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BIOE 370.01: General Ecology

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ECOLOGY (BIOLOGY 370)
Fall Semester 2014

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Office hours: Monday, 11-12
or by appointment

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Text: Elements of Ecology (8th edition) by Thomas Smith and Robert Smith

You have three options:

1) Buy the book
2) Loose leaf textbook: Available as 3-hole punched loose-leaf format. You can just the sections you need to class. Cheaper than text book but you cannot sell it back at the end of the semester. Works out about the same as the book.
3) Copies of the book are on reserve in the library.

Overview

In this class we will focus on some of the major themes of modern ecology. Ecology is a huge field, and we will touch on several hierarchical levels of ecological organization, from individuals, populations, communities, landscapes and ecosystems. The class will review classical historical ideas and studies, as well as current exciting field, experimental and theoretical studies.

In addition to studying basic ecological principles, we will also consider some of the many ecological consequences of human activities. As a species, we are having enormous impacts on ecological processes around the world. Every day ecological issues related to human activities are at the forefront of the local, national, and international news: timber and logging issues, roadless areas, heavy metal pollution as a result of mining, the removal of Milltown dam, effects of grizzly bears and wolves, effect of introduced species on native ecosystems, habitat loss, deforestation, extinction, water issues, desertification, emergence of new diseases, global climate change, and environmental refugees, to name just a few. Our individual behaviors and choices as consumers also have profound ecological consequences; the ecological consequences of our activities are having huge social, medical, political and economic impacts that we need to understand.

The goals of this class are for you to:

1) Understand the historical development of some important ecological concepts, some current debates and unresolved ecological issues;

2) Understand how science works to answer questions;
3) Be able to think critically and independently about ecological issues;
4) Understand how human populations and activities are influencing ecological processes.

In addition to material covered in lectures, you will be responsible for about 20-30 pages of reading per week from the textbook and other assigned papers. Since the material builds upon previous topics it is very important that you to keep up with the readings. If you have problems with class material, deadlines or any other issues related to the class I urge you to talk with me as ***EARLY*** as possible. I will be better able to help you if you talk with me as problems arise. You will find that I am extremely sympathetic and flexible if you talk with me early; you will find that I am an unsympathetic ogre ten minutes before an assignment is due.

Course Outline and Assigned Readings

Week	*Topic*	*Reading from Text*
1: 25 Aug	Introduction and Overview Natural Selection and Scale	Chapter 1
2: 1 Sept	Types of Selection; Finches, Crossbills and Sticklebacks (1 ***Sept - Labor Day – no classes)***	Chapter 5 (omit Hardy-Weinberg box)
3: 8 Sept	Determinants of Global Climate	Chapter 2
4: 15 Sept	Foraging Ecology of Animals and Humans	Chapter 15 (pp. 281-285)
5: 22 Sept	Physiological Ecology	Plants: Chapter 6 Animals: Chapter 7
6: 29 Sept	Demography of single populations	Materials to be provided
2 Oct	***Test 1: 6-8 PM in ISB 110***	
7: 6 Oct	Ecological Genetics and Behavioral Ecology	Materials to be provided
8: 13 Oct	Matrix approaches to population modeling	Materials to be provided
9: 20 Oct	Competition	Chapter 14
10: 27 Oct	Predator-prey interactions	Chapter 15
11: 3 Nov	Wiggle Room	
6 Nov	***Test 2: 6-8 PM in ISB 110***	
12: 10 Nov	Community Ecology	Chapters 17
13: 17 Nov	Community Ecology	Chapter 19
	26-28 Nov - No classes - Thanksgiving	
14: 24 Nov	Community Ecology	Chapter 16
15: 4 Dec	Biogeography	Chapter 17
10 Dec	***Final Exam: Wednesday, 8-10 AM, ISB 110***	

Tests

Test 1 and 2 will be held during the evenings outside of normal class time. I do this so that you will have all the time you need to write the tests. Please plan ahead now for these tests.

Important Dates About Dropping Classes

To 15th instructional day	You can drop classes on Cyberbear	September 15 = last day
16th to 45th instructional day	Drop requires form with instructor and advisor signature, a $10 fee from registrar's office, and a 'W' (for withdraw) will show up on your transcript.	September 16 through October 27
Beginning 46th instructional day	You are allowed to drop a class only under very limited and unusual circumstances. Not doing well in the class, deciding you are concerned about how the class grade might affect your GPA, deciding you did not want to take the class after all, and similar reasons are NOT among those limited and unusual circumstances. If you want to drop the class for these sorts of reasons, make sure you do so by the end of the 45th instructional day of the semester.	October 28

Grading Scheme

Assignments	21
Field Notebook	10
Test 1	23
Test 2	23
Final Exam	23
Total	100

Extra credit opportunities

You will have the chance throughout the semester to do things for extra credit. Many of these will be to attend seminars, meetings, or other activities and then give me a short write-up of the event. Instructions for the write-ups are on the course Moodle site. I will suggest suitable activities throughout the course, but you should also feel free to run ideas you may have by me and I will decide if they are suitable for extra credit. You will be awarded points for these extra credit activities on a "diminishing returns curve:"

First five: up to 1 point each
Six-11: up to half point each
Thus the maximum you could attain through extra credit activities would be 8 points. Extra credit activities will not be accepted after the last week of class.

We have several regularly-scheduled ecological seminar series. These outstanding seminar series are fair game for extra credit:

Organismal Biology and Ecology Seminars: These feature the research of graduate students and faculty in OBE. They are held every Wednesday, 12-1, ISB 110.
OBE Seminar Series: These seminars feature outstanding guest speakers from around the world. This is a chance to hear some of the top scientists in the world talk about their work. These seminars are every Wednesday, 4-5 PM in ISB 110.

Wildlife Biology Seminars: These feature the research of graduate students and faculty in the Wildlife Biology Program. They are held every Friday, Forestry 206.

Computing Resources

The Division of Biological Sciences manages a computer lab in HS 114. This computer lab is dedicated for biology classes. You need to sign up for an account, and this will enable you to have access to the computers and printers. A lab monitor can help you set up your account.

Moodle

You will be able to access many resources through the course Moodle site. For example, you will be able to download all my PowerPoint lectures, study guides for tests, additional readings, assignments, and much more. You will need your NetID and username to log on. If you need help contact the IT Help Desk in SS 126.

iTunes U

You can download recordings of the lectures on your iTunes U site.

Students with Disabilities

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact DSS in Lommason 154 or 243-2243. I will work with you and DSS to provide an appropriate modification.

Student Conduct Code

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code.

Plagiarism Policy

Although I encourage you to work collaboratively with others in this class, ***the work you hand in must be your own.*** For example, in the demography assignments, it makes sense to work with others on the math, but the answers you hand in must be in your own words. A good rule of thumb is that you can work together up to the point of committing words to paper (or word processor). After that, you must work independently. I remind you of the official University policy on plagiarism: "Plagiarism is the representing of another's work as one's own. It is a particularly intolerable offense in the academic community and is strictly forbidden. Students who plagiarize may fail the course and may be remanded to Academic Court for possible suspension or expulsion (See Student Conduct Code section of this catalog). "Students must always be very careful to acknowledge any kind of borrowing that is included in their work. This means not only borrowed wording but also ideas. Acknowledgment of whatever is not one's own original work is the proper and honest use of sources. Failure to acknowledge whatever is not one's own original work is plagiarism." (From The University of Montana Catalog).

If you have any questions about the line between collaboration and plagiarism, see me or the teaching assistants before you hand in material. Assignments from two or more students that have significant overlap will be regarded as reflecting a violation of the expectation that students turn in independent work. All the students involved will be given no points for that material, and the violation will be dealt with according to the Student Conduct Code. Penalties may be as severe as suspension or expulsion from The University.

Learning Outcomes

Here are the main concepts and learning goals for the class. You should understand and be able to explain:

Weeks 1 and 2

- the importance of spatial and temporal scale important in ecological studies
- examples of ecological processes that occur over large spatial scales and long temporal scales
- Natural Selection. Domestication. How are they similar? How are they different?
- conditions required for Natural Selection to work.
- the different ways that selection can modify an original population.
- examples of stabilizing, directional and disruptive selection.

Week 3

- the main patterns of climate on the earth.
- the "First Principles" that help us understand patterns of global climate.
- why deserts are found mainly on the west sides of continents at 30^{o} N and S, and not on the east sides?
- Milankovitch cycles.
- why moving parcels of air or water tend to deflect to the right in the northern hemisphere and to the left in the southern hemisphere.
- the evidence that global temperature is increasing. When did the rise seem to start?
- the importance of the oceans in absorbing additional heat.
- the evidence that human activities have played a role in the rise in temperatures. How strong do you think the evidence is?
- where anthropogenic carbon emissions end up.
- the effect of CO_2 on ocean chemistry.
- the predictions about how climate may change around the world, in North America, and in Montana.

Week 4

- the evidence that animals are careful consumers, and balance energy and nutrient needs and consider the costs of "shopping" for different kinds of "groceries?"
- the Central Place Foraging model. How can it be used to predict the optimal energy returns that food patches with different characteristics can yield?
- the typical food production systems in the US 100 years ago and today.
- the concentration of market control in the US agricultural system? How is this measured?
- how far and how many intermediate links (middlemen) are there between where food is grown and consumers under the typical US food production system. Why is this hard to measure?
- What UM is doing about some of these issues.

Week 5

- the differences between C_3, C_4, and CAM plants.
- Photorespiration. Why is it important? How do C_4 plants lower the energy loss caused by photorespiration?
- why one type of photosynthetic pathway doesn't prevail in all biomes on Earth.
- Scholander curves
- some examples of the ecological distributions of animals being influenced by their physiological tolerances.

Week 6

- the history of the human population size.
- the estimates for the carrying capacity for humans.
- what is λ. What is r? How are they related?
- density dependence.
- the equation: $N_t = N_o e^{rt}$.
- the logistic equation, and how it incorporates density dependence.
- the Ricker Model. How does it incorporate density dependence?

Week 7

- the importance of genetic diversity important.
- what is meant by the concept of an "ideal population."
- genetic bottleneck.
- effective population size.
- how inbreeding influences genetic diversity.
- the "rules of thumb" for minimum effective population sizes if we wish to maintain genetic diversity in populations.
- the ecological and genetic effects of habitat fragmentation.
- "Habitat connectivity" and "corridors" are terms that are used a lot. Why are these things important from a genetic and conservation stand-point?

Week 8

- how to convert between a life cycle graph and the equivalent projection matrix.
- how to use projection matrices.
- what information projection matrices give us about future populations.
- how to calculate and interpret the left and right eigenvectors of a projection matrix.
- how projection matrix techniques have been used in ecology.

Week 9

- Competition.
- competitive exclusion.
- resource partitioning.
- the Lotka-Volterra model of competition. Be able to derive the isoclines and plot them in phase space. Why do trajectories have to cross isoclines at right angles to the axis of that particular species? Be able to explain with a diagram.

Week 10-11

- some adaptations shown by organisms to help them capture food or avoid being eaten.
- examples of predators affecting communities.
- Batesian mimicry? How is it thought evolve? Be able to give examples.

- Mullerian mimicry? How is it thought evolve? Be able to give examples.
- why poisonous things tend to be bright.
- the Red Queen hypothesis. How does it apply to interactions between predators and prey?
- search images.
- frequency-dependent selection. How can it generate diversity in prey types?
- mesopredator release. Provide examples.
- the Lotka-Volterra model of predator-prey interactions.

Week 12-15

- what is a biological community.
- direct interactions. Be able to give examples.
- indirect interactions. Be able to give examples.
- trophic cascades. Be able to give examples.
- keystone species. Be able to give examples.
- "ecosystem engineers." Be able to give examples.
- how communities can be changed by the introduction of non-native species. Be able to give examples.