Soil Organismal Diversity
11:216:422 (3 cr)
Spring Semester

Instructor: John Dighton, Ph.D., Professor, Department of Ecology, Evolution and Natural Resources, Biology Department (Camden), Director Pinelands Field Station

Prerequisites: 11:119:102 or 11:119:116 or by permission of the instructor.

Grading: Graded

Method of Instruction: Hybrid

Catalogue Description: This hybrid course introduces students to the complexity of biotic diversity in soil and their function in providing nutrients for primary production especially in natural and agro-ecosystems. In addition to assimilating information students will acquire skills of reading scientific articles, interpreting data and understanding how the science relates to the bigger picture of ecosystem functioning.

Justification:
Existing soils courses largely focus on pedology and the microbial processes in soil. To understand the ecology of soil we need to know the diversity of organisms that reside there, their interactions and functions that are involved with litter decomposition, nutrient cycling and plant roots in the maintenance of plant productivity. In addition the effects of human interaction in commercial forestry, agriculture and pollution are liable to affect the diversity and function of soil biota leading to soil degradation.

Learning Goals:
Students are expected to gain an understanding of the range of biotic diversity within soils and how this biota interacts to drive the ecosystem services provided by soil.

1. Broadly identify soil micro-, meso- and macro-fauna; be able to identify functional groups of fungi and bacteria and to link interactions between these organisms to soil processes
2. This understanding will be measured in terms of tests and quizzes, but more importantly in the ability of the student to read and critically evaluate peer reviewed publications relative to major themes in the course
3. Evaluate the implications of agricultural and forestry practices on soil health and sustainability
4. Predict the effects of anthropogenic forces on soil health and sustainability

Course Description: The objective of this course is to introduce students to the biodiversity and complexity of soil biota. This biota is essential to the function of soil in providing the soil matrix and its fertility to support primary production. This hybrid course will provide basic information in the form of lectures (one per week), with lecture material, assigned readings, additional readings

and links to web sites posed on a Sakai site. Individual student assignments based on readings and other material found by students will be the basis of directed on-line discussion forums. Grading will be based on weekly assignments, contribution to the discussion forum and mid-term and final exams.

Areas to be covered will include**:** Soil biodiversity (bacteria, fungi, soil micro- meso- and macro-fauna) and structural and physiological adaptations to life in soil, **i**nteractions of biota and the mineral matrix to form soil structure and fertility (soil formation, nutrient cycling), the rhizosphere (microbial and fungal interactions with roots), **t**rophic interactions in soil, **a**boveground – belowground interactions and plant growth**, s**oil pathogens and the development of suppressive soils and interactions of soil biota and humans (agroecosystems (agriculture and production forestry), pollution, climate change)

Course Materials:
The assigned text will be Coleman, Crossley and Hendrix 'Fundamentals of Soil Ecology' 2nd Edition, Elsevier, or equivalent. Most reading material will be primary journal articles posted on the Sakai site. Assigned reading material and the writing assignments and grading will be conducted in Sakai, where a chat room will be established as students will be expected to participate in class discussions.

Examinations and assignments: Class grade will be based on a mid-term and final exam, quizzes and assignments based on assigned readings. Students will be expected to contribute to an on-line discussion forum based on specific themes highlighted by the reading assignments.

Syllabus: (readings suggested include classic papers and recent journal articles – these are subject to review and change). Directed reading assignments will steer the students to critical evaluation of the contents of peer reviewed articles and the associated writing assignments to place this understanding in the broader context or the class theme at that time.

Lecture Schedule

Week	Theme	Activity
1	Introduction, basic components of soil, structure and pedology 'Dirt the Movie'	Lecture On-line movie (questionnaire)
2	Bacteria and fungi as decomposers; introduction to nutrient cycling Reading: Clarholm (1994) 'The Microbial Loop'	Lecture Reading (writing assignment 1 – linking reading with lecture information)
3	Protozoa and nematodes Reading: Ekschmitt et al. (2001) nematode communities and soil function	Lecture (in class quiz 1) Reading (writing assignment 2 nematode communities and function
4	Mycorrhizae: description of types and associations with plant groups Reading: Dighton (2009) 'Mycorrhizae'	Lecture Assignment 3 - Literature search for an interesting mycorrhizal paper to summarize
5	Mycorrhizae: function in nutrient uptake and plant defense Reading: Simard (1997) - Interplant nutrient and carbon transfer	Lecture (in class quiz 2) Reading (writing assignment 4 on mycorrhizal function – extending information given in lecture and readings)
6	The rhizosphere – interactions beyond mycorrhizae Reading: Bueé (2009) – rhizosphere review	Lecture Reading (writing assignment 5)
7	Soil microarthropods: tardigrades, mites, collembola Mid-term exam	Lecture On line exam
8	Soil arthropods: beetles, pseudoscorpions, millipedes, centipedes, spiders etc. Reading: Bird (2004) soil arthropods and tree harvesting	Lecture Reading (writing assignment 6 on interpretation of paper)
9	Enchytraeids and Earthworms: ecology and effects on soil, ecosystem engineers	Lecture (in class quiz 3)

	Reading: Meysman et al. (2006) Bioturbation	On-line writing 7 - earthworm effects and comparison with other soil ecosystem engineers
10	Soil food webs and implications for nutrient cycling Reading:	Lecture (in class quiz 4)
11	Soil pathogens and suppressive soils Reading: Packer & Clay (2000) Jansen Connell overdispersal model	Lecture Reading (writing assignment 8 – soil suppressiveness)
12	Agricultural soils and tillage practices Reading: Jacobs et al (2010) tillage practices	Lecture Reading
13	Urban soils and soil ecotoxicology Reading: Aldaya et al. (2006) soil ecotoxicology	Lecture (in class quiz 5) Reading (directed writing 9 assignment interpretation of reading)
14	Review Dirt the movie	Review Questionnaire – revisit answers from the first viewing
	Final exam	

Writing assignments in relation to readings are structured with questions being posed to guide the students in their reading of the article, but allowing them to insert their own interpretation and discussions relating this to the bigger picture of ecosystem services. Readings will be posted on-line and the writing assignment will be open at the start of class and close the following morning. Writings will be submitted and graded on-line.

In addition to the formally submitted writing assignments and on-going chat room will be available to share thoughts on lecture and reading material. Students will be encouraged to read outside the material provided. The reading / writing assignment and participation in online class discussion is anticipated to be equivalent to one class period plus and hour of homework time (addressing SEBS Online and Hybrid Course Policy point F)

Grading:

7 quizzes / questionnaires at 10 points each	70
9 writing assignments at 20 points each	180
2 exams at 100 points each	200
	450

The following grading scheme will be used, unless the instructor feels it necessary to use a modified scheme. Writing assignments will be submitted online through Sakai and graded online (addressing

SEBS Online and Hybrid Course Policy point G). The mid-term exam will be open book and conducted online as the writing assignments, but the final exam will be a written comprehensive exam in exam period each student contribution will be anonymous to other students and the only shared information between students will be comments in the chat room (addressing SEBS Online and Hybrid Course Policy point H).

Grade Interpretation Points earned

A Outstanding 90–100%
B+ 85–89%
B Good 80–84%
C+ 75–79%
C Satisfactory 70–74%
D Poor 60–69%
F Failing < 60%

Additional Information: Contact Dr. John Dighton at dighton@camden.rutgers.edu

SEBS Online and Hybrid Course Policy
A. *Description of pedagogical and practical reasons for an online/hybrid version of the course and its appropriateness, comparison with the traditional format of this or similar courses, and identification of which elements substitute for what, spelled out.*

Pedagogical reasons:

- The hybrid format will support an active learning environment in which students will review course materials, read peer reviewed publications, and apply skills independently on individual assignments. Collaboration among students for developing interpretative skills of assigned papers will be encouraged through the use of chat room.
- The hybrid format will allow students to venture beyond the information provided in regular lectures and the use of on-line journals supported by the library will be encouraged to further student's understanding.
- Practical reasons:
- The material is conducive to students who can work with some degree of flexibility in their schedule. The format will help students develop good time management skills under multiple demands for their time.
- The instructor has other responsibilities of teaching at another campus and running a remote facility. The hybrid format also provides him with greater flexibility and productivity.

There is no traditional-format version of this course at SEBS. The points above address SEBS Online and Hybrid Course Policy point A.

B. *The information required in the proposal of such courses will include syllabus, the url of the web site, and urls of planned online resources to be used.*

- Major elements of the syllabus are contained in this proposal.
- The course will be housed on Sakai.

- The main course materials are established in a course currently being taught in Camden (Ecology of Soil Organisms 50:120:422 – lab 423), but reading material may vary from those stated in the draft syllabus above.

These points address SEBS Online and Hybrid Course Policy point B.

C. *Limits on class size, and expectations of demands on course instructors, clearly spelled out and justified.*
The ideal maximum enrollment for a class of this nature would be 20. It is anticipated that the demands on the instructor will be similar to those for a traditional 3-credit course as grading and commenting on writing assignments and steering chat room discussions would be equivalent to a traditional class period (addressing SEBS Online and Hybrid Course Policy point C).

D. *Qualifications of the student target audience and prerequisites clearly spelled out and justified.*
The course is designated 400 level. No prior experience in the topic is assumed. (SEBS Online and Hybrid Course Policy point D)

E. *Qualifications of the instructor(s) for online instruction clearly spelled out.*
The instructor has developed a similar hybrid curse in Camden (Ecology of Soil Organisms 50:120:422) and ran a gradate course in Forest Ecology (56:120:582) on similar lines. (SEBS Online and Hybrid Course Policy point E).

F. *Numbers of hours and timing of required student online involvement clearly spelled out, as well as all other expectations of what students must do and when.*
Students will need to complete assignments weekly as itemized in the course syllabus. Assignments will consist of reading course materials and completing writing assignments according to schedule. Collaboration in the chat room for discussions of topics is highly encouraged. It is expected that assignments will take approximately 3 hours a week, which is equivalent to a lecture period and homework time.

G. *Rubric for evaluation of student online participation spelled out.*
The online portion of this hybrid course will be writing assignments related to the directed readings, each of which will be given a grade. The online discussion forum will be established to facilitate discussion of these topic among students and it is expected that each student will contribute comments to this discussion each week with the penalty of dropped points from the assignment if the student does not contribute.

H. *Measures for ensuring academic integrity, and specifically identity integrity, for the course. (For examples, testing issues need to be addressed in courses that involve exams.)*
Students will be directed to the University's Academic Integrity Policy, and warned about the consequences of plagiarism. Turnitin.com will be used to check the uniqueness of student assignments as appropriate.