University of Manitoba
Department of Soil Science

Faculty of Agricultural and Food Sciences
SOIL 4400 Soil Ecology

Course Outline 2012
Instructor: Dr. Mario Tenuta
Department of Soil Science

Introduction

Welcome to Soil Ecology! This is an exciting time, we are about to embark on a marvelous journey through the most complex ecological system known, SOIL. In our journey we meet many organisms that collectively are the soil food web. Each one has a role in determining processes having agronomic and environmental implications from determining conditions for growth of a root tip to affecting our climate. The presence and activities of soil organisms can be "a canary in a coal mine" or signal "all is well" for the long-term productivity and health of soil, and also of the environment. Any exploration of soil organisms requires knowledge of interactions of individuals within a population of similar organisms, interaction with other types of organisms and also interaction with the soil environment. Thus this course has the titled Soil Ecology because it is an exploration of interactions between soil organisms and their soil environment. Let's begin the journey.

By the end of this course you will

1) have a greater appreciation for the life beneath your steps
2) be familiar with the function of the major groups of soil microorganisms and fauna in soil
3) understand the bioenergetics and nutritional requirement of key organisms in the soil food web
4) apply basic laboratory techniques and approaches to determine the kinds of soil organisms and their activities
5) know the role of the soil food web in the formation, degradation, and maintenance of organic matter
6) know the critical role of organisms in the cycling N, P, S and the consequence to crop nutrition and environmental quality
7) know the kinds of beneficial and deleterious associations plants have with soil microorganisms
8) know the practically of using microorganisms to remediate/rehabilitate highly disturbed or contaminated soil
9) understand that the kinds and activities of soil organisms are affected by management practices and land use making some excellent bioindicators of good land stewardship
10) understand how we can build soil to be more productive and more efficiently use inputs
11) appreciate how soil organisms can alter our climate
12) be familiar with human pathogens found in manure and in soil
13) understand the science of composting

Your role

To be an active participant in lectures
To ask and respond to questions (keep in mind there is no such thing as a poor question)
Print the lecture handout prior to coming to class
Print and read the laboratory exercise prior to attending laboratories
When working as a team, all members are to share the work load
Explore the Soil Ecology Website (*Your Portal to Underworld Ecology*)
Let Dr. Tenuta know when you are not having fun learning about soil ecology
Above all, have an insatiable attitude for learning!

Web location of lecture and laboratory materials

You will find lecture and laboratory materials at the following link, click on Soil 4400 at

http://home.cc.umanitoba.ca/~tenutam/
Some files will be in Adobe Acrobat format or in Microsoft Word and may be password protected. The password is
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Lecture and laboratory notes will be posted 24 hours prior to each session.
Other materials as required will be posted on the web site, check frequently. In class we will go over the organization of the website.

Lecture slides and notes will be posted 24 hours after the session. You are required to know for exams all material covered in lectures and laboratories. Materials and links on the website are for your benefit to clarify items discussed in lectures and laboratories.

Instructor

Prof. Mario Tenuta
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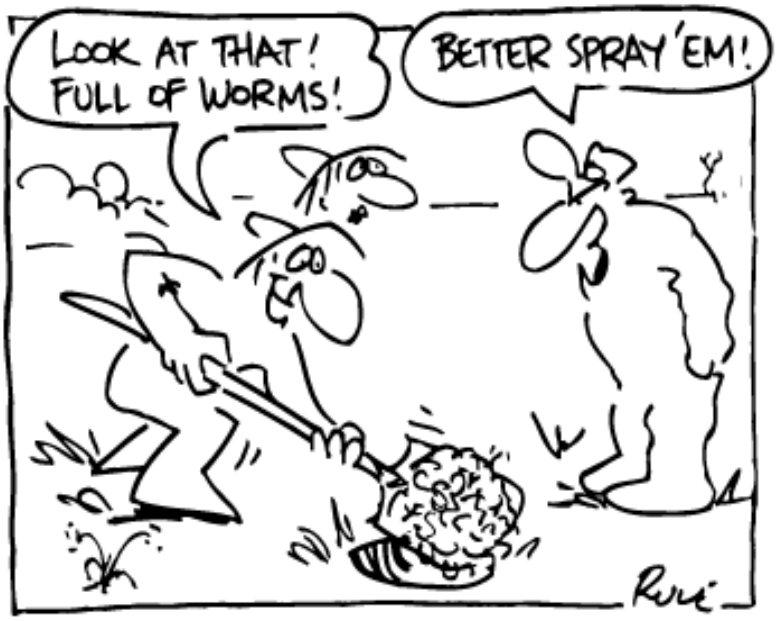
Telephone: 474-7827
E-mail: tenutam@cc.umanitoba.ca
Consultation times
Talk to me after lectures
otherwise appointments by e-mail

Lectures
T-Th 10:00-11:15
344 Ellis Building

Practicals
T 2:30-5:30
318 Ellis Soil Lab
Not scheduled regularly but announced week before

Textbook
None required

Suggested Text Readings
Soil Microbiology and Biochemistry 3rd Edition (Paul, 2007);
Fundamentals of Soil Ecology 2nd Edition (Coleman et al., 2004)



Hopefully you will learn what is wrong with this attitude

Course Evaluation

Mid-term..... …30%
Assignments .....……40%
Lab 1 (10%)
Lab 2 (10%)
Famous Soil Organism (10%)
Famous Soil Ecologist (10%)
Final Exam.....30%
Total ……..…100%

The results of the mid-term test will be returned well prior to the voluntary withdrawal deadline of March 16, 2011.

Examination and Assignment Dates

Famous Soil Organism – Jan 18, 2012 in Pratical
Midterm – Feb. 16, 2012 in Class
Lab Assignments. – Lab 1 Feb. 9 and Lab 2 March 22
Famous Soil Ecologist – March 28, 2012 in Lab
Final Exam - TBA in class between April 9-23 - 2 hour exam

Late Submissions

10% will be deducted per working day for late submission of all assignments.

ACADEMIC DISHONESTY

This course abides by the University's statement on Academic Dishonesty including sections dealing with 'plagiarism and cheating' and 'examination impersonation' outlined in the University General Calendar.

PLAGIARISM AND CHEATING

To plagiarize is to take ideas or words of another person and pass them off as one's own. In short, it is stealing something intangible rather than an object. Obviously it is not necessary to state the source of well known or easily verifiable facts, but students are expected to acknowledge the sources of ideas and expressions they use in their written work, whether quoted directly or paraphrased. This applies to diagrams, statistical tables and the like, as well as to written material. To provide adequate documentation is not only an indication of academic honesty but also a courtesy which enables the reader to consult your sources with ease. Failure to do so to constitutes plagiarism. *Only when statements are placed in quotations and cited can they be reproduced from another work in a student's paper. Most often a student will paraphrase or summarize the work of another with a citation given for the source of the information..* It will also be considered plagiarism and/or cheating if a student submits a term paper or laboratory report written in whole or in part by someone other than himself or herself, or copies the answer or answers of a fellow student in any test, examination, or take-home assignment.

Plagiarism or any other form of cheating in examinations or term tests (e.g., crib notes) is subject to serious academic penalty (e.g., suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments will also be subject to serious academic penalty.

EXAMINATIONS - IMPERSONATIONS

A student who arranges for another individual to undertake or write any nature of examination for and on his/her behalf, as well as the individual who undertakes or writes the examination, will be subject to discipline under the University's Student Discipline Bylaw, which could lead to suspension or expulsion from the University. In addition, the Canadian Criminal Code treats the personation of a candidate at a competitive or qualifying examination held at a university as an offense punishable by summary conviction. Section 362 of the Code provides:

"Personation at Examination

362. Every one who falsely, with intent to gain advantage for himself or some other person, personates a candidate at a competitive or qualifying examination held under the authority of law or in connection with a university, college or school or who knowingly avails himself of the results of each personation is guilty of an offense punishable on summary conviction. 1953-54, c.51, s.347."

Both the personator and the individual who avails him/herself of the personation could be found guilty. Summary conviction could result in a fine being levied or up to two years of imprisonment

Lecture Outline

Module 1 – Introduction

What is Soil Ecology?

Ecological environment of soil

Module 2 –Diversity of Soil Life

Diversity of soil organisms

Tree of life, bacteria

Fungi, Protozoa, Chromista, Animals

Methods of studying diversity

Direct: observation and isolation

Indirect: signatures and molecules

Module 3 -Energy and Growth

Strategies to obtain energy

Module 4 –Element and Nutrient Cycles

Carbon cycling

Importance of soil organic matter and building it in soil

Decomposition of Soil Organic Matter

Soil Food Webs

Nitrogen cycling

Biological N fixation, Mineralization

Nitrification, Denitrification

Module 5 –Applications in Soil Ecology

Rhizosphere symbionts of plants: Mycorrhizal fungi and PGPR

Deleterious organisms to plants: Soilborne plant pathogens, biological control and disease suppressive soils

Deleterious organisms to humans: Pathogens from manure

Relying on soil organisms in low input and organic management systems

Biological indicators of soil health

Global warming: Soil organisms, greenhouse gas emissions, climate change

Science of composting

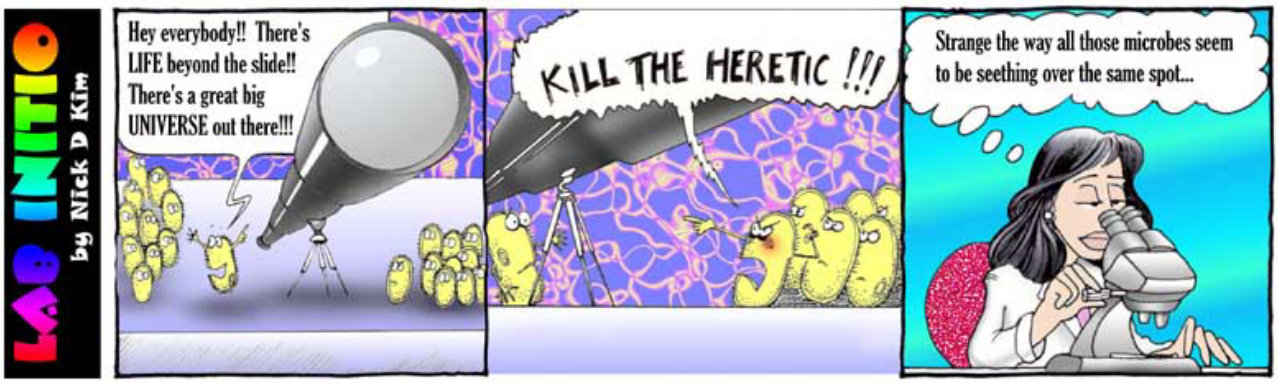
Bioremediation techniques

Module 6

Future Directions in Soil Ecology

"*Le rôle des infiniments petits m'apparaissait infiniment grand.*" Louis Pasteur (1822-1895)

I hope they have the same effect on you, enjoy the course.



Winter Term 2012 Academic Schedule

January 3	University reopens (no classes).
January 4	Classes resume in most faculties and schools.
January 4 - 17	Registration revision period for Winter Term courses/Last date for refund
January 5	Last date for Winter Term fee payment
February 20	Louis Riel Day. University closed.
February 20 - 24	Mid-Term break: No classes or examinations in most faculties and schools
March 16	Last day for Voluntary Withdrawal from all Fall/Winter Term 2011/2012 and Winter Term 2012 courses Some faculties have courses with irregular withdrawal dates, see your faculty general office for information
April 5	Classes end in most faculties and schools.
April 6	Good Friday Holiday: University closed.
April 9 - 23	Final examination period for most faculties and schools. Students must remain available until all examination obligations have been fulfilled

Discovering A Famous Soil Organism

You are to pick one of the following famous soil organisms. Please email Dr. Tenuta with your top 3 soil organism choices. Organisms will be assigned based on first a first response first assigned basis. You will prepare a 10 minute presentation on your famous soil organism. ***You are to address the following within that time***:

Name: give scientific name and authority, and common names. Describe what its scientific name means and its origin. Describe the phylogeny of your organism.

Mug Shot: Get a picture of your organism.

Claim to Fame: Describe what ecological role your organism performs. Is it exploited by us in any fashion?

Environmental Preference: Describe where your organism lives and its preferred environmental conditions. How does this relate to its ecological role? Does it have an economical role?

Presentation and Handout: You are to prepare a maximum 2-page point-form handout of your famous soil organism to give to me on class Tuesday morning. I will photocopy for the class and prepare overheads for you to use during your presentation. Your presentation will be 10 minutes in the lab period with a few minutes for class discussion.

Would You Mind Being this Organism? Explain

You are to pick one Famous Soil Organism from below, clear the organism with Dr. Tenuta.

Name	***Presenter***
Acaulospora laevis	
Amorphotheca resinae	
Aporrectodea trapezoides	
Azospirillum brasilense	
Caenorhabditis elegans	
Folsomia candida	
Frankia alni	
Gonostomum affine	
Hypoaspis miles	
Meloidogyne hapla	
Penicillium Bilaii	
Pseudomonas fluorescens	

Bring a memory stick to the laboratory or email the presentation to Dr. Tenuta.

Have fun with this. Think of it as a Life and Times TV show or Biography of a soil organism.