

SOIL 4400 Soil Ecology Course Syllabus

January - April 2023

Instructor: Dr. Xiaopeng Gao, Dept. of Soil Science, 311 Ellis Building

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Calendar Description for this Course – physical chemical and biological properties of soils; function of the major groups of soil microorganisms and fauna in soil; the carbon, nitrogen, and phosphorus cycles.

Prerequisite: Undergraduate level SOIL 3600 Minimum Grade of D or Undergraduate level 040 360 Minimum Grade of D or Undergraduate level AGECE 2370 Minimum Grade of D or Undergraduate level BIOL 2300 Minimum Grade of D.

Course Objectives - After completing this course, students will:

- 1) be familiar with the function of the major groups of soil microorganisms and fauna in soil
- 2) understand the bioenergetics and nutritional requirement of key organisms in the soil food web
- 3) apply basic laboratory techniques and approaches to determine the kinds of soil organisms and their activities
- 4) know the role of the soil food web in the formation, degradation, and maintenance of organic matter
- 5) know the critical role of organisms in the cycling N, P and the consequence to crop nutrition and environmental quality
- 6) know the kinds of beneficial and deleterious associations plants have with soil microorganisms
- 7) 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
- 8) understand how we can build soil to be more productive and more efficiently use inputs
- 9) appreciate how soil organisms can alter our climate
- 10) understand the science of composting

Class Timetable and Location - Lectures and labs will be offered in person. Students are required to participate in lectures on Tuesdays, and Thursdays 10:00-11:15 am and labs on Thursdays 2:30-5:25 pm. This format will facilitate a sustainable pace for learning, plus live discussion of students' questions and assisted group work during the lab periods.

Notices and Course Materials Posted on UM Learn – Students are also expected to regularly access the notices and class material posted on the UM Learn website for this course. Summary lecture notes and reference material for the laboratory assignments will be posted on UM Learn. For more information about accessing UM Learn, go to: <https://centre.cc.umanitoba.ca/technology/umlearn/>

Recommended Text – Not required.

Suggested readings:

- 1) Weil R.R., and Brady N.C. 2017. The Nature and Properties of Soils, 15th Edition. (the 14th and 13th editions are also good) Collier MacMillan Publishers, N.Y.
- 2) Paul E. 2015 Soil Microbiology, Ecology, and Biochemistry 4th Edition, Academic Press
- 3) Krzic M. et al. 2021. Digging into Canadian Soils: An Introduction to Soil Science.
<https://openpress.usask.ca/soilscience/>

Availability of Instructor - Students with questions or suggestions are strongly encouraged to ask questions during or immediately after the regular lecture periods and lab periods. There will also be optional tutorial sessions prior to exams. Due to other time commitments that are unpredictable, please call or send the instructor an e-mail to set up mutually suitable appointment.

Class Communication via Email - Students are expected to establish and regularly access their official University email account, which is the email address that will be used for communication about this course.

Evaluation and Marking Scheme:

- Evaluative feedback will be given to students prior to the voluntary withdrawal deadline.
- Mid-term test (close book) will be written during the lab period.
- The final exam will be two-hours in length and in close book format.
- Failure to write a midterm or final exam at the scheduled time will result in a grade of zero, except in properly documented cases of medical emergency.
- Detailed instructions for each exam and assignment will be provided.
- Grammar, spelling and composition will be evaluated and considered as part of the grading criteria for tests and assignments.
- Attendance, participation and completion of weekly assignments in the laboratory is compulsory. All lab assignments must be completed satisfactorily to receive a passing and complete grade.
- General grading scheme (subject to modification by instructor): 90-100 A+, 80-90 A, 75-80 B+, 70-75 B, 65-70 C+, 60-65 C, 50-60 D, <50 F. Comments and grades will be provided on exams and assignments.

Weighting of components:

Midterm exam	25%
Weekly laboratory assignment	25%
Term project on Famous Soil Organism	20%
<u>Final exam (TBA)</u>	<u>30%</u>
Total	100%

Academic Integrity

Academic integrity helps all of us, improving the quality and long term value of learning, as well as maintaining a good reputation and public confidence in individual students and graduates, as well as students, staff, our Faculty, our university, and our profession.

The University of Manitoba regards acts of academic misconduct in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence. Penalties range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University. Examples of misconduct include, but are not limited to:

- a) Plagiarism – the presentation or use of information, ideas, sentences, findings, etc. as one's own without appropriate attribution in an assignment, test or final examination.
- b) Cheating on quizzes, tests or final examinations – the circumventing of fair testing procedures or contravention of exam regulations. Such acts may be premeditated/planned or may be unintentional or opportunistic.
- c) Inappropriate collaboration – when a student and any other person work together on assignments, projects, tests, labs or other work unless authorized by the course instructor.
- d) Duplicate submission – cheating where a student submits a paper/assignment/test in full or in part, for more than one course without the permission of the course instructor.
- e) Personation – writing an assignment, lab, test, or examination for another student, or the unauthorized use of another person's signature or identification in order to impersonate someone else. Personation includes both the personator and the person initiating the personation.
- f) Academic fraud – falsification of data or official documents as well as the falsification of medical or compassionate circumstances/documentation to gain accommodations to complete assignments, tests or examinations

If you have any questions about how to make sure that you're complying with the University's expectations for academic integrity in this course, please contact the instructor for this course.

For more information about the U of M's commitment to academic integrity, go to:

<http://umanitoba.ca/student-supports/academic-supports/academic-integrity>

For more information about the U of M's Student Discipline By-Law, go to:

<http://crscalprod.ad.umanitoba.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=440&chapterid=5113&topicgroupid=27390&loaduseredits=False>

In Case of Illness

Students who are unable to meet a course requirement due to medical circumstances are currently not required to submit medical notes. However, students are required to contact their instructor or academic advisor by email to inform of the missed work and to make arrangements for extensions, deferrals, or make-up assignments. Please follow these guidelines if you are unable to meet an academic requirement for your courses.

- Contact your instructor for term work such as a class, quiz, midterm/test, assignment, lab;
- Contact an advisor in your faculty/college/school of registration for a missed final exam (scheduled in the final examination period);
- Inform your instructor/advisor as soon as possible. Do not delay. Note for final exams, students must contact within 48 hours of the date of the final exam; and
- Email your instructor/advisor from a U of M email address, and include your full name, student number, course number, and academic work that was missed.

Other Student Resources

For student resources, including student accessibility services, writing and learning support, library information, academic advisory services, student advocacy, and policies regarding student discipline, intellectual property and reporting sexual assaults, please see **Schedule A - Policies and Resources for Students** posted on this course's UM Learn website.

SOIL 4400 Soil Ecology Course Outline

(Draft – November 17, 2022)

I. Introduction

- A. What is Soil Ecology?
- B. Ecosystem services of soil
- C. Soil forming factors

II. Ecological environment of soil

- A. Soil water: characteristics and behavior
- B. Soil mineral
- C. Organic matter in soil
- D. Soil aggregates
- E. Soil aeration

III. Diversity of Soil Life

- A. Soil Biota - Diversity of Soil organisms
- B. Soil Food Web

IV. Element and Nutrient Cycles

- A. Carbon cycling
- B. Nitrogen cycling
- C. Phosphorus cycling
- D. Environmental issues of N and P

IV. Applications in Soil Ecology

- A. Rhizosphere Ecology
 - 1) Rhizosphere
 - 2) Mycorrhizal fungi
 - 3) Science of composting
 - B. Global warming
 - C. Biological indicators of Soil Health
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