ESPM 111 Ecosystem Ecology
Whendee Silver/Dennis Baldocchi
Spring 2008
Syllabus

Course description
This course will develop the principles of ecosystems ecology, with an emphasis on their application to terrestrial ecosystems. Ecosystem ecology involves the study of energy and material flows through both the living (plants, animals, microbes) and non-living (soils, atmosphere) components of ecological systems. We will study the major element cycles (carbon, nitrogen, phosphorus) and patterns of energy flow through ecosystems, including how those fluxes and their controls differ for different ecosystems. Our goal is to develop a solid understanding of the links between ecosystem structure and function. Thus we will focus on the logical connections among ideas so that complex processes can be understood from some basic concepts.

Course grade
In order to provide some experience in ecosystem analysis, five problem sets are required. Assignments will include a mix of data reduction and interpretation. These problem sets along with the case studies and explorations (typically presented in Fridays' lecture) will form the topics for the discussion section. **It is imperative that you come to class and actively participate in discussion sections.** To learn ecosystem ecology, you need to practice the specific application of concepts described in lecture. Assignments are due in class on Friday, one week from the date assigned. Late assignments will be accepted the following Monday in class for a maximum of ½ credit. No late assignments will be accepted past Monday. Graded assignments will be returned to students during section.

There will be a Midterm and Final exam. Grades will be calculated as follows:

Homework assignments:	30%
Midterm:	35%
Final:	35%

Instructors
Whendee Silver — Office Hours: TBA
319 Hilgard Hall
wsilver@nature.berkeley.edu
643-3074

Dennis Baldocchi — Office Hours: TBA
345 Hilgard Hall
baldocchi@nature.berkeley.edu
642-2874

GSI
Chloe Lewis — Office Hours: TBA
45 Hilgard Hall
chlewis@nature.berkeley.edu

Lecture Outline

Week	Date	Lecture Topic	PROF	Reading
1	W Jan 23	L1 Introduction: overview and course mechanics	WS	Chapin et al. 1996
	F Jan 25	L2 The ecosystem concept/scaling, part 1	DDB	Chapter 1; Brown et al 2002
2	M Jan 29	L2 The ecosystem concept/scaling, part 2	DDB	
	W Jan 31	L3 History of ecosystem ecology	WS	Chapter 1
	F Feb 2	L4 Climate and atmosphere	DDB	Chapter 2
3	M Feb 4	L5 Ecosystem-climate Interactions	DDB	Chapter 2
	W Feb 6	L6 Ecosystem structure and function	DDB	Chapter 4
	F Feb 8	L7 Energy	DDB	Chapter 4
4	M Feb 11	L8 Water and ecohydrology	DDB	Chapter 4
	W Feb 13	L9 Geology and soil development	WS	Chapter 3
	F Feb 15	L10 Soil biology (Mary Firestone)	WS	Chapter 3
5	M Feb 18	No Class (Holiday)		
	W Feb 20	L11 State factor analysis of ecosystems: a virtual hike through the ecological staircase	WS	
	F Feb 22	L13 Principles of the carbon cycle	DDB	Chapter 6/Ch 15
6	M Feb 25	L15 Respiration and decomposition	WS	Chapters 8 and 9
	W Feb 27	L14 Ecophysiology of leaves	DDB	Chapter 5
	F Feb 29	L16 Decomposition II	WS	
7	M Mar 3	L 17 Production and carbon balance of plant stands	DDB	Chapter 6
	W Mar 5	L18 Review for Midterm #1	WS/DB	
	F Mar 7	**L19 Exam #1**		
8	M Mar 10	L20 Remote sensing of ecosystem ecology, on towards global ecology	DDB	Running et al, 2004
	W Mar 12	L21 Nutrient cycling I	WS	Chapters 8 and 9
	F Mar 14	L22 Nutrient cycling II	WS	Chapters 8 and 9
9	M Mar 17	L23 Nutrient use efficiency	WS	Chapter 9
	W Mar 19	L24 Nitrogen and phosphorus	WS	Chapter 9
	F Mar 21	L25 Case study: Nutrient limitation to terrestrial ecosystems: examples from Hawaii	WS	Aber and Melillo Chapter 22
10	M Mar 24	**Spring Break**		
	W Mar 26	**Spring Break**		
	F Mar 28	**Spring Break**		
11	M Mar 31	L26 Nitrogen II	WS	Chapter 11
	W April 2	L27 Nitrogen III	WS	Chapter 12
	F Apr 4	L28 Case Study: Nitrogen deposition	WS	Hairston et al. 1960
12	M Apr 7	L29 Ecosystem dynamics	DDB	Chapter 13
	W Apr 9	L30 Ecosystem development during primary and secondary succession	DDB	Chapter 13
	F Apr 11	L31 Case study oak savanna (Dennis Baldocchi)	DDB	
13	M Apr 14	L32 Biodiversity I: Meaning and measures of biodiversity	WS	Chapter 13
	W Apr 16	L33 Biodiversity II: Consequences for ecosystem function	WS	Chapter 13
	F Apr 18	L34 Impacts of disturbance on ecosystems	WS	
14	M Apr 21	L35 Landscape patterns in ecosystem structure and function: Resource gradients	DDB	Chapter 14
	W Apr 23	L36 Modeling as an integrative ecosystem tool	DDB	

	F Apr 25	L37 Global biogeochemical cycles	WS	
15	M Apr 28	L38 Global climate change	DDB	
	W Apr 30	L39 Ecosystems and environmental change part I Effects of Temperature, CO_2, precipitation, O_3 on ecosystem function and vegetation dynamics	DDB	
	F May 2	L40 Ecosystems and environmental change part II Shifts in ecosystem function and vegetation dynamics	DDB	
16	M May 5	L41 Restoration ecology	WS	Chapter 15
	W May 7	L42 Summary: Ecosystem sustainability and the future: Human as THE keystone species	DDB/WS	
	F May 9	L43 Review for Midterm #2		
17	**M May 12**	**L44 Exam #2**		

TEXT: Principles of Terrestrial Ecosystem Ecology. F. Stuart Chapin III, Pamela A. Matson, and Harold A. Mooney. 2001. Springer-Verlag, New York, NY USA

Additional Readings (subject to change)

Barford, C. C., S. C. Wofsy, M. L. Goulden, J. W. Munger, E. H. Pyle, S. P. Urbanski, L. Hutyra, S. R. Saleska, D. Fitzjarrald, and K. Moore. 2001. Factors controlling long- and short-term sequestration of atmospheric CO2 in a mid-latitude forest. Science 294:1688-1691.

Brown JH, Gupta VK, Li BL*, et al.* (2002) The fractal nature of nature: power laws, ecological complexity and biodiversity. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences* **357**, 619-626.

Chapin, F. S. I., M. S. Torn, and M. Tateno. 1996. Principles of ecosystem sustainability. American Naturalist **148**:1016-1037.

Clark, D. A., S. Brown, D. W. Kicklighter, J. Q. Chambers, J. R. Thomlinson, and J. Ni. 2001. Measuring net primary production in forests: Concepts and field methods. Ecological Applications **11**:356-370.

Hairston, N. G., F. E. Smith, and L. B. Slobodkin. 1960. Community structure, population control, and competition. American Naturalist **94**: 421-425.

Huston, M. A. 1997. Hidden treatments in ecological experiments: Re-evaluating the ecosystem function of biodiversity. Oecologia, Berlin **110**:449-460.

Ryan, M. G., and B. J. Yoder. 1997. Hydraulic limits to tree height and tree growth: What keeps trees from growing beyond a certain height? Bioscience **47**:235-242.

Running S, Nemani R, Heinsch F*, et al.* (2004) A continuous satellite-derived measure of global terrestrial primary production. *BioScience* **54**, 547-560.

Stephenson, N. L. 1990. Climatic Control of Vegetation Distribution the Role of the Water Balance. American Naturalist **135**:649-670.

Tilman, D., and J. A. Downing. 1994. Biodiversity and stability in grasslands. Nature **367**:363-365.