Ecology: Cool science that matters

COURSE OBJECTIVES

To explore the central theories and principles in ecology and evolution, and to survey the evidence that supports them. Major topics will include:

- *Limits to Distribution*. What determines where species do and do not occur?
- *Behavioral Ecology*. How does the behavior of individuals evolve and what are the consequences for biological populations?
- *Population Ecology*. What determines the abundance, dispersion, age structure, and dynamics of biological populations?
- *Species Interactions*. What is the nature of species interactions such as competition, predation, parasitism, and mutualism? How do these interactions influence distribution and abundance?
- *Community Ecology*. What determines the structure, organization, and dynamics of groups of species?
- *Ecosystem Ecology*. How do energy and matter move through the biological and physical components of ecosystems? How do organisms and abiotic factors influence the function of ecosystems and the services they provide to society?
- *Applied ecology*. How do humans influence biological systems and vice versa?

To participate in the process by which theories are conceived, tested, refined, and falsified.

- Learn how to ask ecological questions, formulate hypotheses, generate predictions, design and conduct experiments, perform quantitative analyses, interpret data, and report findings.
- Become proficient in reading graphs, interpreting data, evaluating and manipulating simple mathematical models, and applying empirical data to evaluate theoretical predictions.
- Gain understanding of the structure of knowledge in ecology, biology, and the natural sciences in general.

STAFF & OFFICE HOURS:

Professors:	Matt Ayres (LSC 125); Office hours Tues 1:30-2:30 pm, Fri 2-3 pm, & by appt.
Laboratory Director:	Craig Layne (LSC 121); Office hours by appt
Graduate Assistants:	Clare Doherty, Office hours to be announced Ciara Kernan, Office hours to be announced Hunter Snyder, Office hours to be announced

TEXTS and READINGS:

Many lecture readings will come from the following text:

Ecology: The economy of nature. Robert Ricklefs and Rick Relyea. 2013. 7th Edition.
ISBN-10: 1429249951; ISBN-13: 9781429249959

Other readings will be announced in class and made available on Canvas

EXAMINATIONS: The two mid-term examinations will be held in the evening to eliminate time constraints on your success. Please see the detailed schedule and mark exam dates on your calendars.

LECTURES: M, W and F 10:10 to 11:15 in LSC 201; x-period TH 12:15-1:05
Your attendance at all lectures and X-periods is expected. Please be on time. Announcements are generally made at the beginning of class. Careful attention to lectures is the most effective (and time-efficient) preparation for examinations. The exams will cover materials in lectures, X-hours, and labs.

LABORATORIES: Monday 2:15-6:15, Tuesday 2:30-6:30, or Wednesday 3:30-7:30
Attendance in all laboratories is mandatory. Labs meet in LSC 102 beginning with the first week of class. Via previous correspondence with Craig Layne, the Lab Coordinator, you should already have been assigned to one of the laboratory sections. If not, please contact us immediately. Laboratories consist of field and laboratory activities such as sample collection and enumeration, experimental manipulation, data analysis, interpretation, and discussion. You cannot make up labs. Come dressed appropriately for each week's laboratory: labs happen rain or shine, warm or cold.

SPECIAL NEEDS: We encourage students with disabilities, including invisible disabilities like chronic diseases, learning disabilities, and psychiatric disabilities to discuss appropriate accommodations with the professor after class or during office hours. You may also wish to talk with your teaching assistant if laboratory accommodations would be appropriate.

MENTAL HEALTH: We recognize that the academic environment at Dartmouth is challenging, that our terms are intensive, and that classes are not the only demanding part of your life. Dartmouth offers resources to support your wellness, including:
Your undergraduate dean (http://www.dartmouth.edu/~upperde/);
Counseling and Human Development (http://www.dartmouth.edu/~chd/); and
The Student Wellness Center (http://www.dartmouth.edu/~healthed/). We encourage you to use these resources and come speak with me to take care of yourself throughout the term.

RELIGIOUS HOLIDAYS: If you have a religious observance that conflicts with the course schedule, please come speak with me early in the term and I will be happy to develop appropriate accommodations.

ILLNESS: If you become ill and cannot make it to an exam please alert me prior to the exam. If you must miss a laboratory due to illness please alert your TA prior to the lab.

CANVAS All important class materials (e.g., readings and handouts) will be posted on Canvas.

USE A 3-RING BINDER FOR LECTURE AND LAB: With each lecture unit, we will provide a handout with a skeletal outline of the material that is designed to make it easy for you to take good notes while still being able to listen and see visualizations. Our powerpoint files are typically visualizations rather than words and are not designed for taking notes nor as a primary source for your studying. We will provide the powerpoint files on Canvas after lectures so that you can use as a resource for studying, but we highly recommend that you get a 3-ring binder and use that to organize your lecture and lab materials. All course and lab handouts will be triple punched for insertion into a binder. Additional notes can be easily incorporated on separate sheets of punched paper.

HONOR PRINCIPLE: The Dartmouth honor principle applies to all work in this class. In lab, you are encouraged to collaborate fully with fellow students while conducting research and interpreting data. However, as soon as you begin writing a lab report, the writing must be entirely your own. Please just ask if you ever have questions about the boundaries of collaboration.

EXAMINATIONS AND GRADING:

For the overall course grade, the lecture and lab material will contribute 65% and 35%, respectively. The breakdown of lecture and lab grades will be as follows:

Lectures	Midterm Exam 1 (9 lectures):	25%
	Midterm Exam 2 (10 lectures):	30%
	Final Exam (9 lectures + cumulative; ~1/3 cumulative):	45%
		100%

Laboratories[a]	Phenology data entry	20
	Weevils research summary	35
	Browse data visualization	30
	Benthic inverts paper	45
	Phenology interpretations	20
		150 points

[a] Laboratory point allocations may be adjusted as the term progresses. Instructions, expectations, and due dates/times for each lab assignment will be discussed in lab meetings and available in Canvas

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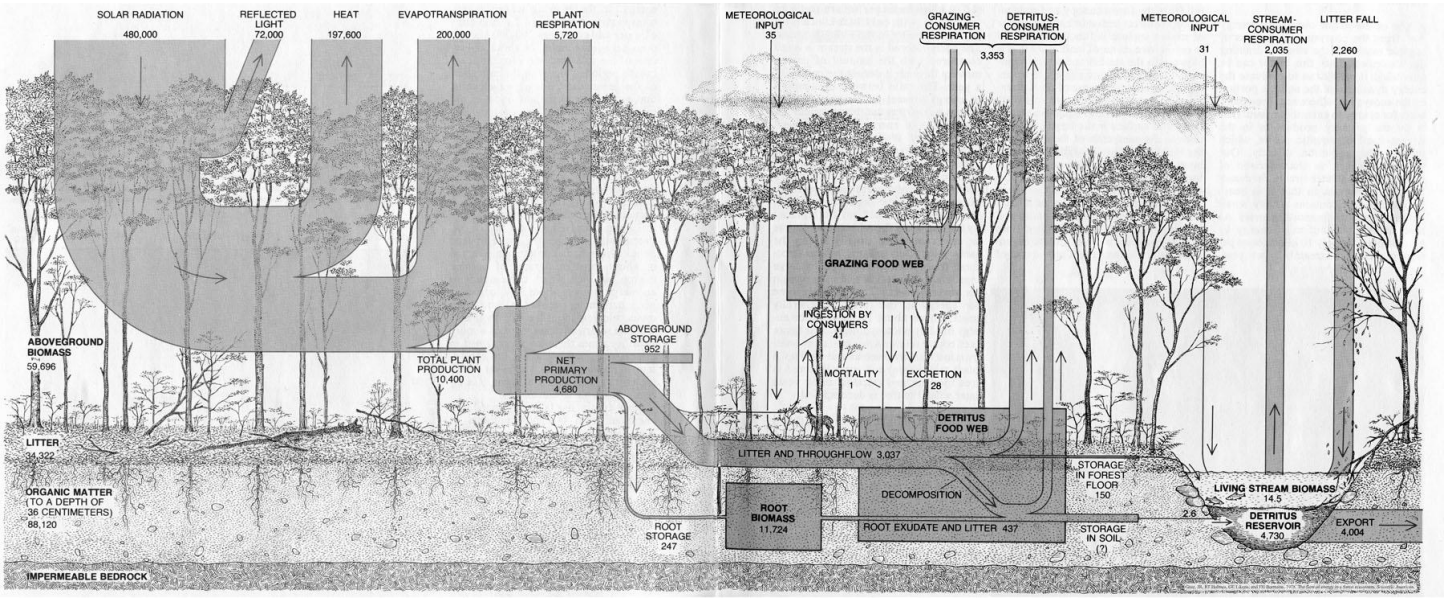

Classical depiction of a temperate forest ecosystem derived from studies of the Hubbard Brook Experimental Forest near Mt. Moosilauke. Taken from:

Gosz, J. R., R. T. Holmes, G. E. Likens, and F. H. Bormann. 1978. The flow of energy in a forest ecosystem. *Scientific American* 283:92-102.

SOME SUGGESTIONS FOR SUCCESS IN BIO 16

- In general, strive to understand all basic concepts. Then the details will come more easily.
- For theories and concepts presented in lecture:
  - Understand their relevance to the broader topic
  - Identify the patterns and processes that can be explained
  - Understand assumptions and postulates
  - Understand the nature of supporting evidence. Be able to explain specific examples of relevant evidence from lectures and readings.
  - Be able to define and correctly use relevant terminology
  - Know and be able to use any essential equations
  - Recognize any important limitations on applicability
  - Be able to apply the theory or concept to explain new facts and generate predictions regarding unfamiliar systems
- For examples presented in lecture:
  - Understand their relevance to the broader topic
  - Understand central conclusions and important theoretical implications
  - Be able to interpret any figures or tables. How do data support central conclusions?
  - Understand relevant natural history details. Be able to define and use relevant terminology
  - Be able to extend conclusions to similar biological systems
  - Be able to interpret similar data from unfamiliar systems
  - Be able to suggest alternative examples, not discussed in class, that illustrate the same principle
- Understand how theories and concepts relate to one another.
- Continually ask yourself, why is this concept important?

<u>While in lecture:</u>

- Use the lecture fully. For most students, this is the most time-efficient way to master the subject. Do not miss lectures. Much of the lecture material is not covered in the texts.
- Concentrate. If the pace seems slow, challenge yourself with points from the list of bullets above (e.g., relationships among theoretical concepts, alternative examples of the same principles). If the pace seems fast, stay focused on the concepts and the relevance of the concepts, and plan to assimilate the details later.
- Organize your thinking in terms of (1) theories and concepts and (2) details and examples that are relevant to the theories and concepts.

<u>Outside of lecture</u>

- Review your lecture notes several times beginning within a day of each lecture. For each theory and example, work through the list of bullets identified above. Use the textbook index to look up relevant passages and efficiently clarify points from the lecture. Try studying with a colleague. Use your TA and the instructors to resolve questions.
- Read all required readings once before lecture and at least once more after lecture. Use the readings to (1) clarify lecture material and (2) to expand the lecture material. As you read, ask yourself:
  - What are the theories that are being presented? What are the postulates? How does this theory and its presentation compare to the lecture material?
  - What new examples were given? How do the examples relate to the theories and concepts being discussed in the text and in lecture?

<u>In exams</u>

- Read each question carefully and understand it fully. Ask the instructor if you are uncertain.
- Think before you write. Identify the key points that your answer should contain and then communicate them clearly and unambiguously. Use graphs and equations as appropriate. Answer questions fully but efficiently. Do not omit key points but do not use any more words than necessary.

Bio 16: Ecology. Spring 2018. Revised 25 March 2018

Day	Date	Lecture Topic	Readings[a]	Lab activity
Mon	26-Mar	Introduction	Ch 1, 7	No lab
Wed	28-Mar	Global change and food security	Ch 2-3	
Thu	29-Mar	X-hour[b]: Clare Doherty, Ciara Kernan, Hunter Snyder		
Fri	30-Mar	Global change and food security		
Mon	2-Apr	Limits to distribution I: Physical & chemical factors	Ch 4	Phenology of maples and birds
Wed	4-Apr	Limits to distribution I: Physical & chemical factors, cont.		
Thu	5-Apr	X-hour[b]: TBA		
Fri	6-Apr	Limits to distribution II: Species interactions		
Mon	9-Apr	Limits to distribution III: Habitat selection & the niche		Stream benthic invertebrates I
Wed	11-Apr	Limits to distribution IV: Dispersal	Ch 9	
Thu	12-Apr	X-hour[b]: TBA		
Fri	13-Apr	Behavioral Ecology I. Sexual selection		
Mon	16-Apr	Behavioral Ecology I: Sexual selection, cont. **Exam 1: 7-9 pm (26 Mar to 13 Apr)**		White pine weevils I
Wed	18-Apr	Behavioral Ecology II: Optimal foraging, group decisions	Ch 10	
Thu	19-Apr	X-hour[b]: TBA		
Fri	20-Apr	Population ecology I: Dispersion & abundance	Ch 11-12	
Mon	23-Apr	Population ecology I: Dispersion & abundance, cont.		White Pine Weevils II
Wed	25-Apr	Population ecology II: Life tables & population structure	Ch 13	
Thu	26-Apr	X-hour[b]: TBA		
Fri	27-Apr	Population ecology II: Life tables & population structure, cont.		
Mon	30-Apr	Population ecology III: Life history theory	Ch 8	Deer browsing
Wed	2-May	Poulation Ecology IV: Dynamics		
Thu	3-May	X-hour[b]: Jeff Kerby		
Fri	4-May	Poulation Ecology IV: Dynamics, cont.		
Mon	7-May	Community Ecology I: Competition	Ch. 16	Stream Benthic Invertebrates II
Wed	9-May	Community Ecology II: Mutualisms. **Exam 2: 7-9 pm (16 Apr to 7 May)**		
Thu	10-May	X-hour[b]: Celia Chen		
Fri	11-May	Community Ecology III: +/- interactions, herbivory	Ch 14-15	
Mon	14-May	Community Ecology III, cont.: Predation, parasitism, coupled dynamics		Stream Benthic Invertebrates III
Wed	16-May	Ecosystem ecology I: Energy and productivty	Ch. 20	
Thu	17-May	X-hour[b]: TBA		
Fri	18-May	Ecosystem ecology I: Energy and productivty	Ch. 21	
Mon	21-May	Ecosystem ecology II: Elements and nutrients		Phenology of maples and birds II
Wed	23-May	Ecosystem ecology III: Water		
Thu	24-May	X-hour[b]: TBA		
Fri	25-May	Ecosystem ecology IV: Biodiversity and ecosystem function		
Mon	28-May	Memorial day. No class		No lab
Fri	1-Jun	**FINAL EXAM: comprehensive (08:00 - 10:00; sorry!)**		

[a] From textbook. Other readings as assigned.

[b] Local Luminaries Series: talks on their current research by Dartmouth scientists