

**University of Manitoba
Faculty of Agricultural and Food Sciences
SOIL 7270 Advanced Soil Ecology**

**Course Outline Winter 2010/11
Instructor: Prof. Mario Tenuta
Department of Soil Science**

Introduction

Soil ecology is the study of interactions between soil organisms and the soil environment. The field is of interest to a broad range of scientists including environmentalists, agronomists, plant pathologists, food scientists and ecologists. The need to understand the relation of the soil environment to the presence and functioning of species and communities of soil organisms unifies studies in soil ecology. A theme throughout this course will thus be the complexity of the soil environment is reflected in the kinds and functions of organisms from the individual to community level of organization. Our goal in this course is to develop a level of comprehension at the graduate level in how soil biological communities respond to soil environmental conditions, plants, and land management. The course is tailored to the interests of the students. The topic areas to be covered will be developed with consultation of students. This course is offered in the winter term if there are more than 4 students enrolled. The course structure has usually been a mix of lectures by the instructor and students. Discussion and analysis of research papers is also done to obtain depth in understanding in key topics. Students have been graded based on their lecture presentation, a major report reviewing the subject area of their presentation, short assignment for each paper discussed in class, and class participation.

Instructor

Prof. Mario Tenuta
Department of Soil Science
Room 309, Ellis Building
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E-mail: tenutam@cc.umanitoba.ca

Lectures

Proposed 3 hours / week (Wed 9-12)
Ellis Building (room 342)

Textbook

None
required

Course Materials

Suggested books as general references
Fundamentals of Soil Ecology 2nd Edition, Elsevier Academic Press (Coleman et al. 2004)
The Living Soil, Science Publishers Inc. (Gobat et al. 2004)
Soil Microbiology, Ecology, and Biochemistry 3rd Edition, Academic Press (ed. E. Paul 2007)

Website

Course materials will be posted at the following website (material password protected)
[http://www.umanitoba.ca/faculties/afs/soil_science/MSSS/Ecology/Graduate/Graduate Soil Ecology.html](http://www.umanitoba.ca/faculties/afs/soil_science/MSSS/Ecology/Graduate/Graduate%20Soil%20Ecology.html)

Menu tabs also provide further information contained in the Soil Ecology SOIL 4400 website.

Prerequisites

Any of the following at the undergraduate level: soil microbiology, plant pathology, senior undergraduate level course in microbiology, food microbiology, environmental chemistry, or soil ecology

Course Evaluation

Student Presentation.....	20%
Major Report	30%
Reading Assignments.....	30%
Participation.....	20%

Student Lead Classes

Students will prepare and deliver a 50 minute lecture to the class on a topic of relation to their graduate program in consultation with Dr. Tenuta. This will be followed by a 15 minute discussion on the topic. A 15 minute break will then follow before we meet for discussion of paper(s). The paper to be discussed each week in class will be assigned by the instructor. In cases of short papers, two papers may be assigned. Grading will be based upon the quality of the lecture content, delivery, and success in engaging the class to participate with questions and comments. Students are to meet with Dr. Tenuta 3 weeks before their lecture to establish the subject topic and areas to be covered in the presentation and major research report. A draft of the presentation is to be provided to Dr. Tenuta 7 days in advance to the student presentation and the final version of the presentation 1 day before the presentation.

Instructor Lead Classes

Assigned readings will be discussed and elaborated upon during a presentation given by Dr. Tenuta. Readings will be posted on the web under the Graduate menu tab on the Soil Ecology SOIL 4400 website. Students must have read and analyzed the readings before coming to class. Further, students are required to actively participate in discussion of the readings. Each student's contribution to the discussion is tracked so Dr. Tenuta can assign a final participation grade.

Major Report

Students will prepare a review paper synthesizing the important literature and topic areas of the research field they gave their Student Presentation on. The paper is to be no longer than 25 pages double spaced. Students will prepare:

- Outline of their paper due Feb 2
- Draft of paper due March 16
(marked draft will be available March 23)
- Final Revised Paper due April 13

Reading Assignments

For each original research paper given as a reading, students are to prepare a response to the following questions:

- a) What are the novel point(s) of the paper?
- b) What did you learn most from the paper?

- c) How would you have done the study differently? For review articles discuss how you would have structured the paper differently, included different topics or had a different emphasis. Explain why you would make the differences.
- d) How would you have analyzed the results differently or altered the discussion? Do not answer this question for review papers but elaborate on a) instead.

Participation

Participation will be evaluated by the instructor throughout the course with particular emphasis on student involvement in paper discussions and discussions resulting from lectures.

Late Submissions

10% will be deducted per working day for late submissions. Let's not need to go there.

Class Schedule and Outline

Subject areas will reflect the interests of students. Provided below is a tentative outline to be refined following an organizational meeting the first week of classes in September. Each section will begin with a lecture presented by the instructor. *All topics will be structured around our guiding theme, the relation of a dynamic soil environment to the presence and functioning of organisms.* Though each student has a focus area for their thesis there are important principles to understand from all lectures and papers. During the course explore these principles in class discussions.

Date	Lecture Topic/Readings	Leader
Jan 12	The Soil Environment <i>Readings: Standing and Killham 2007; Papendick and Campbell 1980</i>	Mario
Jan 19	Soil Biological Diversity	Mario
Jan 26	Methods in Soil Ecology	Mario
Feb 2	Soil Biological Response to Stress and Disturbance	Mario
Feb 9	Competition in Soil Communities	Mario
Feb 16	Soil Foodwebs: Energetics, Importance and Response to Management	Mario
Feb 23	Break - No class	
March 2	Soil Organic Matter, Decomposition and Carbon Sequestration	TBD
March 9	Plant and Free-living Biological Nitrogen Fixation	TBD
March 16	Biological Oxidation/Reduction of Soil Nitrogen	TBD
March 23	Mycorrhizal Symbiosis	TBD
March 30	Rhizosphere Processes Affecting Plant Health	TBD
April 6	Soil Health	TBD

Contact hours = 11*3 = 33 hours (plus 3 hours expected consultation with Dr. Tenuta)

Book Bibliography

Fundamentals of Soil Ecology, Coleman et al. 2004 2nd Edition, Elsevier Academic Press, New York, USA
(*good overview*)

Manual of Soil Analysis: Monitoring and Assessing Soil Bioremediation (Soil Biology), Margeain and Schinner 2005, Springer (*practical and focused*)

Modern Soil Microbiology 2nd Edition van Elsas et al. 2007, Marcel Dekker (*compilation of topics by experts*)

Principles and Applications of Soil Microbiology 2nd Edition, Sylvia et al. 2005, Pearson/Prentice Hall
(*highly recommended*)

Soil Biology Guide, Dindal 1990, John Wiley and Sons (*out of print, pity a smashing book on organism diversity*)

Soil Biology Primer, Ingham 2000, http://soils.usda.gov/sqi/concepts/soil_biology/ (*general highschool level*)

Soil Ecology, Killham 1994, Cambridge University Press (*basic overview*)

Soil Ecology, Lavelle and Spain 2002, Springer

Soil Microbiology, Ecology and Biochemistry 3rd edition, Clark 2007, Academic Press

Soil Microbiology 2nd Edition. Tate 2000. John Wiley and Sons, Toronto

The Biology Of Soil: A Community And Ecosystem Approach (Biology of Habitats), Bardett 2005, Oxford University Press

The Living Soil. Fundamentals of Soil Science and Soil Biology. Gobat et al. 2004, Science Publishers, Inc., Enfield, New Hampshire, USA

By the end of the course we hopefully will be able to ascertain if Mr. Oppenheim is correct.

*The foolish person seeks happiness in the distance,
the wise grows it under his feet.*

- *James Oppenheim*