Ecosystem and Global Ecology: BOT/MBI/ZOO 672

Spring 2012 MWF 11:15 – 12:05, W 12:15 – 1:05, 114 Benton Hall

Instructors:

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COURSE CONTENT

This course provides comprehensive coverage of ecosystem concepts and processes at scales from local patches to the global biosphere. The course encompasses the full range of the Earth's biological diversity (plants, animals and microbes), and its ecosystems (freshwater, terrestrial, and marine). It explicitly integrates the roles of organisms into ecosystem functioning and global processes.

COURSE OBJECTIVES

1. To explore the central questions, principles, and theories of ecosystem and global ecology. Major topics will include:
   - Climate and its regulation of ecosystems
   - Primary and secondary productivity
   - Food webs
   - Decomposition and detritivory
   - Biogeochemistry, nutrient budgets and cycling of carbon, nitrogen, and phosphorus
   - Ecosystem processes from local to global scales
   - Methods and approaches used by ecosystem and global ecologists

2. To consider the similarities, differences, and linkages between ecosystem ecology and other ecological sub-disciplines including physiological, population, and community ecology.

3. To evaluate how ecosystem and global ecology can be used to help understand and solve environmental problems.

4. To develop proficiency in the skills used by ecologists, including:
   - Reading, understanding, and critiquing the primary literature in ecosystem ecology
   - Leading an effective discussion of this literature
   - Developing and writing an effective research proposal
   - Developing and using computer models of ecological systems

COURSE STRUCTURE

The course combines lectures, assigned readings and discussion. Lectures are meant to be interactive, and questions from students are encouraged. Readings include those meant to supplement the lectures, from the textbook and from the primary literature. In addition, readings include those specifically for discussion periods. All readings besides those in the textbook will be available either on the course Niihka site or from on-line journals through Miami's library.

DISCUSSIONS

Most weeks there will be organized discussion periods. For each discussion, the entire class will read 1 or more journal articles, which are assigned by the instructor. One or two students will be assigned to lead each discussion. The discussion leader is also responsible for reading 2-3 other papers from the primary literature (i.e., journal articles, not book chapters, review papers, or articles from websites). At the beginning of the discussion period, the leader will provide the class with a 1-page outline of the paper that a) summarizes the findings of the paper, b) provides additional citations and c) lists a few questions related to the discussion topic. The leader will also provide a brief (5 minutes!) conceptual background for the paper, and then lead the discussion. Other students will ***post 1-2 written questions on the Niihka Forum Discussion Board the day before the discussion***. The leader will use these to enhance the discussion. Note that the discussion should focus on key concepts and linkages among papers rather than be just a summary.

MODELING ASSIGNMENTS

The ability to understand and develop both conceptual and quantitative models is an essential tool in ecosystem ecology. There will be a modeling exercise to introduce students to the topic. Each modeling exercise will consist of computer code and output, and a written report. We will use the open source R programming language for these exercises. You will need to download R and install it on your laptop. If you don't have your own laptop, speak to one of the instructors, and we will make arrangements for you to borrow one. To download R, google "R" and follow links to "R Project for Statistical Computing" and find the download site for your computer's operating system (Windows, Mac or Linux). By clicking on the appropriate links, R will download and install fairly easily. After installing R, open the application, and begin to work through a tutorial that we have put on the course Niihka site.

GRADING

First exam.. 20%
Second exam 20%
Final exam... 20%
Modeling assignments 20%
Discussion leader assignment (including discussion and write-up) . 10%
Participation in discussions (including submitted questions)……… 10%

TEXTBOOK:

Chapin, F.S. III, P.A. Matson, and P.M. Vitousek. 2011. Principles of terrestrial ecosystem ecology. Springer.

Date	Subject	Instructor
9 Jan	Ecosystem concepts	MV
11 Jan	Paper discussion: The ecosystem concept (Groffman et al. 2004)	all
11 Jan	Modeling	HS
13 Jan	Climate system	MV
16 Jan	MLK day – no class	
18 Jan	Paper discussion: State factors (Horsley et al. 2000)	all
18 Jan	Modeling	HS
20 Jan	State factors: overview and soil development	MF
23 Jan	Terrestrial primary production: patterns and climate control	MF
25 Jan	Paper discussion: Vegetation change, NPP and ecosystem C balance (Knapp et al. 2008)	all
25 Jan	Modeling	HS
27 Jan	Terrestrial NEP and decomposition	MF
30 Jan	Aquatic primary prodiction	MV
1 Feb	Paper discussion: Aquatic NPP (Vadeboncoeur et al. 2008)	all
1 Feb	Modeling	
3 Feb	Energy flow	MV
6 Feb	Aquatic NEP and decomposition	MV
8 Feb	Paper discussion: Energy flow (Benstead et al. 2009)	all
8 Feb	Modeling	HS

10 Feb	Food webs: bottom-up and top-down control	MV
13 Feb	Food webs: Ecosystem subsidies and spatial flows	MV
15 Feb	Exam 1 (both hrs)	
17 Feb	Paper discussion: Food web regulation (Kauffman et al. 2010)	all
20 Feb	Terrestrial Biogeochemistry: Nitrogen	MF
22 Feb	Paper discussion: Ecosystem nitrogen retention (Vitousek & Reiners 1975, Goodale et al. 2003).	all
22 Feb	Modeling	HS
24 Feb	Terrestrial Biogeochemistry: other elements and interactions	MF
27 Feb	Terrestrial Biogeochemistry over geologic time	MF
29 Feb	Paper discussion: Decomposition (Hobbie & Vitousek 2000)	all
2 Mar	Modeling	HS
2 Mar	Biogeochemistry: hydrology (guest lecture by Bill Renwick)	
5-9 Mar	Spring Break	
12 Mar	Ecological stoichiometry	MV
14 Mar	Paper discussion: Watersheds/terrestrial-aquatic linkages (Kara et al. 2011).	all
14 Mar	Modeling	HS
16 Mar	Consumer regulation of nutrient cycling	MV
19 Mar	Nutrient limitation in aquatic ecosystems	MV
21 Mar	Paper discussion: Animal regulation of nutrient cycling (Moore et al. 2011)	all
21 Mar	Modeling	HS
23 Mar	Eutrophication	MV
26 Mar	Biodiversity and ecosystem function	MV
28 Mar	Exam 2 (both hrs)	
30 Mar	Modeling	HS
2 Apr	Global climate change: carbon cycle and its link to climate	MV
4 Apr	Paper discussion: Environmental change in arctic tundra (Mack et al. 2004)	all
4 Apr	Modeling	HS
6 Apr	Global climate change and terrestrial ecosystems	MF
9 Apr	Global climate change and aquatic ecosystems	MV
11 Apr	Paper discussion: Eutrophication (Schindler et al. 2008; Scott & McCarthy 2010, 2011; Paterson et al. 2011)	all
11 Apr	Modeling	HS
13 Apr	Lakes as sentinels, regulators and integrators of climate change (guest lecture by Craig Williamson)	
16 Apr	Stability, resilience and regime shifts	MV
18 Apr	Paper discussion: Climate change and aquatic ecosystems (Marcarelli et al. 2010)	all
18 Apr	Modeling	HS
20 Apr	Ecosystem science and public policy	MV
23 Apr	Ecosystem services	MV
25 Apr	Paper discussion: Ecosystem resilience/regime shifts (Carpenter et al. 2011)	all
25 Apr	Modeling	HS
27 Apr	Synthesis	MV