Ecosystem Ecology
Biology 476 (3 credits)
Spring 2013

Instructor: Tamara Harms
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Office hours: T 11-12, TH 3:30-4:30, or by appointment
AHRB 120 or 153 (location posted on Bb)

Prerequisites: Introductory Ecology or Plant Biology

Course materials
Peer-reviewed papers: As assigned for discussion sessions. Available on Blackboard

Course description
Ecosystem ecology is the scientific study of the interactions, including feedbacks, among organisms and the non-living environment. The first part of the course provides an introduction to the ecosystem concept and the historical development of the field. Next, we survey the environmental factors (e.g., climate and soils) that govern ecosystem processes. We then discuss the major ecosystem processes and mechanisms driving them. Finally, we integrate this information to consider ecosystem services, sustainability, and responses of ecosystems to global change.

Oral-Intensive (O) Course
This course is being considered for designation as Oral-Intensive (O). Oral activities in this course will follow these guidelines:
-A minimum of 15% of the graded work in the O course will be based on effectiveness of oral communications
-Students will receive intermediate instructor assistance in developing presentational competency
-Students will use their communication competency across the span of the semester, not just in a final project
-Students will receive instructor feedback on the success of their efforts at each stage of preparing their presentations

Specific course components that meet the O requirement:
1) Lead and participate in discussions of scientific literature. The instructor will provide lecture material on effective scientific discussions and engage students in generating an outline of discussion leadership and participation strategies. Students will receive input from the instructor on individual discussion agendas prior to leading the discussion, and a written evaluation following submission of a discussion summary by the student.

2) Students will present a collaborative summary of a semester-long laboratory experiment. Each student will be responsible for presenting an informal, individual
summary of mid-term results, and a final group presentation will synthesize individual results with contributions from each student.

**Course objectives**
- Describe the major ecosystem processes and the factors influencing process rates (in written and oral forms)
- Apply the scientific method to ecosystem problems
- Analyze ecosystem processes using quantitative methods
- Read, analyze, and discuss scientific literature

**Instructional methods**
Class periods will include lectures, discussions, problem sets, and short written exercises. I will establish an atmosphere that encourages interaction. Your participation will contribute to the success of the course.

**Grades and assignments**
Participation in class discussions/activities 10%
Discussion leadership 15%
Decomposition lab report 15%
Decomposition group presentation 10%
Midterm 25%
Final 25%

Assignments turned in after due dates will receive reduced credit.

The instructor reserves the right to modify the final grade in consideration of notable progress demonstrated by an individual, or unforeseen and extenuating circumstances. In such cases, extra credit assignments and/or makeup work may be assigned at the discretion of the instructor.

Course syllabus may be modified at the discretion of the instructor.

**Student responsibilities**
1) Participate in class sessions. Full participation will require completion of all assigned readings before class.

2) Lead discussion of scientific papers as assigned. Responsibilities of discussion leaders include:
   - Submit a planned agenda for the discussion 1 week before the in-class discussion.
   - Meet with the instructor during office hours to modify the agenda. Meetings outside of office hours must be scheduled at least 1 week in advance.
   - Submit a written synopsis of the discussion that includes: a) the key points or issues that emerged during the discussion, and b) a self-evaluation of discussion leadership. Due within 1 week of the discussion session.

3) Contribute to class research project
   - Each individual will design and complete laboratory or field work studying an aspect of decomposition and soil respiration
   - Students will report on preliminary results in class Mar 28. A question & answer session will follow each presentation. Students will receive instructor feedback
following presentations, which is to be incorporated into the final presentation.

– Students will collaborate to produce a final group presentation, synthesizing results from all experiments. Each student will present during the final session, with grades assigned individually and for the entire group. A question & answer period will follow, with questions from the instructor and guest panelists.

4) Communication
– Check Blackboard site frequently. All course announcements and assignments will be posted on Blackboard
– Read and respond to UAF email in a timely fashion
– Include BIOL 476 in the subject line in all email correspondence with instructor

Student Code of Conduct
The UAF code of conduct details expectations of graded student work and is available at http://www.uaf.edu/catalog/current/academics/regs3.html. Collaboration on exams and written lab reports is not allowed in this course. The code of conduct states that “students will not represent the work of others as their own.” In this course this includes the work of other students, as well as plagiarism of the published work of other authors. Plagiarism is grounds for course failure. Explanations of plagiarism and how to properly cite sources are available from UAF libraries:
http://www.uaf.edu/library/instruction/handouts/Plagiarism.html
http://www.uaf.edu/library/instruction/handouts/Citing.html

UAF Policies Disabilities Services
The University of Alaska Fairbanks is committed to providing equal access for students with disabilities. The Office of Disability Services implements the Americans with Disabilities Act (ADA) and insures that UAF students have equal access to the campus and course materials. The instructor will work with the Office of Disabilities Services (208 Whitaker, 474-5655) to provide reasonable accommodation to students with disabilities. If you have a physical or learning disability, please advise us in writing of any special consideration necessary by the beginning of the second class.
Course schedule

Jan 17 (Thurs)
- Course mechanics
- Problem-solving in ecosystem ecology
- Assignment of discussion leaders

Jan 22 (Tues)
- Ecosystem concept and history
- Discussion: history and development of the ecosystem concept; Tansley, Gleason, and Clements
  *Reading: p. 3-22 in Chapin et al., excerpts from Tansley, Gleason, and Clements*

Jan 24 (Thurs)
- Climate, atmosphere, and ocean circulation
- How to read scientific papers
  *Reading: p. 23-50 in Chapin et al.*

Jan 29 (Tues)
- Structure and goals of scientific discussions
- Discussion: Decomposition, Hobbie 1996
  *Reading: p. 183-208 in Chapin et al., Hobbie 1996 Ecological Monographs*

Jan 31 (Thurs)
- Field trip to various West Ridge sites
- Design decomposition experiments
- Construct litterbags, soda lime chambers (homework + office hours)

Feb 1 (Fri): Drop deadline

Feb 5 (Tues)
- Energy balance
- Set up experiments
  *Reading: p. 93-100 in Chapin et al.*

Feb 7 (Thurs)
- Lithosphere: state factors, soils
  *Reading: p. 63-90 in Chapin et al.*

Feb 12 (Tues)
- Hydrologic cycle
- Discussion: Chronosequence approach, Vitousek & Farrington
  *Reading: p. 100-122, 403-407 in Chapin et al., Vitousek & Farrington 1997*
- Weigh litterbags

Feb 14 (Thurs)
- Metabolism
- Productivity
  *Reading: p. 123-181 in Chapin et al.*

Feb 19 (Tues)
- Decomposition
Discussion: trophic effects on whole ecosystem metabolism, Schindler et al.
*Reading: p. 183-208 in Chapin et al., Schindler et al. 1997 Science*
- Weigh litterbags

Feb 21 (Thurs)
- Carbon cycle
  *Reading: p. 407-414 in Chapin, p. 358-382 in Schlesinger*

Feb 26 (Tues)
- Global patterns in primary productivity
- C turnover/residence time exercise: bring calculators/laptops
  *Reading: p. 50-62, 177-181 in Chapin*
- Weigh litterbags

Feb 28 (Thurs)
- Nitrogen cycle
  *Reading: p. 259-286, 414-418 in Chapin et al., p. 383-396 in Schlesinger*

Mar 5 (Tues)
- Nitrogen cycle
- Small watershed approach
- Discussion: small watershed approach, Likens et al.
  *Reading: Likens et al. 1970 Ecological Monographs*
- Weigh litterbags

Mar 7 (Thurs)
  **Midterm**

March 11-15: Spring break

Mar 19 (Tues)
- Small watershed approach data analysis exercise: bring laptops
- Weigh litterbags

Mar 21 (Thurs)
- P cycle
  *Reading: p. 287-290, 417-419 in Chapin, p. 396-401 in Schlesinger*

Mar 26 (Tues)
- Stoichiometry
- In-class data analysis of preliminary data
  *Reading: Elser et al. 2000 Ecology Letters*

Mar 28 (Thurs)
- Presentation of preliminary results from decomposition experiments
  - Discussion: ecological stoichiometry, Schade et al.
  *Reading: Schade et al. 2003 Ecology Letters*
- Weigh litterbags

Apr 2 (Tues)
- Disturbance & Succession
  *Reading: p. 339-367 in Chapin et al.*
Apr 4 (Thurs)
- Succession
- Discussion: Vitousek & Reiners
  Reading: Vitousek & Reiners 1975 Bioscience

Apr 9 (Tues)
- Sustainability & Resilience
- Weigh litterbags

Apr 11 (Thurs)
- Ecosystem services
- Discussion: regime change, Scheffer et al.
  Reading: p. 423-447 in Chapin et al., Scheffer et al. 2001

Apr 16 (Tues)
- Socio-ecological systems
- Discussion: ecosystem services, Foley et al.
  Reading: Foley et al. 2005

Apr 18 (Thurs)
- Global change and ecosystem processes: temperature

Apr 23 (Tues)
- Global change and ecosystem processes: nutrient loading (dead zone)
- Final litterbag and soda lime weigh-in
- Discussion: nutrient loading; Schindler, Mulholland
  Reading: Schindler 1974, Mulholland et al. 2008

Apr 25 (Thurs)
- Global change and ecosystem processes: CO₂ increase
- Statistical analysis of decomposition data

Apr 30 (Tues)
- Global change: interactive effects
- Discussion: ocean acidification, Hoegh-Guldberg et al.
  Reading: Hoegh-Guldberg et al. 2007 Science

May 2 (Thurs)
- Decomposition presentation
- Recap and review

May 9: Final exam, 1-3 pm
- Decomposition lab report due