly.
   (a) `Excel` (or a look-alike). Free for matriculated students.
   (b) **R**. Free. Go to `http://cran.case.edu/` and get the version for your computer.
   (c) `RStudio`. Free front-end for **R**. Install after you install **R**. Go to `https://www.rstudio.com/products/rstudio/download/#download` and choose the version for your operating system under the "Installers for Supported Platforms" heading.
8. **Fellow students**. During class you'll be given opportunities to work with neighbors to discuss questions posed during class. Hopefully you'll make some connections that might lead to

study partners. You don't have to interact with anyone if you don't want to - this is up to you.

9. **Email**. You are responsible for information provided to you via your Geneseo email account from me. This is the most effective way to reach me outside of office hours. Note that you <u>must use</u> only your `@geneseo.edu` account when sending me an email. Otherwise your message may be marked as spam and I may not get it. I do not check my spam.

10. **Past assessments**. Every assessment I've given in this class since 1998 is available in my Geneseo "Outbox." For help on finding boxes see https://wiki.geneseo.edu/display/cit/Inboxes+and+Outboxes.

11. **"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://www.sciencemag.org/news,
   (c) http://www.nature.com/news/,
   (d) https://www.nationalgeographic.com/latest-stories/.
   (e) https://www.livescience.com/.

12. **Additional SUNY Geneseo resources**. See `https://wiki.geneseo.edu/display/PROVOST/Syllabus+Resources+Related+to+Student+Success`.

4 Grading stuff

The following table shows the breakdown for points. The number of total points available is flexible and depends on how <u>you</u> decide to weight the final assessment (see item # 5 on page 8).

Item	Number	Points for each	Total pts	% Total *
Ecological Explorations (EE)	4	10	40	15.1
Ecological Applications (EA)	3	20	60	22.6
Assessment 1	1	30	30	11.3
Assessment 2	1	60	60	22.6
Assessment 3	1	50 - 100 (default = 75)	75 $\pm$ 25	28.3
Total (depends)	11		265 $\pm$ 25	100

* Note: The percentages for each category are based on weighting the final the default number of points (75). If you make the last assessment worth only 50 points then Assessment 3 is worth 20.8% of your grade and the other assignments will have greater weight. If you up it to 100 points it'll be 34.5% of your grade and the other assignments will have a lower weight.

"Ecological Explorations" (EE) are shorter homework assignments (see section 5.1 for details). "Ecological Applications" (EA) are longer homework assignments that are quantitative applications of data and/or models to understanding ecological principles (see section 5.2 for details). All assignments are due at the beginning of class. Otherwise they accrue a late fee of 5 pts per 24 hrs late. If you can't make it to class that day email it to me well before class begins so it can be considered on time. Note: Printers are usually down right before class so plan ahead. Printing 5 minutes before class represents <u>extremely risky behavior</u>. We will spend ~15 minutes or so discussing in groups what you found.

What's my grade in this class?

Your grades will be maintained in Canvas up until the Assessment 3. For that you choose the weight (see item 5 on page 8). Unfortunately, Canvas can't handle different weights for different students. Therefore, your final grade will NOT be found on Canvas.

The "Explorations" and "Assessments" usually come back during the next class meeting. They'll have a rubric attached letting you know how you did. I go over the assessments in detail the day they are handed back. Ecology Application assignments take about a week to return. If you miss the classes when things are handed back you may have to catch me in my office pick it/them up.

I will use the following relationships to translate the proportion of earned points into letter grades:

Score		Letter Grade		Score
0.933	$\leq$	A		
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.				

5 Homework Assignments

5.1 Ecological Explorations (EE, 10 pts each)

These are assignments that are planned as two-part experiences. The first part involves completing the assignment which you bring, printed out, on the day each is due (see schedule in section 7). The second part of the assignment involves sharing in groups what you found. Note: handwritten assignments will not be considered.

5.2 Ecological Applications (EA, 20 pts each)

We will explore a few in-depth applications of methods used by ecologists in this class. These include working with data and modeling. Galileo is attributed as saying that Nature 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, these applications are designed to help you explore Nature more deeply.

If you find computer programming, math, and/or statistics intimidating and/or challenging recognize this about yourself and plan accordingly. In this class we will see data and output from models daily. These application exercises, however, are opportunities for you to gain this fundamental skill in science.

5.2.1 General instructions

1. For full credit you need to hand in a paper version of the assignments in class on the day they are due (see the schedule on page 9. Handing them in after the due date/time is considered late (e.g., coming late to class with it is late). See item #12 below.

2. So here are some ways to lose points before I grade these:

   (a) -5 pts for each 24 hr period handed in late.
   (b) -5 pts for emailing assignment on time and making me print it for you (unless pre-approved).
   (c) -1 pt for no staple.
   (d) -1 pt for asking a tree give up its life for a title page.
   (e) -5 pts if I find it under my door when I return from class (that's considered late).
   (f) Do not put it in my office mailbox. I rarely check that so many days may go by before I find it, rendering it <u>very</u> late.

3. Each assignment will have its own set of instructions, provided either through email and/or on Canvas. Read these, complete the assignment, then re-read the instructions before handing it in.

4. Your write up should be as short as possible while completing all required tasks.

5. Use only complete sentences.

6. Include your name, date, and assignment name at the top of the front page.

7. Use single-spacing, double-sided printing for your write up.

8. Your report should be structured in numerical order to match the numbered question. Answer each question with any graphs and code before starting the next question.

9. The points for each question are found in the description. This represents <u>the rubric</u> that will be used to evaluate your work. For instance, a question might read: "(5 pts) Provide a publication-quality graph of these data." You earn all 5 points if you do this and lose points for things like not labeling your y-axis correctly.

10. If required include code you have written or modified (omit code I provided). It must be your own so that, if asked, you could tell me what it all does. If using external literature provide complete citations. Do not try to find code online that you think solves your problem but you have no idea what it does. 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!

11. All work must be your own. Feel free to review College's policy on academic dishonesty.

12. **Finally, know yourself and accept yourself!** You probably know if using **R** challenges you, papers are hard to write, you tend to hand assignments in late, or you often have other challenges. So, be your own best colleague. If you're healthy during this new era of a pandemic, get to work! You might not be able to pull off that all-nighter to complete an assignment. Be sure to use your resources (see above). So, I'm not really saying "plan ahead." It's more like "assume the plan will change so plan for the unplanned."

5.3 Getting help on the Ecological Application Assignments

These assignments are challenging. TA Laura and I are here to help you succeed. Here are suggestions on how to proceed in general.

1. Helping yourself. I've spent a lot of time writing the directions to these assignments. Did you start at the beginning? Frequently I've had students go straight to the questions and get stuck. Suffering with **R**? Did you work through the Appendices in your textbook? They're there to help you if **R** boggles you. Finally, don't stare at an error message for 6 hours (I've

heard this often!). If you can't get it after 5-10 minutes of using your **R** resources then move on to the next tips.

2. Come to my or your TA's office hours ready to explain your challenge. Have the **R** script file open on your computer with the cursor on where you're stuck. It'll probably be a quick visit.

3. Carefully draft an email of your question. Choose either me or TA Laura. Send your **R** script file as an <u>attachment</u> (not copied into the email and not a screen shot!). Indicate the line number in the script file that's giving you trouble. If the code reads in a data file send that, too. We will run your code and see the exact same error message and will likely be able to tell you how to fix the problem.

Note that Dr. H. is unlikely to answer questions during darkness or on the morning the assignment's due.

5.4 Using 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 skills:

1. create a folder for this class, such as "PoE Spring 2022";
2. download a file from the internet and move it to your PoE folder;
3. install, run, and use MS `Excel` (and maybe Word), **R**, and `RStudio`;
4. search for help on the internet (e.g., search "make a folder on a mac");
5. use your textbook's appendices (there are three dedicated to **R**).

6 Assessments (a.k.a., exams)

The content covered by the three assessments is cumulative. Any material covered up to the assessment can be included on the assessment. Note that the assessments increase in their weight. This is because, as with all classes, figuring out how someone is assessing your knowledge can be challenging. Be sure to read about the availability of old assessments in section 7 below. Here are some thoughts on these for this class.

1. **How I write assessments**. When I write these I do it from scratch (I don't intentionally reuse questions). Some questions often will be similar because of this. I write the assessments using the readings, post-lecture notes (on Canvas in Files), and the homework assignments. Stuff I discuss (e.g., "what's new?" stuff) is also material you can be rewarded for knowing. 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. **Study effectively for the assessments.** The best way to study for an assessment is to use your insight from lectures and the book to build potential assessment questions and then really answer them. Ask yourself after lecture or after reading a chapter "What could/would Hartvigsen ask on this?" Also, perhaps in lecture you heard me say something like "I really like this experiment." That might be important! Make the assessment yourself, preferably with a study buddy or group and ask each other your questions (and answer their questions).

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 your calculator with fresh batteries. You may borrow these from people before assessments but **NOT** during assessments.

4. **No bathroom breaks?** During all assessments there are no rest breaks (you won't have time). Prepare yourself to be comfortable. This has evolved out of prior experiences where folks have created unfair advantages for themselves.

5. **Weighting the final assessment**. The default value of the final assessment is 75 points. However, you decide the weight of the assessment (number of points) <u>after</u> you complete it but <u>before</u> you hand it in. That weight ranges from 50 – 100 points.

6. **Missing an assessment (exam)**. Missing an assessment is a big deal. I am happy to work with you if you keep me informed with an email notification before the assessment and I receive from you evidence of your reason for missing class (e.g., notification from the health center).

   But what if you can't make it because you're barfing that morning? Go to the health center instead. Email me evidence that you saw them. It is your responsibility to chat with me about this. Appropriate excuses include illness with evidence of your visit to an appropriate professional or notification through the Dean of Students Office (Phone: 585-245-5706; Email: deanstu@geneseo.edu).

7. **Past assessments** are provided in my OutBox in the PoE folder (see CIT's wiki to learn how to find Outboxes). I've tried to include both the test and the key. If it's not there it doesn't exist. Please note that old assessments may not reflect what your assessment will look like.

8. **Emailing questions.** Feel free to send me an email. Only send this from your Geneseo account (else it might be lost in my spam folder and you'll think I don't respond to emails). You can send me a screen captured image of a lecture slide or past test question and ask something specific about it. The clearer the question the more helpful I can be. A question like "can you explain what the slide says?" is too vague and can't be answered by email. Please bring these types of questions to office hours. I won't be able to respond to questions the evening before or morning of an assessment. Please plan ahead!

6.1 An approach to crush assessments

Be your strongest, most consistent and honest ally. Try this: **Study like you're taking an exam**. Each study session should be no longer than the length of the exam you're studying for. You probably know you wouldn't do your best on an exam constantly checking your phone, texting friends, and listening to music. Treat your study time with the same intensity as taking the test. We all get tired after taking a test and the same should happen when you study. Study effectively and then take an awesome break. What else? Get that sleep you have heard so many times as being important. And even eating well is important. Use what biologists have taught us. Treat college like a professional athlete in training. And, like professionals, use your resources.

7   Schedule

The following is the semester plan. For assessments you're responsible for all material covered before (they are cumulative). Dates for assessments and due dates for homeworks are provided.

1. EE = Ecological Explorations (see section 5.1).
2. EA = Ecological Applications (see section 5.2).
3. Readings are from the textbook The Science of Ecology (pdf on Canvas).

Date	Day	Topic	Do/Due/Bring
1/27/2022	Thu	Introduction to Ecology + Evolution. Introduce EE #1	Read Preface + Chapt 1
2/1/2022	Tue	Adaptations in the Field. Meet at gazebo in the Roemer Arboretum. Check weather & wear appropriate clothes!	Review the Arbo's mission at on it's website.
2/3/2022	Thu	EE #1 discussion. Evolutionary ecology and three models of evolution	EE #1 Due. Read Chapt. 2. Bring laptop with R and RStudio working. Have worked through textbook appendices A + B.
2/8/2022	Tue	The Physical Environment (part 1).	Read Chapt. 3. Bring laptop
2/10/2022	Thu	The Physical Env (part 2). Introduce EA #1	Bring laptop.
2/15/2022	Tue	Orgs in the Physical Env	Read Chapt. 4.
2/17/2022	Thu	Intro to Population Ecology	Read Chapt. 5.
2/22/2022	Tue	EA #1 Discussion. Unregulated + Regulated Growth	EA #1 due. Read Chapt. 6 + 7.
2/24/2022	Thu	Regulated Growth. Introduce EE #2	Read Chapt. 8.
3/1/2022	Tue	Assessment #1	Be prepared for Assessment #1
3/3/2022	Thu	More Pop Growth + Behavioral Ecology	Read Chapt. 9 and bring laptop
3/8/2022	Tue	EE #2 discussion. Behavioral Ecology II + Game Theory. Introduce EE#3	EE #2 Due
3/10/2022	Thu	Metapopulations. Introduce EA #2	Read Chapt. 10. Bring laptop
3/15/2022	Tue	SPRING BREAK	
3/17/2022	Thu	SPRING BREAK	
3/22/2022	Tue	EE #3 Discussion. Competition 1	EE #3 due. Read Chapt. 11.
3/24/2022	Thu	Competition Model	
3/29/2022	Tue	EA #2 Discussion. Herbivory	EA #2 due. Read Chapt. 12.
3/31/2022	Thu	Predation. Introduce EE #4	Read Chapt. 13.
4/5/2022	Tue	Predation Model	Read Chapt. 14.
4/7/2022	Thu	Assessment #2	Be prepared for Assessment #2

4/12/2022	Tue	Parasites, Parasitoids, Pathogens.	Read Chapt. 15.
4/14/2022	Thu	EE #4 discussion. Mutualism, Commensalism, + Amensalism	EE #4 Due
4/19/2022	Tue	Trophic interactions (food webs). Introduce EA #3	Read Chapt. 16.
4/21/2022	Thu	GREAT DAY	
4/26/2022	Tue	Spatial and Temporal Community Dynamics	Read Chapt. 17.
4/28/2022	Thu	Ecosystem Ecology	Read Chapt. 18.
5/3/2022	Tue	Biodiversity	Read Chapt. 19.
5/5/2022	Thu	EA #3 discussion. Biogeography	EA #3 due. Read Chapt. 20.
5/10/2022	Tue	Humans and the environment	Reading TBA
5/12/2022	Thu	Conservation biology	Reading TBA
5/19/2022	Thu	Final. 8-10:30 for the 11:30 â€“ 12:45 section. Schrader 1	Be prepare for Assessment #3
5/19/2022	Thu	Final. 12:00 â€“ 2:30 for the 1:00-2:15 section. Schrader 1	Be prepare for Assessment #3

8 Zoom

I will email the link to you if the office hour is on Zoom. There's a waiting room. If you don't get in right away consider these:

1. I'm with someone who wants a private conversation. If you wanted a private conversation I'd make others wait....
2. I'm dealing with someone from a different class and you wouldn't be interested.
3. I see you and will let you in as soon as is humanly possible, without being rude to who is in the room.

This applies to in-person office hrs, too. If it's been awhile and you can't wait please send me an email with your question. I'll do my best.

9 Religious observances

It is my responsibility, as outlined in the College's Undergraduate Bulletin, to accommodate religious observances. No assessments have been scheduled to occur on notable observance days. However, as stated in the 2017-2018 Bulletin, I am "to comply in good faith with the provisions of... " section 224-a of the Education Law of New York State. I am happy to meet your needs if you inform me of any such absence at least one week prior to the conflict. Without you providing me this information I will not be able to help you meet your learning expectations for this class.

10 Challenges

I will do my best to make reasonable accommodations for students with documented physical, emotional, or cognitive disabilities. In addition, I will do my best to accommodate challenges brought about through pregnancy, parenting, or care giving. Students should contact the Office of Accessibility Services (585-245-5112) and me to discuss needed accommodations as early as possible in the semester. I am happy to accommodate your needs for completing assessments in the Test Center (https://www.geneseo.edu/is/testcenter/main) during class time.

References

Hartvigsen, G. 2021. A primer in biological data analysis and visualization using R, 2nd ed. Columbia University Press.