

NRM 485, Soil Biology

Fall 2020

Course description: Subject matter in this course will include lectures and discussions on soil as a habitat for living organisms, the major groups of organisms in the soil, the major biological processes that occur in the soil and their significance to soil productivity and environmental quality, and methodology for studying soil organisms and their processes.

The course will consist mostly of lectures by the instructor but there will also be some class discussion. Each student will be expected in all discussions.

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Optional Textbook: Soil Microbiology, Ecology, and Biochemistry, 3rd ed., edited by E.A. Paul, Academic Press (ecopy is available)

Grading policy: The following grading policy will be used for this course:

<u>Letter Grade</u>	<u>Score (%)</u>
A	91-100
B	81-90
C	71-80
D	61-70
F	< 61

The instructor reserves the right to curve upward but not downward.

There will be two exams (middle term and final) in this course (30% of each). There will be a synthesis paper of student choice (30%). You will be required to turn in a draft, followed by the final paper. The draft will be critiqued and returned to you prior to writing the final paper. In addition, a brief topic description will be required for the synthesis paper. You will be expected to give an oral presentation, near the end of the semester, on your synthesis paper (10%). There is a list of topics in this syllabus.

Exams will consist of a combination of essays, short answer questions, and multiple choice questions, and will be a take home exam.

Middle term exam: 30%, Final exam: 30%,
Synthesis paper: 30%, oral presentation on synthesis paper: 10%

Honor Code

The UAF Honor Code will be enforced in this class. The UAF Honor Code is as follows:

1. Students will not collaborate on any quizzes, in-class exams, or take home problems or exams that will contribute to their grade in the course unless permission is explicitly given by the instructor. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.
2. Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself in compositions, theses, and other reports.
3. No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors.

Violation of the Honor Code will result in a failing grade for the assignment, and ordinarily, for the course in which the violation occurred. Moreover, violations of the Honor Code may result in suspension or expulsion.

Student Outcome

After taking the class, students should,

1. *Understand soil types, and functions of soil organisms.*
2. *Understand key soil factors affecting organism growth.*
3. *Understand interactions of soil organisms such as neutralism, commensalism, amensalism, parasitism, and predation.*
4. *Understand methods of studying soil microorganisms.*
5. *Understand role of microorganisms playing in organic matter, organic waste and contaminates. Understand role of metal status change facilitated by microorganisms.*
6. *Understand role of microorganism in nitrogen cycle.*
7. *Understand role of microorganisms in phosphorus cycle.*
8. *Understand roles of microorganism in sulphur cycle.*
9. *Understand management practice impact on carbon sequestration of soil.*
10. *Be able to use technical term to write a synthetic and research paper.*

Learning Disabilities

If any student enrolled in this class has a learning disability which may interfere with his or her ability to perform any of the work in the course, it is the student's responsibility to inform the UAF Center for Health and Counseling and the course

instructor within the first two weeks of class so that accommodations can be made.

Student protection and service

Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/ OR GRADUATE STUDENT VERSION: Student protections and services statement: Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/

UAF COVID-19 policies: social distance of 6 feet, and wear mask in classroom.

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uafstudents?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

NRM 485, Soil Biology

General Course Outline

	Topic	Approx. dates
1	Introduction of the class The soil as a habitat for organisms - Review soil properties - Architecture of organisms using soil as their houses	8/24 - 8/27
2	The organisms of the soil	8/31 – 9/2
3	Methodologies for studying the soil populations and their activities, and experiment and data analysis	9/7 – 9/9
4	Relationships among organisms of the soil	9/14
5	Relationships between soil organisms and plant roots	9/17, 9/20
	Synthesis paper topic description due Discuss topics and area of studies	9/20
6	The carbon cycle and decomposition of organic residues	9/23, 9/28
7	Soil organic matter and its management	9/30, 10/5
	Middle term exam	10/7 -10/12
	Draft synthesis paper due	10/12
8	Nitrogen transformations in soil (the nitrogen cycle)	10/14, 10/19
9	Sulfur transformations in soil (the sulfur cycle)	10/21, 10/26
10	Biogeochemistry of phosphorus and other elements	10/28, 11/2
11	Trace gas fluxes in soil and their measurement	11/4, 11/9
12	Biodegradation and bioremediation of contaminants in soil	11/11, 11/16
13	Student oral presentations	11/18,
14	Final exam	11/23, 11/30
15	Synthesis paper due	11/30

Synthesis and technical report for NRM 485

The purpose of the NRM 485 written synthesis paper is to give you a chance to research a topic in more detail than will be done in class and to gain practice in synthesizing information from the class and the literature. The paper should be on a topic of interest to you and related to soil biology. I have included a list of example topics at the end of this file; you are **NOT** required to use a topic from the list. Papers will be graded on coverage of topic (i.e. adequate coverage without excess detail), accuracy of information presented, appropriateness of references, organization, ability to discuss the pertinent information from the literature and synthesize it into a coherent body of information, and quality of presentation (how well it is written, including spelling and grammar). A brief (1/2 page) topic description will be due on 30 January. I will use this to determine if your topic seems reasonable for a synthesis paper and if it is appropriate for this class. You should turn in a draft by 20 February. I will critique the draft, and then return it to you with comments and suggestions for improvement. The final paper will be due on 07 March.

The main purposes of the topic description are to help you focus on your topic early in the semester and to help me decide if your topic is appropriate for the class and if it is doable. It should simply be a short description of what you plan to write your paper on. Some time should have been spent searching the literature prior to writing the topic description. At least three references should be included with the topic description.

The paper should **not exceed five pages** in length. **At least eight pertinent references** should be cited in the paper; **at least five of them must be from the peer reviewed literature**. Internet sources are acceptable, but must be credible. The internet can be a good source of information, but there is also a lot of bad information on the internet and much of it is unverifiable. I urge you to use care if you use it. **Wikipedia or You-tube are not acceptable references for this class.** If you have trouble finding information, please feel free to contact me. My phone number is 474 7620, fax number is 474 7004, and e-mail address is mzhang3@alaska.edu

You should list all references cited in a section called Reference List or Literature Cited. This section should be placed at the end of the report. Proper formats for references are given below. Please follow these formats for citing and listing references for your paper.

After synthesizing information in the literature in the area of your choice, you should be able to develop a hypothesis and lay out what approach(es) might be used to solve one of the problems from the area of your choices. In brief, for synthesis, you need find a subject area and collect information in that area, and then identify one area that needs further research (synthesis), and develop research ideas and methods from that (technical report).

At least eight pertinent references should be cited in the paper. Internet sources are acceptable, but must be credible. The internet can be a good source of information, but there is also a lot of bad information on the internet and much of it is unverifiable. I urge you to use care if you use it. **Wikipedia is not an acceptable reference for this class** If you have trouble finding information, please feel free to contact me. You should list all references cited in a section called Reference List or Literature Cited. This section should be placed at the end of the report. Proper formats for references are given below. Please follow these formats for citing and listing references for your paper.

Example Formats for Literature Citations for Written Paper/Reports for NRM 485

Note: all references cited in the text should be listed in the Literature Cited section and all references listed in the Literature Cited section should be cited in the text.

Methods for Citing Literature in the Text

One author: Solinsky (1992) found that organisms in subarctic soils ...
(author's name is part of sentence) **OR**

Research on soil organisms in Alaska (Solinsky 1992) showed that...
(author's name is not part of sentence)

Two authors: Solinsky and Smith (1995) -(authors' names part of sentence) **OR**

(Solinsky and Smith 1995) - (authors' names not part of sentence)

Three or more authors: Solinsky et al. (1997) - (authors' names part of sentence) **OR**

(Solinsky et al. 1997) - (authors' names not part of sentence)

Two or more references cited simultaneously:

(Clay 1994, Chang and Clay 1996, Ellsbury 1997) oldest reference comes first

Listing of Publications in Reference List (should be alphabetical)

The publication types listed below are the most commonly cited in papers in soil science and related fields. Many other types of publications exist. If you have questions about citation style, please see me.

Single author in journal:

Clay, D.E. 1997. Comparison of the difference and delta ¹⁵N approaches for evaluating liquid ammonium nitrate utilization by maize. *Communications in Soil Science and Plant Analysis* 28:1151-1161

Multiple authors in journal:

Häkan, W., Arnebrant, K., Östrand, F., and Kårén, O. 1997. Uptake of ¹⁵N-labeled alanine, ammonium, and nitrate in *Pinus sylvestris* L. ectomycorrhiza growing in forest soil treated with nitrogen, sulphur or lime. *Plant and Soil* 195:329-338. **Note: list all authors, do not use et al.**

Circulars, bulletins, numbered reports:

Pellett, H. 1923. Bacteria and root rot diseases of potatoes. University of Alaska. Agricultural and Forestry Experiment Station Circular # 115. 30 pp. Fairbanks, Alaska.

Books:

Schwartz, R.J. 1955. *The Complete Dictionary of Abbreviations*. T.Y. Corwell Co., New York.

Chapter in Book:

Link, G.K.K. 1928. Bacteria in relation to plant diseases. pp 590-606. *In* E.O. Jordon and I.S. Falk (ed.) *The Newer Knowledge of Bacteriology and Immunology*. University of Chicago Press, Chicago.

Author is agency, business, etc.:

Alaska Cooperative Extension. 1996. Food for Thought. University of Alaska. Alaska Cooperative Extension Bulletin # 39. Fairbanks, Alaska

Internet:

Holmes, J.K. and Carpenter, P.J. 1995. Guidelines for better writing [Online]. <http://www.usa.net/~vinced/home/better-writing.html>.

Suggested topics for term paper (NRM 485 Soil Biology)

- 1) Pesticide decomposition in soil (if you pick this topic, you should choose a specific pesticide or class of pesticides; otherwise the topic will be too broad).
- 2) Effect of heavy metals on soil microbial activity.
- 3) Effect of management practices (pick one, such as tillage, crop rotation, application of pesticides, many others) on soil microbial biomass and activity.
- 4) Effect of management practices (pick one, such as tillage, crop rotation, afforestation, others) on carbon sequestration in soil.
- 5) Microbial transformation of metals (you should pick a particular metal or class of related metals).
- 6) Biodegradation of organic contaminants in soil (if you choose a topic similar to this one, you will want to narrow it, maybe by picking a particular compound or class of compounds).
- 7) Probable effects of climate change on decomposition of forest litter in subarctic environments.
- 8) Microbial activity under snow or in frozen soil.
- 9) Mineralization and nitrification of nitrogen in sewage sludge.
- 10) Role of nematodes in controlling bacteria populations in soil.
- 11) Role of nematode trapping fungi on soil ecosystem function.
- 12) Soil enzyme activities and environmental impact (choose one of nitrogenase, phosphatase).
- 13) Transgenic genes in soil and their impact on soil ecosystems.
- 14) Soil impact on prion proteins (mad cow disease causing protein).
- 15) Advances in using genomic technologies in study soil microorganisms.