BIOLOGY 201 FIRST SUMMER SESSION 2010
ECOLOGY AND EVOLUTION

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BIOLOGY 201 WEBSITE: https://blackboard.unc.edu

LECTURES: Daily 9:45-11:15 AM, Coker Hall, Room 201

OFFICE HOURS: Immediately after class on most days

RECITATION: Meet in Wilson Hall, Room 132 or as noted in the Recitation syllabus.

PHILOSOPHICAL BACKGROUND:

Evolution is played out in an ecological context. Ecological processes that cause changes in the genetic make-up of populations are the basis of evolution. Since all biological processes are ultimately part of evolution, ecology and evolution are intimately intertwined. The ecological interactions of populations, species, communities and ecosystems all have evolutionary consequences. ***Therefore, all environmental issues have an ecological basis and both ecological and evolutionary consequences.*** Global warming, deforestation, overpopulation, etc. result from the actions and interactions between organisms and their environment. The new, often impaired environment forces all species to adapt to it. This compels all species to change (evolve). Some will thrive and others will go extinct. We must take this seriously since *"extinction is forever".*

Several concepts help unify this course. One is the role of **diversity**. We will consider many types of diversity from genetic diversity (the variety of genotypes in a population or species), which fuels evolution; to species diversity (the variety of species in a natural community), which stabilizes ecosystem processes. Diversity is fundamental to evolution, population biology and ecology. The other unifying concepts are **spatial and temporal heterogeneity**. All systems are variable in space and time. This idea underlies the development of new species, genetic drift, coexistence of competing species, predator-prey dynamics, seasonality, and the structure and dynamics of communities and ecosystems. We will organize the course by using these conceptual threads to weave a coherent understanding of the interrelationships between ecology and evolution.

OBJECTIVES:

In this course you will begin to understand the processes that govern the distribution and dynamics of ecological systems. Ecology is the study of the interactions of organisms with each other and with their environment. Evolution is the consequence of ecological interactions played out over time. This seems simple enough, but nature is exceedingly complex so a superficial analysis of an ecological issue can produce an answer that this shallow and perhaps even dangerously incorrect. Understanding the complexity that will be introduced to you in this course will likely be your biggest challenge.

COURSE ORGANIZATION:

This course is divided into three main sections:

Part I, Evolution, is about the mechanisms of evolution, at the population and phylogenetic levels. We will examine populations as evolutionary units. Population genetics is a quantitative tool for analyzing evolutionary change. We will see how changes in gene frequencies in a population lead to changes in populations and the formation of new species, i.e. evolution.

Part II, Population Ecology. We will study the dynamics of population level processes, including survivorship and reproduction leading to population growth and regulation.

Part III, Community and Ecosystem Ecology, will focus on communities and ecosystems and how populations interact through competition, predation, and mutualism. Then we will examine how population processes are influenced by their environmental constraints, ranging from seasonality and spatial heterogeneity to disturbances. We will learn what determines the structure of natural communities, i.e. species diversity. The interplay of the communities with their physical environment results in production, energy flow, decomposition and nutrient cycling at the ecosystem level. The community and the constituent populations determine ecosystem level processes. In turn the dynamics of the ecosystem determine the conditions for population and community change and ultimately for evolution. We will end with a discussion of the impact of ecology on many current environmental and conservation issues.

RECITATION:

Your recitation section meets three times a week (M, T, & Th): section 601 meets at 12:00, section 602 meets at 1:00. The Recitation grade will constitute 20% of your final grade. It can raise your grade but it cannot rescue you: you must pass the lecture to pass the class. You are assigned to one recitation section and you must attend that section. Recitation is a mini-lab, containing computer simulations, discussions, and field trips. **All field trips take 2 hours and attendance is required (missing a field trip is a reduction of 10% of your Recitation grade).** There are two this session, one uses Bolin Creek and the other Battle Park, a 93 acre public-access area owned by the University and managed by the Botanical Garden. Check your recitation schedule and plan accordingly. If you have a legitimate conflict, we will help you reschedule your field trips. However you are always responsible for any content you may have missed. Let your TA know if you have recitation conflicts.

THE RELATIONSHIP BETWEEN THE LECTURES AND THE READINGS:

Attendance at all lectures is essential for success in this course. Every two classes equals one week of a regular academic semester. Consequently, **you cannot let yourself fall behind in the readings or in lecture material.** It is fine to use flash cards to make sure that you understand terms and concepts and to help you remember people and what to associate them with. However, my tests will ask more from you than simply whether or not you can memorize facts. I give you my powerpoints on blackboard so that you can take notes on the examples and stories I tell that illustrate concepts and show how ecologists and evolutionary biologists test hypotheses and apply concepts to real world observations. These stories almost always end up as test questions. My hope is that you use the powerpoints, your notes from class, and the readings to “triangulate” onto a solid understanding of the material.

CRITIQUES OF ORIGINAL ECOLOGICAL PAPERS: DUE DATE: JUNE 7 (EMAIL TO ME)

In order to help you start reading original scientific papers, you will need to find an article, read it carefully (probably more than once) and then analyze and criticize it. Each critique will be your own original evaluation of an article from the contemporary ecological or evolutionary literature. This paper will be your critical analysis of the article. You do not need to demonstrate complete knowledge of the paper, but you need to demonstrate that you understand it. The paper can be on any topic of interest to you in the listed journals. The critique is due on June 7, 2008 (I will deduct 10% for each day late up to a maximum of 50%). Select your article from among the major ecological and evolutionary journals **(Ecology, Ecological Monographs, Ecological Applications, Ecology Letters (short articles), J. British Ecological Society, Evolution, Oikos, Oecologia, American Naturalist, J. North American Benthological Society,** etc.). If you have any questions on the appropriateness of any article, please discuss it with me. These Journals can be found in the Biology Libraries (Zoology is on South Road, back of Wilson Library and Botany is on 3rd floor Coker Hall). Many of them are also available on line. **Only choose articles published since January 2007.**

On blackboard you will find a Word document in the Assignments section that has 10 questions you should answer after reading your paper. You should answer these questions thoroughly, but succinctly. If you cut and paste large parts of the text of the paper you have chosen into the answers on this sheet I will give you an F for this assignment. Therefore you MUST paraphrase the information in the paper and answer the questions in your own words.

EXAMS AND COURSE GRADING

There will be one midterm exam, a two-page critique of an article from the literature and a final exam

Midterm Exam .....…….....30%
Critique…….....10%
Final Exam....……...…..40%
Recitation (including the Field Trips)…..20%
100%

The final is cumulative. The midterm covers material to date.

TEXTBOOKS:

S&S = Smith, T.M. and R.L. Smith. 2008. Elements of Ecology. 7th Edition. Pearson Benjamin Cummings, Sn Francisco.

N = Neal, Dick. 2004. Introduction to Population Biology. Cambridge University Press. Cambridge, England.

BIOLOGY 201: ECOLOGY AND POPULATION BIOLOGY LECTURE SCHEDULE

DATE	TOPIC	READINGS (Chapter Numbers)
May 11 (T)	Ecology, Environment, Evolution & Man The Ecology of NC Environmental Problems	**N 1,2,3 S&S 1,2**
12 (W)	Spatial and Temporal Variation in Environment; Organisms in Nature: Distribution of Species Populations; Biomes; Introduction to Biodiversity.	**S&S 3,4,23,24,25**
13 (Th)	Niche Theory; Fundamental Niche, Realized Niche	**S&S pp. 272-281, S&S Chaps. 5, 6, 7**
14 (F)	Populations and Species as Genetic Units Evolutionary Stability (Hardy-Weinberg Law)	**N 6, 7**
17 (M)	Genetic Change (Mutation, Gene Flow, Genetic drift	**N 8, 9**
18 (T)	Natural Selection, Fitness	**N 10, 11**
19 (W)	Inbreeding, Heritability	**N 8, 12, 13**
20 (Th)	Speciation, Phylogeny	**N 20, TBA**
	POPULATION ECOLOGY	
21 (F)	Population Ecology: Demography	**S&S 9**
24 (M)	Life Tables, Fertility Tables, Population Growth	**N14; S&S 10, 11**
25 (T)	**MIDTERM EXAM**	
26 (W)	Population Regulation, Metapopulations, Life Histories	**N16**; **S&S 8, 11, 12**
27 (Th)	Interspecific Interactions, Mutualism	**S&S 11, 15.10-15.15; N19**
28 (F)	Competition: Biology and Theory	**Reprise S&S 11 plus S&S 13; N17**
31 (M)	**Memorial Day Holiday (no class)**	
June 1 (T)	Predation: Biology and Theory	**S&S 14, 15.1-15.9; N18**
2 (W)	Community Structure. What is a community? I - Association Analysis (Are species are strongly interacting?) II- Measuring Biodiversity	**S&S 16, 17, 26**

COMMUNITY ECOLOGY

3 (Th)	Succession, Disturbance and Equilibrium	**S&S 17,18**
June 4 (F)	Invasive Species, Food Webs, Stability, Landscape ecology	**S&S 17,19**
7 (M)	Non-Equilibrium Determinants of Biodiversity	**S&S 19**

ECOSYSTEM ECOLOGY

8 (T)	Ecosystem Processes I - Primary Production, Energy Flow and Ecological Efficiency	**S&S 20**
9 (W)	Ecosystem Processes II- Nutrient Cycling and Decomposition	**S&S 21, 22**
10 (Th)	Ecosystem Services and Biodiversity	**S&S 27 (optional 23,24 & 25)**
11 (F)	Ecology, Conservation and Sustainable Development	**S&S 27, 28, 29**

FINAL EXAM: MONDAY JUNE 14 8:00AM – 11:00AM Coker 201
The final exam will have 25% from before the midterm and 75% from the rest of the class.