Syllabus

1 Introduction

Biology 461 is a survey of the field of ecology intended for upper-level undergraduates and graduate students. The course aims to give the students a relatively comprehensive understanding of the field of ecology including major concepts, broad empirical patterns and important contemporary directions. The course has a required lab in which students will be exposed to a broad range of experimental, observational and quantitative methodology. Students are expected to have taken either Biology 201 (Introduction to Evolution and Ecology) or its equivalent.

Instructor: James Umbanhowar

Research Assistant Professor of Biology. Office: Wilson 210. Office hours: After class or by appointment. email: jumbanho@unc.edu.

The best time to discuss questions about class material is right after class, when the class material is still fresh in our minds. If that time is inconvenient, please schedule a time to meet with me.

Teaching Assistant: Rob Heckman

Graduate student, Department of Biology Office: Coker Hall 404 Phone: 919-962-6049 Office hours: By appointment email: rwheckman@unc.edu

2 Class expectations and grading

In addition to the prerequisite course in Ecology and Evolution (Bio 201), we expect that you have a solid background in high school algebra. Ideally, you will have taken
a undergraduate level course in calculus, statistics and chemistry, but these are not necessary. I will be taking extra time in lecture to review/introduce key quantitative methods and concepts.

Attendance at lectures and laboratories will be key to your performance in this class. The recommended text is provided as a reference for you and will not be directly referred to. Frequently, there will be additional reading assignments chosen from the primary or secondary literature. They will be listed under assignments on the Sakai page. Please use the forums to discuss any questions you have about reading assignments.

Exam material will be taken primarily from the lecture, assigned readings and laboratory. I like to combine a variety of types of questions on my exams. Typically, these include identification, short answer (a few sentences), graph or figure interpretations, problem solving, and short essays. I will post examples of previous exams on Sakai. You might note that it is common for my questions to require you to use in new ways facts, principles, or approaches we have presented. To do well on our tests, you should not just ”memorize” the material; you should take time to think about what the material means, why it is significant, and how it might be applied and generalized!

Grading will be as follows:
Exams, each - 20%
Lab assignments - 15%
Class participation - 5%
Literature paper - 10%
Lab final project - 10%

Late assignments will be marked down daily, unless previous permission is granted.

Finally, if a serious situation arises that makes it difficult for you satisfactorily complete the requirements of the course, please contact me as soon as possible. I will do my best, within reason, to try to make accommodations for you.
3 Text

I have decided to not have a formal text for this class. The recommended text is purely for your own review of topics covered previously in BIOL 201. I will frequently assign readings from the primary and secondary literature to assist you in understanding concepts that are discussed in class. Please read these before class and be prepared to discuss them in class. You are encouraged to discuss the readings on Sakai before and after class.

4 Class overview

The class follows a largely “constructive” approach. This means that through the semester we will move in a rough hierarchy from individual scale to the scale of the entire globe. This approach mimics one methodology of general research in ecology which tries to apply understanding of simple systems to supersets of these systems. A contrasting approach is to examine properties of these larger systems as “emergent properties” that are difficult to understand as mere compilations of simpler systems. Both approaches have merits and as we get towards the end of the semester we will be examining some of these emergent properties of complicated systems.

The course will start by examining how the behavior and physiology of individual organisms changes in different environments. We will seek to understand how evolution adapts organisms to environments and what the chemical and physical constraints are to this adaptation.

The second section will examine populations of individuals: how they interact and what determines patterns of abundance in time and space.

The third section will focus on major interaction types between two species. We will examine how these interactions alter population dynamics and abundance and also how species adapt to these interactions.

Fourth, we will examine the forces that create assemblages of species that are encountered in nature.

Finally, we will examine the interaction between communities and the physical environment.

As stated earlier, throughout the class we will take frequent breaks from lectures to discuss an article from the primary literature. These discussions are an important part of the class, as they expose you to the real communication medium of science. Science is very hard and in reading these articles critically, you will see just how difficult the actual discoveries of science are.
5 Class schedule

Below is a outline of the class schedule for semester including dates for the exams and paper discussion. The reading assignments are general in nature at this point. I will post specific reading at least two days prior to the class on Sakai. Note that there may be some readings from other sources that are added that supplement the main text.

Ecology of the individual

August 20 Introduction
August 22 Temperature and Energetics

August 27 Resource Use
August 29 Life history theory

September 3 Metabolic theory and body size

Ecology of the population

September 5 Population: demography and population growth

September 10 Intraspecific competition and population regulation
September 12 Populations in space: metapopulations

September 17 Populations in space: spatial spread
September 19 Population management: Fisheries

Ecology of species interactions

September 24 Classical competition theory
September 26 Exam 1

October 1 Competition in varying environments
October 3 Consumer-resource dynamics
October 8 Herbivory & Parasitism
October 10 Mutualism

October 15 Population dynamics redux: regulation
October 17 No Class – Fall Break

**Community Ecology**

October 22 Community structure and description
October 24 Species interactions and community structure

October 29 Food webs: complexity and stability
October 31 Exam 2

November 5 Succession and community stability
November 7 Spatial processes and neutral community theory

November 12 Global patterns of diversity

**Ecosystem Ecology**

November 14 Ecosystem energetics

November 19 Detrivory and nutrient dynamics
November 21 Communities structure and ecosystem function

November 26 Global nutrient cycles
November 28 No Class – Thanksgiving Holiday

December 3 Applied ecology in the Anthropocene

December 12 12:00 PM **FINAL EXAM**
Laboratory Sections

1. Sections
   (a) 401: 2 – 4:50 Tuesdays, in Genome Sciences 1377
   (b) 402: 2 – 4:50 Wednesdays, in Genome Sciences 1378

2. Objectives
   (a) Provide a forum for discussing material presented in lecture.
   (b) Learn how to formulate questions, quantify observations, and test hypotheses.
   (c) Provide field experience in natural ecosystems.
   (d) Provide experience collecting and analyzing data using the R software package.
   (e) Teach how results of scientific studies are published and how to gain access to and evaluate the validity of ecological studies.

3. Attendance
   (a) Students are required to attend all laboratory sessions.
   (b) If you are unable to attend your section during a particular week, be sure to contact Rob as soon as possible, and try to attend the other lab section that week.
   (c) Labs begin the week of August 26.

4. Grades and assignments
   (a) Lab assignments will include three lab reports, a presentation of the group project, and worksheets for certain lab topics.
   (b) Each lab report will be worth 5% of the final grade; the final presentation (along with the written assignment associated with this presentation) will be worth 10% of the final grade; all other lab activities will contribute to participation points, 5% of the final grade. Lack of attendance may result in negative points.
   (c) A semester paper assignment will also be introduced and discussed during the lab period on October 7. This paper assignment will be worth 10% of your final grade.
## Laboratory Outline

<table>
<thead>
<tr>
<th>Week starting</th>
<th>Lab Topic</th>
<th>Assignment due this week in lab</th>
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<tbody>
<tr>
<td>August 26</td>
<td>R introduction and installation</td>
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<td>September 8</td>
<td>Project 1: Pollinator behavior – introduction</td>
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<tr>
<td>September 16</td>
<td>Project 1: Pollinator behavior – data collection</td>
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<td>September 23</td>
<td>Population models using R</td>
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<td>September 30</td>
<td>Project 1: Pollinator behavior – Data analysis</td>
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<td>October 7</td>
<td>Interaction model lab; Library orientation and literature paper introduction</td>
<td>Lab report 1</td>
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<td>October 14</td>
<td>Project 2: plant-insect interactions – introduction</td>
<td>Literature paper topic &amp; annotated bibliography</td>
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<tr>
<td>October 21</td>
<td>Project 2: plant-insect interactions – data collection</td>
<td>Lab report 2</td>
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<td>October 28</td>
<td>Independent project: planning</td>
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<td>November 4</td>
<td>Project 3: Community structure – introduction</td>
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<tr>
<td>November 11</td>
<td>Project 3: Community structure – data collection</td>
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<td>November 18</td>
<td>Open – work on project</td>
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<td>November 25</td>
<td>No lab – Thanksgiving</td>
<td>Lab report 3</td>
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<td>December 2</td>
<td>Presentations of independent projects</td>
<td>Abstract and Figures due in lab projects</td>
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