

## **BIOLOGY 353/653: Ecosystem Ecology**

Fall 2005, CRN 11541/11634

TIME AND PLACE: 11-11:50 AM M, W, F; Room 222 Biology Building  
INSTRUCTOR: Dr. M. E. McTammany, 311 Biology Building, x73975, mmctamma@bucknell.edu  
OFFICE HOURS: by appointment or luck (until 5:30 PM)  
PREREQUISITES: BIOL 208 (Population and community biology); junior, senior, or grad students

COURSE DESCRIPTION: Ecosystem ecology deals with how organisms interact with the physical and chemical environment to produce energy flow and nutrient cycling from local to global scales. We will study how these processes differ among ecosystems, vary over time and space, and are affected by disturbance and human activities.

### TEXTBOOK (required)

Principles of Terrestrial Ecosystem Ecology. F. S. Chapin, III, P. A. Matson, and H. A. Mooney, 2002, Springer-Verlag.

Other reading (next page) and course materials will be available on Blackboard throughout the semester.

### GRADE

Attendance and Participation	25%
Quizzes and Assignments	25%
Semester Project	30%
Final Exam	20%
<b>Total</b>	<b>100%</b>

ATTENDANCE: Attendance is expected in my class. Please see me in the beginning of the semester if you will miss class due to an extracurricular activity. You will lose ¼ point per unexcused absence.

PARTICIPATION: We will discuss readings from primary literature for you to interpret ecological research and learn experimental design. Students are expected to read and think about each reading prior to class and to participate in discussion. Each student will receive a grade from 0-5 based on your participation during each discussion. In addition, you will be asked to lead discussion on one of the papers with your project partner (see "Semester Project" below). During discussions, you should feel comfortable offering insights and asking questions. To make this happen, we must cultivate respect and support by listening, acknowledging ideas, and speaking to one another, rather than directing all comments to me.

QUIZZES AND ASSIGNMENTS: Q&A will be given throughout the course to cover lecture and reading material. There will be 10 Q&A during the semester, each worth 25 points. Missed quizzes will receive 0s, and assignments will lose 1 point per day late. The best way to prepare for Q&A is to keep up with readings and regularly review lecture material.

SEMESTER PROJECT: You will complete a grant proposal seeking funding from NSF for a fictional (or not) research project related to some area of community or ecosystem ecology. This project entails several writing assignments and will require extensive work outside of class with a partner. More details on particular assignments related to the project will be given later.

FINAL EXAM: Your final exam will be a cumulative take-home exam with short-answer and essay questions related to lecture and reading material. Final exams will be due during your scheduled final exam time slot (more information later).

HONOR CODE AND PLAGIARISM: We will adhere strictly to the Bucknell Student Handbook policy on collaboration, quizzes, and literature citation. All work turned in, particularly for your grant proposal, must be properly referenced with in-text citations and a complete Literature Cited section containing all external sources (articles, books) used for information. Suspected violations of honor code or plagiarism will be discussed between us and reported to the Dean.

ACCOMMODATIONS: If you require accommodations for a learning disability, please see me in the beginning of the semester to make arrangements for notes, assignments, and exams. You will need to have documentation in order to receive accommodations in this course.

#### PRIMARY LITERATURE (IN ORDER OF DISCUSSION)

- Foley, J. A., M. T. Coe, M. Scheffer, and G. Wang. 2003. Regime shifts in the Sahara and Sahel: interactions between ecological and climatic systems in northern Africa. *Ecosystems* 6(6):524-539.
- Unsworth, M. H., N. Phillips, T. Link, B. J. Bond, M. Falk, M. E. Harmon, T. M. Hinckley, D. Marks, and K. T. Paw U. 2004. Components and controls of water flux in an old-growth Douglas-fir-western hemlock ecosystem. *Ecosystems* 7(5):468-481.
- Sherman, R. E., T. J. Fahey, and P. Martinez. 2003. Spatial patterns of biomass and aboveground net primary production in a mangrove ecosystem in the Dominican Republic. *Ecosystems* 6(4):384-398.
- Cao, M., S. D. Prince, J. Small, and S. J. Goetz. 2004. Remotely sensed interannual variations and trends in terrestrial net primary productivity 1981-2000. *Ecosystems* 7(3):233-242.
- Jeppesen, E., J. P. Jensen, C. Jensen, B. Faafeng, D. O. Hessen, M. Søndergaard, T. Lauridsen, P. Brettum, and K. Christoffersen. 2003. The impact of nutrient state and lake depth on top-down control in the pelagic zone of lakes: a study of 466 lakes from the temperate zone to the Arctic. *Ecosystems* 6(4):313-325.
- Rothstein, D. E., P. M. Vitousek, and B. L. Simmons. 2004. An exotic tree alters decomposition and nutrient cycling in a Hawaiian montane forest. *Ecosystems* 7(8):805-814.
- Compton, J. E., M. R. Church, S. T. Larned, and W. E. Hogsett. 2003. Nitrogen export from forested watersheds in the Oregon Coast Range: the role of N<sub>2</sub>-fixing red alder. *Ecosystems* 6(8):773-785.
- Simon, K. S., C. R. Townsend, B. J. F. Biggs, W. B. Bowden, and R. D. Frew. 2004. Habitat-specific nitrogen dynamics in New Zealand streams containing native or invasive fish. *Ecosystems* 7(8):777-792.
- Stadler, B., T. Müller, D. Orwig, and R. Cobb. 2005. Hemlock woolly adelgid in New England forests: canopy impacts transforming ecosystem processes and landscapes. *Ecosystems* 8(3):233-247.
- Euskirchen, E. S., J. Chen, E. J. Gustafson, and S. Ma. 2003. Soil respiration at dominant patch types within a managed northern Wisconsin landscape. *Ecosystems* 6(6):595-607.
- Groffman, P. M., N. L. Law, K. T. Belt, L. E. Band, and G. T. Fisher. 2004. Nitrogen fluxes and retention in urban watershed ecosystems. *Ecosystems* 7(4):393-403.
- O'Neill, R. V. 2001. Is it time to bury the ecosystem concept? *Ecology* 82(12):3275-3284.

## SCHEDULE

Date	Topic	Reading
Aug 24	Syllabus, terms, hierarchies	
Aug 26	Ecosystem concept	3-17
Aug 29	Energy, atmosphere, climate	18-41
Aug 31	Distribution of Earth's ecosystems	41-45
Sep 2	<b>Projects – introduction, topic exploration</b>	
Sep 5	Climate systems in northern Africa	Foley et al. 2003
Sep 7	Soils, redox	46-67
Sep 9	<b>Projects – experimental design, topics</b>	
Sep 12	Ecosystem radiation	71-77
Sep 14	Water in terrestrial ecosystems	77-96
Sep 16	<b>Projects – library session</b>	
Sep 19	Water flux in old-growth fir-hemlock forests	Unsworth et al. 2004
Sep 21	Photosynthesis, GPP	97-122
Sep 23	NPP, NEP	123-137, 228-230
Sep 26	Carbon budgets	137-150, 233-238
Sep 28	NPP in mangrove ecosystems	Sherman et al. 2003
Sep 30	Remote sensing of global NPP	Cao et al. 2004
Oct 3	Energy flow efficiency	244-257
Oct 5	Trophic dynamics	257-264, 238-243
Oct 7	P affects trophic cascades in lakes	Jeppesen et al. 2003
Oct 10	FALL BREAK	
Oct 12	Detritus and decomposition	151-175
Oct 14	<b>Projects – hypothesis, peer discussion</b>	
Oct 17	Exotic tree decomposition in Hawaii	Rothstein et al. 2004
Oct 19	Nutrient use by plants	176-196
Oct 21	Nitrogen cycling	197-215
Oct 24	Other nutrient cycling	215-223
Oct 26	N export and the role of alder	Compton et al. 2003
Oct 28	Aquatic nutrient cycling	224-243
Oct 31	Nitrogen dynamics in streams	Simon et al. 2004
Nov 2	Community-ecosystem interactions	265-278
Nov 4	Hemlock wooly adelgid alters ecosystem function	Stadler et al. 2005
Nov 7	Temporal patterns, disturbance, succession	281-304
Nov 9	Spatial patterns	305-331
Nov 11	Soil R in different terrestrial patch types	Euskirchen et al. 2003
Nov 14	Global biogeochemical cycles	335-343
Nov 16	Global biogeochemical cycles	343-355
Nov 18	N cycling in urban watersheds	Groffman et al. 2004
Nov 21	Ecosystem management and services	356-370
Nov 23	THANKSGIVING BREAK	
Nov 25	THANKSGIVING BREAK	
Nov 28	<b>Projects – presentations (3)</b>	
Nov 30	<b>Projects – presentations (3)</b>	
Dec 2	Ecosystem concept	O'Neill 2001
Dec 5	<b>Evaluations – project, teaching</b>	