

## PRINCIPLES OF ECOLOGY

“Principles of Ecology” (EBIO 2040) is a required course for Ecology and Evolutionary Biology majors and is also taken by many Environmental Studies majors in the science track. The course provides you with an overview of ecology, covering topics ranging from global abiotic processes to biomes, as well as species-, community-, and population-level dynamics. The lab portion of this course emphasizes techniques of field biology. It complements the lectures by helping you to understand how to generate and test ecological hypotheses by examining issues such as how to quantify and estimate diversity, how to measure landscape level patterns, and how to utilize computer programs to help analyze ecological data. You will also develop, conduct, and present an independent project that will allow you to implement the skills you have learned throughout the course.

Although we will address a wide range of ecological questions in this lab, it is important to realize that the goals of this course are twofold: (1) to familiarize students with hypothesis testing and (2) to teach students the different tools and methods that researchers use to study a variety of topics in ecology.

### **Hypothesis Testing**

Hypothesis testing, also commonly referred to as the scientific method, is essentially a formalized argument that helps you understand how biology works. It is a process that involves making observations, posing questions, formulating hypotheses, and creating experiments to test whether a hypothesis of interest is supported. In this lab, we will begin by formalizing what we mean by the scientific method. Next we will briefly look at a few statistical tools that researchers use to quantify findings and then learn to present data using Microsoft Excel and R, which is a free, open-source sophisticated statistical package. As the labs proceed, we'll either frame our experiments using the scientific method or have you consider how you might use the different methodologies you've learned to test hypotheses.

### **Learning to Use Ecological Tools and Methods**

Although learning to use the scientific method will be a central theme of this course, we will, in certain labs, focus primarily on the use of tools to quantify or describe patterns without explicitly stating and testing a hypothesis. For example, we will explore methods that estimate species diversity, stream quality, distributional patterns, and population sizes. Learning different ecological methods is important because describing and quantifying patterns (making observations) is an important first step when using the scientific method. We will thus explore tools and methods commonly used in ecology to provide you with the means by which you yourself could test a variety of hypotheses or produce observations that help you generate hypotheses. This lab will offer the opportunity to apply the scientific method, concepts in ecology, and the different tools you learn by conducting an independent research project that you will present to your peers.

## Grading Policy and Lab Expectations

The lab grade will be based on 200 pts and will constitute 1/3 of the overall class grade. Detailed grading rubrics and point breakdowns may be found on the lab web page.

### Lab Write-Ups/Homework

<i>Hypothesis Formation</i> .....	5 pts	
<i>Reading Discussion</i> .....	5 pts	
<i>Isle Royale</i> .....	5 pts	
<i>Ponderosa Pines II (Statistical Analyses)</i> .....	10 pts	
<i>Intermediate Disturbance</i> .....	10 pts	
<i>Life Tables</i> .....	5 pts	
<i>Prairie Dog I (Dispersion Pattern)</i> .....	5 pts	
<i>Prairie Dog II (Urbanization Paper)</i> .....	10 pts	
<i>Boulder Creek II (Invertebrate Diversity)</i> .....	10 pts	
	<b>Total:</b>	<b>65 pts</b>

### Independent Project

<i>Pre-Proposal Form (completed <b>before</b> project proposal lab)</i> .....	5 pts	
<i>Project Proposal Form (completed <b>during</b> project proposal lab)</i> .....	5 pts	
<i>Presentation (partners present project together)</i> .....	20 pts	
<i>Paper (each student writes his/her own paper)</i> .....	35 pts	
	<b>Total:</b>	<b>65 pts</b>

**Laboratory Examination**..... **30 pts**

**Quizzes**..... **40 pts**

**Grand Total: 200 pts**

*Extra credit opportunity.* TAs will select the best independent project from each of the 16 lab sections. The teaching team will then choose the four best overall projects from those 16, and both group members of each of the top four projects will receive **TEN (10) EXTRA CREDIT POINTS**.

*Attendance at labs is mandatory.* If you miss a lab, it is your responsibility to make it up in another lab section that *same* week. Please be aware that there is limited room in the vans we will use on travel days, and in order to make up a lab, you will need to make arrangements with a Graduate Teaching Assistant (GTA) who may have 14 or fewer students in his/her section (see the course web page for lab schedules and contact information for each of the GTAs). If you have a valid medical excuse or otherwise, your GTA may let you make up the lab at his or her discretion. An unexcused absence will result in the loss of 5 laboratory points.

*Be on time and come to lab prepared.* It is expected that you will arrive on time, as labs will begin promptly and most often last the whole time period. On travel days, the lab sections will be conducting field experiments and you may be left behind if you are late. Not only are you expected to be on time, you are also expected to have read the week's lab and to come to lab prepared (e.g., have travel gear for travel days, have writing tools, etc.). Given the limited time in lab during some sessions, the GTAs will go over the concepts briefly because they will assume you are familiar with the lab materials.

*Working together.* In this lab, we will have a strong emphasis on students working in groups and on groups presenting their results and ideas to the lab. Although students will be encouraged to work with others, it is expected that all assignments turned in are original works written in a student's own words. All students are expected to abide by the academic standards outlined in the University of Colorado Honor Code. If you are unfamiliar with the Honor Code, you can find it at [www.colorado.edu/academics/honorcode](http://www.colorado.edu/academics/honorcode). Violations of this policy may include: cheating,

plagiarism, academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). **Discussing exam/quiz material after you have taken a test is cheating!!!** Your TAs have been instructed to not give out any answers regarding any quiz or exam until the following lab period. All written work is subject to plagiarism-prevention scanning through TurnItIn.com or SafeAssign. It is your responsibility to understand paraphrasing and quoting of references, as well as appropriate citation of your sources.

We strongly encourage participation and we hope that students use this course as an opportunity to explore concepts, methods, and ways to present materials to your peers and future colleagues. Remember that wrong answers are important because they help clear up ideas and help the GTA know how students are learning the materials. We expect the labs to be open to varying opinions and ideas and that all students will respect their peers. Derogatory language, putting down others, and sexual harassment (<http://www.colorado.edu/sexualharassment>) will not be tolerated in this lab. Please read and understand the Campus Classroom Behavior Policy and Honor Code. As members of the CU-Boulder community, we will abide by the spirit and letter of this policy, which is available online (<http://www.colorado.edu/policies>).

### **Administrative Reminders**

1. If you qualify for accommodations because of a disability, please submit to your GTA a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. (303 492 8671, Willard 322, [www.colorado.edu/disabilityservices](http://www.colorado.edu/disabilityservices)).
2. Teaching faculty shall make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. We encourage you to notify your GTA of anticipated conflicts as early in the semester as possible so that there is adequate time to make necessary arrangements.

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**LABORATORY WEB PAGE:** <http://www.colorado.edu/ceb/courses/2040/>



## EBIO 2040 Schedule

### Fall Semester 2010

Week of	Lab # (F = Field Trip)	Lab Descriptions
August	23	Lab #1 Hypothesis Formation <u>Activities:</u> Intro to the lab, the scientific method & designing a research project; Introduction to statistical analysis in R
August	30	Lab #2 F Producing Life History Tables <u>Activities:</u> Visit Columbia Cemetery to Produce a Life Table
September	6	<b>NO LABS</b> <b>Labor Day Holiday</b>
September	13	Lab #3 *Intermediate Disturbance Hypothesis Simulation; Scientific Writing; Scientific Paper Discussion; Quiz 1
September	20	Lab #4 F *Factors Affecting Growth Rate of Ponderosa Pines <u>Activities:</u> <i>Field data collection:</i> Coring Ponderosa Pines along an elevational gradient
September	27	Lab #5 *Factors Affecting Growth Rate of Ponderosa Pines II <u>Activities:</u> Statistical analysis in R; <i>How to Do Ecology</i> Ch. 1 & 2 Discussion
October	4	Lab #6 Project Proposals Meet to present your independent project proposals; Literature searches; <i>How to Do Ecology</i> Ch. 3 Discussion; Quiz 2
October	11	Lab #7 F Estimating Species Richness & Diversity <u>Activities:</u> <i>Field data collection:</i> Survey Marco-invertebrates in Boulder Creek
October	18	Lab #8 Estimating Species Richness & Diversity <u>Activities:</u> Data analysis, learning to measure diversity; Quiz 3; <i>How to Do Ecology</i> Ch. 4 Discussion
October	25	Lab #9 Isle Royale – Competition Simulation <u>Activities:</u> Scientific Paper Discussion; <i>How to Do Ecology</i> Ch. 5 & 6 Discussion
November	1	Lab #10 F Prairie Dogs & Measuring Distributional Patterns <u>Activities:</u> <i>Field data collection:</i> Record coordinates of prairie dog colonies
November	8	Lab #11 Prairie Dogs & Measuring Distributional Patterns II <u>Activities:</u> Data Analysis; Quiz 4
November	15	<b>Lab Exam</b> Lab Exam and Independent Project Help
November	22	<b>NO LABS</b> <b>Thanksgiving and Fall Break</b>
November	29	Writing Workshop              Revise Independent Project Papers
December	6	<b>Presentations</b> Present Independent Project and Submit Paper

\*Reflects adjustments to the original schedule s a result of the Fourmile Canyon wildfire