Ecosystem Nutrient Cycles

Fall 2005

Instructor: Jason Kaye, ASI 416 (office)
Schedule #: 566278
Credit: 3 hours
Contact info: office phone 863-1614; e-mail: jpk12@psu.edu
Office hours: W & TH 11:15 – 12:15 in ASI 416, or by appointment
Prerequisites: Introductory course in chemistry plus ecology, agroecology, or biogeochemistry

Regular meeting time and location: T, Th 9:45-11:00 in 209 Chambers

Text: Golley, F.B. 1993. The history of the ecosystem concept in ecology. Yale Univ. Press.
Other Reading: Papers to be assigned during the semester from Angel.

Overall course goals: Students will develop knowledge of the biologically important nutrient cycles in terrestrial ecosystems, including linkages between nutrient cycling and energy (carbon) and water flow.

Specific course objectives: Students will complete the class with an understanding of: 1) classic and contemporary theory of biogeochemical cycles at the ecosystem scale, 2) variability in nutrient cycling rates among the major unmanaged and managed ecosystem types, 3) ecosystem responses to natural disturbance and human management, and 4) common and cutting-edge methods of ecosystem analysis.

My teaching philosophy: Discovery is one of the most exciting aspects of science. Students should be given the opportunity to experience discoveries through creative coursework. This should be a student-centered course, your feedback (both anonymously and through formal and informal meetings with me) will help me adapt this course to your interests and needs. Class time will include a mixture of lectures, discussions of primary literature and case studies, and group and independent projects. Independent projects will give students the opportunity to focus on nutrient cycling in ecosystems where they conduct research.

General Schedule:
This schedule will form the foundation for the course, but may change in response to student input. The first part of the course will cover major theoretical advances in ecosystem science and the second part of the course will consider applications of ecosystem theory to environmental management and problem solving.

Week of:	Theme	Reading	Assignment	In class
Aug 30 Sept 1	History of the Ecosystem Origin of nutrients	Golley Chap. 1 - 3	Th:Expectations Th: Box/arrow diagram & state factors	Th: Discuss your ecosystem-pools, fluxes, spatial scale.
Sept 6 Sept 8	Ecosystem concepts The Odums & IBP	Golley Chap. 4 - 5 Odum 69; Hagen 92	Student Meetings	T: Steady state box models Th: Discuss ecosystem evolution; Odum; Hagen
Sept 13 Sept 15	The water cycle The C cycle	Golley 6-7 Swank and Douglas 74	Th: Develop C mass balance for your ecosystem	Methods: C balance, eddy covariance. Methods: small watersheds
Sept 20 Sept 22	The C cycle The C cycle			T:Discuss C mass Balance
Sept 27 Sept 29	Watershed experiments w/ Nutrients Phosphorus	Walker & Syers 76 Bormann & Likens 67		Th: Duscuss Walker and Syers Model
Oct 4 Oct 6	Nitrogen	Vitousek & Reiners 75 Aber et al. 98 Perakis and Hedin 02		Th: **Blind mass balance P**
Oct 11 Oct 13	Exam Open the black box I: Isotopes	Nadelhoffer et al. 99	**T: Exam** Th: P mass balance for your ecosystem Th: Last date for "question-based" review paper topic	Methods: ^{15}N
Oct 18 Oct 20	II: Microbial aspects of N cycling.	Davidson et al. 00 Hart & Stark 97 Schimel and Bennett 04		
Oct 25 Oct 27	III: species effects on ecosystems Nutrient cations	Binkley & Giardina 98 Wardle & Zac. 05 Hooper & Vitousek 98 Drinkwater et al. 98		**Th:Blind mass balance N**
Nov 1 Nov 3	Nutrient cations Ecological Stoichiometry	Jobbagy et al. 04 Yanai et al. 05 Reiners 86 Magill and Cole 81	T: Paper 1st draft due Th: N mass balance for your ecosystem	**Th: Discuss all 4 papers**
Nov 8 Nov 10	Peer review papers Peer review papers			Peer review papers
Nov 15 Nov 17	Complex Adaptive Systems Applications I: forest harvesting II: Mass balance in agriculture	Scheffer et al. 00 Likens et al. 70 Burke et al. 02 Galloway Cowling 02		Th: **Blind mass balance K**
Nov 22 Nov 24	No class? Fri schedule **No class: Thanksgiving**			
Nov 29 Dec 1	III: riparian buffers IV: greenhouse gases	Perterjohn & Correll 84 Lowrance et al. 84 Robertson et al. 00 Matson et al. 98	Th: Cation mass balance for your ecosystem Paper final draft due.	Methods: trace gas fluxes.

Dec 6 Dec 8	V: the global C cycle Scepticism of the concept	Schlesinger Lal? Sagoff O'Neill		Discuss: p 8-9in Golley
Dec 12-16	Final exam week		Take home final	

Assignments, Attendance, Grading, etc.

- Classroom attendance is expected.
- Exams will be a combination of essay, short answer, and multiple choice.
- If you need disability accommodations in this class, please see me ASAP. Information regarding disability is confidential.
- My lectures and supplemental materials will be posted on Angel.
- Grading:
  1. Participation in class discussion (20 %)
  2. Seven "short assignments" underlined above (15%)
  3. Three group mass balance assignments bolded above (20%)
  4. Paper – including peer reviews of others – (20 %)
  5. Midterm (15 %)
  6. Final (10 %)

University Academic Integrity Statement

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