

BIOL 490 001: Global Change Ecology
Tentative syllabus, Spring 2010

INSTRUCTOR: Professor Lauren Buckley, buckley@bio.unc.edu
Office: Wilson 340, Office hours: TBA

TIME AND PLACE: TR 11:00-12:15, New East 301

PREREQUISITE: BIOL 201 or permission of instructor

COURSE DESCRIPTION

While it is clear that global change is a central environmental challenge, the rapidly-emerging research field of Global Change Ecology is just beginning to address how organisms and ecosystems will respond. The course will emphasize how integrating ecology, physiology, behavior, and evolution is enabling understanding past responses and predicting future responses. The course will couple lectures with hands-on experience monitoring and predicting species' responses, discussion of key literature, and debates of crucial policy-relevant issues.

COURSE GOALS

1. To gain a broad understanding of the mechanisms by which plants, animals, and communities are responding to global change.
2. To directly engage with the primary literature in and identify topics at the frontier of global change research.
3. To enhance skills in communicating science and debating scientific issues via oral and written forms.
4. To appreciate the links between physical, chemical, and biological systems, and the changes that may occur with anthropogenic forcing.
5. To become acquainted with methods and tools for analyzing past and predicting future responses to global change.

READING

Articles and chapters will be assigned and distributed on the course wiki. Check the wiki frequently for potential changes in reading assignments. The following text is an optional supplement to the assigned readings. Used copies can be purchased online inexpensively. The class is structured similarly to the book, so the book may afford helpful background reading:

Graves and Reavey. 1997. Global Environmental Change: Plants, Animals and Communities.

ACTIVITIES

Courses meetings will consist of approximately 2/3rds lectures (**Lec** on schedule) and 1/3 activities. There will be three types of activities:

Discussions (Dis)- We will discuss the motivations, methods, results, and implications of recent papers.

Debates (Deb)- We will debate topics of current interest in global change ecology. Key background reading will be assigned. Students will sign up on the Blackboard wiki (by 9AM Wednesday for a Thursday debate and 9AM Monday for a Tuesday debate) for one of two specified debating positions. If the number of people selecting each position is unbalanced, I will randomly reassign people by noon on the day sign ups are due.

Exercises (Ex)- These are activities designed to provide hands-on experience with the methods of global change research. Following exercises 1 and 3-6 exercises (specified below and in the schedule) you will be required to hand in a 1 page summary including figures if appropriate. These do not need to be polished reports, but should clearly and articulately convey your findings from the exercise. Additionally hand in data where relevant.

Ex 1: Vostok Ice Core- We will analyze data from the Vostok Ice Core.

Ex 2: FACE site visit- We will visit or have a researcher visit us from the FACE (Free Air Carbon Enrichment) site in Duke Forest.

Ex 3: Carbon auction- We will conduct several types of carbon markets in class. ~1/2 of class members will be assigned to serve as the CEOs of various carbon-intensive industries. You will be assigned a type of industry, a current level of carbon emission, and an emission reduction target. You should come to class with plans (including cost and volume) for several emission reduction strategies. ~1/2 of class members will be assigned to serve as the CEOs of carbon offset companies. You should come to class with plans for selling carbon offsets or sequestration. Several class members will be assigned to serve on a regulatory board. You should come to class with rough estimates (costs and volumes) for various carbon reduction, offset, or sequestration strategies.

Ex 4: Range models- Each student will predict current and potential future distributions of a chosen species using locality data and the correlative modeling technique Maxent.

Ex 5: Phenology- We will analyze changes in the date of first flight for California butterflies during recent climate change.

Ex 6: Case study- Each student will select a species and investigate whether the species has already responded to climate change and how the species is likely to respond in the future. Come to class prepared to briefly present on the species' potential fate. Will the species move, acclimate, adapt, or face extinction?

ASSIGNMENTS

Additionally, there will be a midterm, final, and two assignments:

Research proposal (3 page)- Students will formulate a research question in global change ecology and write a research proposal to address this question. The proposal will be for a NICCR (National Institute for Climate Change Research) grant (one year exploratory project with a maximum budget of 125k, <http://niccr.nau.edu/>).

IPCC section update (3 pages)- Students will select a section of the IPCC (Intergovernmental Panel on Climate Change) Ch4 report to update with recent research findings (from at least 5 studies).

GRADING

Midterm 15%

Final 20%

Research Proposal 15%

IPCC section update 15%

Lab exercises 20% (Exercises 1, 3-6 each 4%)

Presentations and participation/preparedness for debates and discussions 15%

Late Policy: Unless you have made arrangements with Professor Buckley prior to the due date or have a university excused absence, you will lose 10 percentage points per day on late assignments.

Date	Week	Type	Topic	Due assignments	Assigned reading
* Climate science and history					
12-Jan	W1	Tu	Lec1	Intro and history	
14-Jan	W1	Th	Lec2	Greenhouse gases, Carbon cycle	Houghton 2004
19-Jan	W2	Tu	Lec3	IPCC	IPCC 2007 Technical Summary Pages 21-87
21-Jan	W2	Th	Dis1	Climate Novelty	Williams and Jackson 2007, Williams et al. 2007
26-Jan	W3	Tu	Lec4	Historic climates and responses	Graham et al. 1996
28-Jan	W3	Th	Lec5	Paleoecology	Parmesan 2006
* Plants					
2-Feb	W4	Tu	Lec6	Plant physiology and global change	GEC Chapter 2
4-Feb	W4	Th	Dis2	Ecosystem biogeochemistry	Schimel et al. 2001, Field et al. 2007
9-Feb	W5	Tu	Lec7	GC manipulation experiments	Zavaleta et al. 2003, Suttle et al. 2007
11-Feb	W5	Th	Ex2	FACE site visit or lecture	None for Ex2
16-Feb	W6	Tu	Ex3	Carbon auction	Ex3: Carbon auction
* Animals					
18-Feb	W6	Th	Lec8	Thermal tolerance and stress	GEC Chapter 2
23-Feb	W7	Tu	Deb1	Temperate versus tropical impacts	Tewskbury et al. 2008, Deutsch et al. 2007
25-Feb	W7	Th	Lec9	Range shifts and models	Ex4: Range models Sexton et al. 2009
2-Mar	W8	Tu	Lec10	Evolutionary responses	Etterson and Shaw 2001, Balanya et al. 2006
4-Mar	W8	Th		MIDTERM	
16-Mar	W9	Tu	Deb2	Will species adapt?	IPCC Update Bridle and Vines 2007, Visser 2008
* Species interactions and communities					
18-Mar	W9	Th	Lec11	Phenological change	Ex5: Phenology Cleland et al. 2007
23-Mar	W10	Tu	Lec12	Community changes	Visser and Both 2005
25-Mar	W10	Th	Dis3	Long-term resurveys	Moritz et al. 2008
30-Mar	W11	Tu	Ex5	Species' case studies	Ex6: Case study
* Aquatic ecosystems					
1-Apr	W11	Th	Lec13	Marine Impacts and Acidification	GEC Chapter 5, Menge et al 2008
6-Apr	W12	Tu	Lec14	Coral bleaching and disease	Bruno et al. 2007
8-Apr	W12	Th	Lec15	Freshwater impacts	Battin et al. 2007
13-Apr	W13	Tu	Dis4	Present research proposals	Research proposal
* Conservation					
15-Apr	W13	Th	Lec16	Conservation	Heller and Zavaleta 2009
20-Apr	W14	Tu	Lec17	Agricultural impacts	Lobell et al. 2008
22-Apr	W14	Th	Deb3	Assisted migration	Marris 2008, Schwartz et al. 2009
27-Apr	W15	Tu	Lec18	Climate and disease	Harvell et al. 2002