



SYLLABUS

Soil Ecology: SOIL4400

Winter 2024



UM | Faculty of Agricultural
and Food Sciences

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Course Details

Course Title & Number:	Soil Ecology (SOIL 4400)
Credit Hours	3
Pre-requisites	SOIL 3600, or AGECE 2370, or BIOL 2300
Class Times & days	10:00-11:15am, Tuesdays and Thursdays
Class location	Rm 342 Ellis Building
Lab/tutorial times & days	2:30-5:15pm, Thursdays
Lab/tutorial location	Rm 342 or Rm 318 Ellis Building

Instructor Contact Information

Name

Dr. Xiaopeng Gao, Assistant Professor, Department of Soil Science. Students are welcome to address me by name as either Xiaopeng or Dr. Gao.

Email

Xiaopeng.Gao@umanitoba.ca Email is the most preferred way to contact Dr. Gao.

Office location & phone No.

311 Ellis Building, 204-599-5116

Office Hours or Availability

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 send Dr. Gao an e-mail to set up a suitable appointment.

Traditional Territory or Land Acknowledgment

The University of Manitoba campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Course Description

U of M Course Calendar Description

This course explores soil ecological subjects including 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.

General Course Description

This course will provide students with a comprehensive view of the interactions of soil organisms with their surrounding environment. The course explores the soil food web, and its roles in energy and nutrient cycling. Students will gain insights into the functioning of major soil components and their influence on nutrient cycles, with a particular focus on carbon, nitrogen, and phosphorus. Through a blend of theoretical knowledge and practical applications, students will develop a profound understanding of the ecological dynamics that shape soil environments and impact broader ecosystem health.

Course Learning Outcomes

This course will introduce students to basic theory, concepts and applications of soil ecology. By the end of this course, you should be able to:

- explain the function of the major groups of soil microorganisms and fauna.
- understand the bioenergetics and nutritional requirement of key organisms in the soil food web.
- apply basic laboratory techniques and methodologies to determine the kinds of soil organisms and their activities.
- critically analyze the role of the soil food web in the formation, degradation, and maintenance of organic matter.
- evaluate the role of soil organisms in the cycling of N, P and C, and assess the consequence on crop nutrition and environmental quality.
- develop innovative soil management strategies by synthesizing ecological principles, considering the impact on soil health, biodiversity, and ecosystem services.
- construct critical reviews and scholarly evaluations of current literature in soil ecology, demonstrating an ability to synthesize information and identify gaps in knowledge.

Course Materials

Required Materials

No textbook is required for this course. Students are 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. Students are expected to personalize notes based on the lectures presented. For more information about accessing UM Learn, go to: <https://centre.cc.umanitoba.ca/technology/umlearn/>

Recommended Materials

- 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/>

Course Technology

I will use PowerPoint for lectures and will post lecture slides before class at the UM Learn. Students are welcome to utilize electronic devices such as computers or tablets during class in a responsible, efficient, ethical and legal manner as long as their use is focused on class and is not disruptive to other students. Students should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline “gaming” during scheduled class time. If a student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it.

Course Schedule

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to [section 2.8 of the ROASS procedure](#).

Date	Lecture Topic	Number of Lectures
Jan 9	Introduction A. What is Soil Ecology? B. Ecosystem services of soil C. Soil forming factors	1
Jan 11 – Feb 1	Ecological environment of soil A. Soil water: characteristics and behavior B. Soil mineral C. Organic matter in soil D. Soil aggregates E. Soil aeration	7

Feb 5-15	Diversity of Soil Life A. Soil Biota - Diversity of Soil organisms B. Soil Food Web	4
Feb 27 – Mar 21	Element and Nutrient Cycles A. Carbon cycling B. Nitrogen cycling C. Phosphorus cycling D. Environmental issues of N and P	8
Mar 26- Apr 4	Applications in Soil Ecology A. Rhizosphere B. Mycorrhizal fungi C. Global warming D. Biological indicators of Soil Health	4
Apr 9	Wrap-up and Final Exam Prep	1

Course Evaluation and Assessments

- 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.

Weighting of components:

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

Soil4400 Term Project: Discovering A Famous Soil Organism

You are to pick one of the following famous soil organisms. Please email Dr. Gao with your top 3 soil organism choices. Organisms will be assigned based on a first response first assigned basis. You will need to complete two independent tasks with your famous soil organism: **1) prepare an 8-minute presentation, 2) complete a 5 to 7-page essay (12-point font and a line spacing of 1.5).** This term project is worth 20% of your final grade in this course.

Format: PowerPoint for presentation and word-processed reports saved or printed to pdf format are required. Presentation dates will be during lab sections in March. **The written essay paper will be due by 5:00 pm on April 3rd.** Grammar, spelling and composition will be evaluated and considered as part of the

grading criteria for tests, reports and assignments.

For both presentation and essay paper, **you are to address the following:**

- **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? What is “neat” about this organism?
- **Environmental Preference:** Describe where your organism lives and its preferred environmental conditions. How does this relate to its ecological role? Does it have an economic role?
- **Would You Mind Being this Organism? Explain**
- **Summary**
- **References**

<i>Organism</i>	<i>Presenter</i>
<i>Pseudomonas fluorescens</i>	
<i>Bacillus thuringiensis</i>	
<i>Streptomyces griseus</i>	
<i>Bradyrhizobium japonicum</i>	
<i>Bacillus licheniformis</i>	
<i>Nitrospira spp.</i>	
<i>Glomus spp.</i>	
<i>Agaricus bisporus</i>	
<i>Verticillium longisporum</i>	
<i>Penicillium chrysogenum</i>	
<i>Psilocybe spp.</i>	
<i>Trichoderma harzianum</i>	
<i>Cryptodiffugia operculata</i>	
<i>Colpoda spp.</i>	
<i>Heterodera glycines</i>	
<i>Heterorhabditis bacteriophora</i>	
<i>Enterobius vermicularis</i>	
<i>Rhabditis spp.</i>	
<i>Lumbricus terrestris</i>	
Scarabaeidae	
Enchytraeidae	
<i>Folsomia candida</i>	
<i>Diabrotica virgifera</i>	
<i>Tardigrada</i>	

Labs and Tutorials

Types of Lab Problems and Group Learning

Students will be assigned to groups for the **weekly assignments** and the **term project**. One of the purposes

of assigning students to work in groups is to stimulate a “team-work” approach to the term project and to problem-solving.

Another purpose of group work is to encourage **group learning (not group copying)**. However, group copying or plagiarism is not acceptable. Students are expected to discuss their approach to recommendations with other members of their group, but each member is expected to submit their individual, unique written reports independently (**i.e. copying of assignments is not permitted**). Students will also be expected to use the knowledge and experience gained from their group efforts to work individually on a final lab exam at the end of term.

Weighting of lab components toward final grade in course

weekly problems	25%
term project on soil organisms	
Oral presentation	10%
<u>written essay</u>	<u>10%</u>
Total	45%

Group learning is an important component of this course; therefore, participation in the weekly laboratory exercises is compulsory. Excused absences are allowed only in cases of medical or personal emergency. Generally most assignments must be completed by the end of each lab period; late weekly assignments will be assigned a grade of zero, but must still be submitted in satisfactory condition. All weekly assignments must be completed satisfactorily to receive a passing and complete grade in the course.

This lab schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to [section 2.8 of the ROASS procedure](#).

Date	Lab #	Topics
Jan 11	1	overview of term project: Famous Soil Organism soil water parameter calculations
Jan 18	2	Soil mineral CEC calculations
Jan 25	3	Soil aggregate and soil aeration
Feb 1		No lab
Feb 8	4	Soil biota - 1
Feb 15	5	Soil biota - 2
Feb 22		No lab
Feb 29	6	Midterm exam
Mar 7	7	Soil N processes
Mar 14	8	Rhizosphere and mycorrhiza
Mar 21	9	Student presentation
Mar 28	10	Optional tutorial

Grading

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	92.00-100.00	4.25-4.5	4.5
A	85.00-91.99	3.75-4.24	4.0
B+	78.00-84.99	3.25-3.74	3.5
B	72.00-77.99	2.75-3.24	3.0
C+	66.00-71.99	2.25-2.74	2.5
C	60.00-65.99	2.0-2.24	2.0
D	50.00-59.99	Less than 2.0	1.0
F	Less than 50		0

Course Policies

Academic Integrity

Each student in this course is expected to abide by the University of Manitoba Academic Integrity principles. You should consistently acknowledge and reference the contributions of others in your oral presentation and written report in the Soil4400 Term Project. All weekly lab assignments are to be completed independently. In instances where collaborative work is encouraged, it is essential to ensure that the project adheres strictly to academic integrity regulations. During examinations, it is mandatory that each student performs their own work. Any inappropriate collaborative behavior or violation of Academic Integrity principles will result in serious disciplinary action. Penalties range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University.

Refer to specific course requirements for academic integrity for individual and group work such as:

- I. Group projects are subject to the rules of academic dishonesty;*
- II. Group members must ensure that a group project adheres to the principles of academic integrity;*
- III. Students should also be made aware of any specific instructions concerning study groups and individual assignments;*
- IV. The limits of collaboration on assignments should be defined as explicitly as possible; and*
- V. All work should be completed independently unless otherwise specified.*

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>

Artificial Intelligence

All assignments and exams must be completed by each student independently. The use of artificial intelligence tools is strictly prohibited. This includes, but is not limited to, editing software (i.e., Grammarly), paraphrasing generators (i.e., Quillbot), Text generators (i.e., Chat GPT), Image generators (i.e., DALL-E), and predictive text (i.e., suggestions in Outlook). Any use of these AI tools would be treated as academic misconduct/cheating.

Accessibility

The University of Manitoba is committed to providing an accessible academic community. [Students Accessibility Services \(SAS\)](https://umanitoba.ca/student-supports/accessibility) (<https://umanitoba.ca/student-supports/accessibility>) offers academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

520 University Centre

(204) 474-7423

Student_accessibility@umanitoba.ca

Class Communication

You are required to obtain and use your University of Manitoba email account for all communication between yourself and the university. All communication must comply with the Electronic Communication with Student Policy:

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html.

Recording Class Lectures

No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Dr. Gao. Course materials (both paper and digital) are for the participant's private study and research.

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and university guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn) or any website (e.g., Course Hero, Chegg, etc.), unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the [University's Copyright Office website](http://umanitoba.ca/copyright/) (<http://umanitoba.ca/copyright/>) or contact um_copyright@umanitoba.ca.

Academic Supports

Academic Learning Centre: The Academic Learning Centre serves graduate and undergraduate, full and part-time students at UM. Make an appointment with a writing or study-skills tutor or sign up for one of our many workshops, all at no charge. <https://umanitoba.ca/student-supports/academic-supports/academic-learning>

UM Libraries: <https://umanitoba.ca/libraries/>

Student Counselling Centre:

The Student Counselling Centre (SCC) provides free counselling and mental health support to University of Manitoba, English Language Centre, and International College of Manitoba (ICM) students. We are

open year-round, Monday through Friday from 8:30 am to 4:30 pm. Our commitment is to offer a support service to every student who contacts us. <https://umanitoba.ca/student-supports/student-health-and-wellness/student-counselling-centre-scc>

University Health Services:

The University of Manitoba has two health clinics that provide the effective, patient-centered, collaborative, multidisciplinary primary care required for the success and well-being of UM students. <https://umanitoba.ca/student-supports/health-wellness/university-health-service>

University Copyright Office:

They support faculty, staff, and students in the use and creation of copyright protected materials in their teaching, research, and studies. They also monitor the university's compliance with copyright rules, encourage appropriate practices and engage in policy development and dissemination. The most important work they do is answer your questions. Take the guesswork out of copyright by contacting them. <https://umanitoba.ca/copyright/>

Grade Appeals:

If you disagree with a grade you've received, first talk to coordinator. You can also file a formal appeal about your grades. <https://umanitoba.ca/registrar/grades/appeal-grade>

Student Advocacy:

Student Advocacy is a safe place for students. They help students navigate university processes and advocate for their rights as a student at UM. <https://umanitoba.ca/student-supports/academic-supports/student-advocacy>

Respectful Work and Learning Environment (RWLE) Policy:

The University of Manitoba wishes to promote and support a community which embraces diversity and inclusion, provides for equality of opportunity, and recognizes the dignity of all people. For further resources please see <https://umanitoba.ca/about-um/respectful-work-and-learning-environment-policy>

Sexual Assault:

Sexual violence affects people of all ages, sexual orientations, genders, gender identities, abilities and relationship statuses. The Department of Soil Science is committed to ensuring a respectful work and learning environment and a safe and inclusive campus community where survivors of sexual violence receive the supports they need to succeed both academically and personally. For resources please see <https://umanitoba.ca/sexual-violence>

Intellectual Property:

The Partnerships and Innovation office helps uncover the full potential of research by considering options to move advances into practice in the community. This includes evaluation and protection of Intellectual Property (IP), identifying partners for commercialization, and licensing IP. <https://umanitoba.ca/partnerships-and-innovation/innovation-development>

UM Safe:

The University of Manitoba has transportation safety programs help ensure your safety when travelling to, from and around our campuses. More, see <https://umanitoba.ca/security/um-safe>

See The Centre's [Sample ROASS Schedule "A"](#) for more information.