

BI 516 – Advanced Ecosystem Ecology and Global Change

MF 1-2, W 1-3, Biology Rm. 151

Winter 2008

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Text: Chapin, Matson, and Mooney “Principles of Ecosystem Ecology”

NATURE OF THE COURSE:

Ecosystem ecology involves the study of energy and material flows through both the living (plants, animals, microbes) and non-living (water, soils, atmosphere) components of ecological systems. We will study the major element cycles (carbon, nitrogen, phosphorus) and patterns of energy flow through ecosystems, including differences among those fluxes and their controls for different ecosystems. A central theme of the course is the relationship of these ecosystem processes to many current environmental issues of global importance, such as elevated CO₂, global warming, enhanced nitrogen cycling, and loss of biodiversity.

This seminar course will combine both lectures and discussions. The Monday and Friday lectures, combined with readings from the textbook, are intended to give you a fundamental understanding of ecosystem concepts and theory. On Wednesdays, we will discuss papers from the current literature relevant to the topic from the previous lectures.

The goals of this course are to

- 1) give you a firm understanding of the **concepts and mechanisms of ecosystem ecology**;
- 2) improve your abilities to **lead and participate in discussion** of scientific literature, including **developing skills in critical thinking**;
- 3) **introduce you to the primary literature** and some of the current “hot topics” being studied and debated in the field;
- 4) **enhance your understanding** of how human society is altering ecosystems, some of the problems that entails, and some of the solutions that might be possible.

COURSE GRADE:

1. Your grade will be based on a total of 305 possible points:

a. Lead two discussions. 100 points (50 points each). You will be the discussion leader for two classes. One lead will be solo, the second will be with one other student. Discussion leadership will entail more than just reading the required papers and “winging it.” You will need to prepare a set of questions to help focus the discussion (to be handed out at class time) and do additional background reading in the primary literature necessary to prepare yourself as an effective class leader (supply an annotated bibliography, 6 reference minimum in addition to the assigned articles). For co-led discussions your annotated bibliography should not overlap with that of your co-leader.

b. Discussion attendance and participation. 25 points. Discussion attendance and participation are mandatory and constitute an important component of this class. Failure to attend (without a pre-approved excuse) or to participate in discussion regularly will result in loss of 3 points per discussion missed. Missing more than 5 discussions results in loss of all 25 points.

c. Exams: 2 Midterms (50 points each) and a **comprehensive final exam** (100 points).

d. Late assignments lose 1/3 grade per day (i.e., going from a B+ to a B).

e. Academic dishonesty will not be tolerated. Assignments with plagiarism problems or cheating on exams can result in no credit, failing the class, or expulsion from the university. Questions about plagiarism? Ask me and/or see Western’s web sites: <http://www.library.wvu.edu/ref/plagiarism.html> and <http://www.wvu.edu/depts/soc/plagiarism.PDF>.

2. Your final grade will be determined as a percentage of the point total:

	B+	87-89.9	C+	77-79.9	D+	67-69.9	F	0-59.9
A	93-100	B	83-86.9	C	73-76.9	D	63-66.9	
A-	90-92.9	B-	80-82.9	C-	70-72.9	D-	60-62.9	

BI 516 - Class schedule

Readings listed as CMM are chapters from the Chapin, Matson, and Mooney textbook.
Discussion readings are from the primary literature (see reading list, below).

<i>Week</i>	<i>Date</i>	<i>Topic</i>	<i>Reading</i>
1	W, 1/9	Course introduction, The Ecosystem Concept	CMM: 1
	F, 1/11	Climate	CMM: 2
2	M, 1/14	Overview of the Carbon Cycle, Productivity	CMM: 15 (335-343), 6
	W, 1/16	<i>Discussion 1 – Ecosystem concept, climate</i> (one leader)	(Vitousek 1994, Brook 2005)
	F, 1/18	Controls on Net Primary Productivity	CMM: 6
3	M, 1/21	No Class – Martin Luther King, Jr. Day	
	W, 1/23	<i>Discussion 2 – Carbon cycle 1</i> (one leader) Paper topics due	(Oberbauer et al. 2007)
	F, 1/25	Controls on Gross Primary Productivity	CMM: 5
4	M, 1/28	Controls on Gross Primary Productivity	CMM: 5
	W, 1/30	<i>Discussion 3 – Carbon cycle 2</i> (2 leaders)	(Wardle et al. 2004, Kitayama 2005, Wardle et al. 2005)
	F, 2/1	Midterm 1	
5	M, 2/4	Decomposition	CMM: 7
	W, 2/6	<i>Discussion 4 – Decomposition</i> (one leader)	(Finzi and Schlesinger 2002)
	F, 2/8	Terrestrial nutrient cycles – nitrogen	CMM: 15 (343-348), 9
6	M, 2/11	Terrestrial nutrient cycles – nitrogen	CMM: 9
	W, 2/13	<i>Discussion 5 – Nutrient cycling 1</i> (two leaders)	(Helfield and Naiman 2001, Helfield and Naiman 2003, Kirchhoff 2003)
	F, 2/15	Nutrient cycling – nitrogen Paper first drafts due	CMM: 8
7	M, 2/18	Nutrient cycling – Plant nutrient use	CMM: 8
	W, 2/20	Trophic dynamics Students finish commenting on first drafts	CMM: 4 (71-77), 11
	F, 2/22	<i>Discussion 6 – Nutrient cycling 2</i> (no leader)	(Chapin 1980, Funk and Vitousek 2007)
8	M, 2/25	No Class – President’s Day	
	W, 2/27	<i>Discussion 7 – Trophic dynamics</i> (one leader)	(Gruner 2004)
	F, 2/29	Midterm 2	
9	M, 3/3	Community effects on ecosystem properties First drafts handed back	CMM: 12
	W, 3/5	<i>Discussion 8 – Biodiversity and ecosystem functioning</i> (2 leaders)	(Loreau et al. 2001, Thompson et al. 2005)
	F, 3/7	Temporal dynamics: Disturbance and succession	CMM: 13
10	M, 3/10	Disturbance and succession	CMM: 13
	W, 3/12	<i>Discussion 9 – Disturbance</i> (one leader)	(Bond-Lamberty et al. 2007)
	F, 3/14	Synthesis: Managing Ecosystems <i>Discussion 10 – Ecosystem Services and Managing Ecosystems</i> (one leader?) Final drafts due	CMM: 16 (Kremen and Ostfeld 2005)
11	W, 3/19	Final Exam – 10:30 a.m. – 12:30 p.m.	

BI 516 - Primary Discussion Papers

- Bond-Lamberty, B., S. D. Peckham, D. E. Ahl, and S. T. Gower. 2007. Fire as the dominant driver of central Canadian boreal forest carbon balance. *Nature* **450**:89-92.
- Brook, E. J. 2005. Tiny bubbles tell all. *Science* **310**:1285-1287.
- Chapin, F. S., III. 1980. The mineral nutrition of wild plants. *Annual Review of Ecology and Systematics* **11**:233-260.
- Finzi, A. C., and W. H. Schlesinger. 2002. Species control variation in litter decomposition in a pine forest exposed to elevated CO₂. *Global Change Biology* **8**:1217-1229.
- Funk, J. L., and P. M. Vitousek. 2007. Resource-use efficiency and plant invasion in low-resource systems. *Nature* **446**:1079-1081.
- Gruner, D. S. 2004. Attenuation of top-down and bottom-up forces in a complex terrestrial community. *Ecology* **85**:3010-3022.
- Helfield, J. M., and R. J. Naiman. 2001. Effects of salmon-derived nitrogen on riparian forest growth and implications for stream productivity. *Ecology* **82**:2403-2409.
- Helfield, J. M., and R. J. Naiman. 2003. Effects of salmon-derived nitrogen on riparian forest growth and implications for stream productivity: Reply. *Ecology* **84**:3399-3401.
- Kirchhoff, M. D. 2003. Effects of salmon-derived nitrogen on riparian forest growth and implications for stream productivity: Comment. *Ecology* **84**:3396-3399.
- Kitayama, K. 2005. Comment on "Ecosystem properties and forest decline in contrasting long-term chronosequences". *Science* **308**:633b.
- Kremen, C., and R. S. Ostfeld. 2005. A call to ecologists: measuring, analyzing, and managing ecosystem services. *Frontiers in Ecology and the Environment* **3**:540-548.
- Loreau, M., S. Naeem, P. Inchausti, J. Bengtsson, J. P. Grime, A. Hector, D. U. Hooper, M. A. Huston, D. Raffaelli, B. Schmid, D. Tilman, and D. A. Wardle. 2001. Biodiversity and ecosystem functioning: current knowledge and future challenges. *Science* **294**:804-808.
- Oberbauer, S. F., C. E. Tweedie, J. M. Welker, J. T. Fahnestock, G. H. R. Henry, P. J. Webber, R. D. Hollister, M. D. Walker, A. Kuchy, E. Elmore, and G. Starr. 2007. Tundra CO₂ fluxes in response to experimental warming across latitudinal and moisture gradients. *Ecological Monographs* **77**:221-238.
- Thompson, K., A. P. Askew, J. P. Grime, N. P. Dunnett, and A. J. Willis. 2005. Biodiversity, ecosystem function and plant traits in mature and immature plant communities. *Functional Ecology* **19**:355-358.
- Vitousek, P. M. 1994. Beyond global warming: ecology and global change. *Ecology* **75**:1861-1876.
- Wardle, D. A., L. R. Walker, and R. D. Bardgett. 2004. Ecosystem properties and forest decline in contrasting long-term chronosequences. *Science* **305**:509-513.
- Wardle, D. A., L. R. Walker, and R. D. Bardgett. 2005. Response to comment on "Ecosystem properties and forest decline in contrasting long-term chronosequences". *Science* **308**:633c.