

**NRMT/BIOL 2110 Forest Soils and Water Autumn 2021**

**COURSE OUTLINE**

**Faculty: Dr. W.L. Meyer**

**Office** BB-1003B; **Phone:** (807) 343-8445; **E-mail:** Leni.Meyer@Lakeheadu.ca  
Office hours for academic counseling: Monday – Wednesday 11:30 – 13:30

**Lectures** Monday and Wednesday 19:30-20:30 Meet at BB 2006;

**Labs** Monday 08:30 – 11:30; Tuesday, Thursday 14:30 - 17:30 Meet at BB 1022

**THE FIRST FIVE LABS ARE OUTDOORS - ALL OUTDOOR LABS HAVE TO BE DONE OR THERE WILL BE A '0' GIVEN. I WILL TAKE ATTENDANCE IN THE FIELD. (WE'LL MEET AT BB 1022 FIRST).**

**FIELD LABS REQUIRE HARD HATS, STEEL-TOED BOOTS AND HIGH VIS VESTS**

All Meyer notes and Indoor Lab assignments will be **emailed** to class: **I don't use D2L**

**COURSE OBJECTIVES**

1. To measure **soil characteristics in the field**, to understand **soil forming factors** and to describe **soil processes** occurring at a site, all part of experiential learning exercises (part of five questionnaires done in first five labs);
2. To understand the concept of soil as a '**living**' three-dimensional **body** and as a **portion of the natural landscape** (part of five questionnaires done in first five labs);
3. To **analyze** and **interpret** basic **soil physical, chemical, and biological** properties as part of case studies (Five indoor lab assignments done during the last half of the term).

**EVALUATION OF STUDENT PERFORMANCE**

Five outdoor labs (each worth 5 marks)	25 %
Five questionnaires about labs and lectures (each worth 3 marks)	15 %
Five Indoor Exercises in labs (each worth 12 marks)	<u>60 %</u>
<b>NO FINAL</b>	100 %

**Due dates will be announced ORALLY as the labs are assigned (usually you'll have one week + to do the labs)**

**COURSE OUTLINE** (lectures may change order depending on class input)

**0. INTRODUCTION (ALSO IN LAB LECTURES)**

- 0.1 The soil horizon and profile - definitions (lect. 1+2)
- 0.2 A brief history of soil science (lect. 2)
- 0.3 Soil as a portion of the landscape (lect. 2)

**1. SOIL PROCESSES (ALSO IN LAB LECTURES)**

- 1.1 Organic matter accumulation (Organic soils)
  - 1.1.1 Origin and nature of organic matter ('O' vs. 'L, F, and H') (labs, lect. 3)
  - 1.1.2 Breakdown products of organic matter (lect. 3)
- 1.2 Organic matter and mineral soil biomixing
  - 1.2.1 Influences of SOIL FORMING FACTORS (Chernozems) (lect. 3)
- 1.3 Water movement down the profile
  - 1.3.1 Translocation of clay (Luvisol, Vertisols) (lect. 4+5)
  - 1.3.2 Leaching of iron and aluminum (Podzols) (lect. 4+5)
  - 1.3.3 Leaching of organic compounds (Podzols) (lect. 4+5)
  - 1.3.4 Salt movement (Solods) (lect. 4+5)
- 1.4 Water saturation of the profile
  - 1.4.1 Mottles and gleying (Gleysols) (lect. 4+5)
- 1.5 Freezing (Cryosols) (lect. 6)
- 1.6 Time (Regosols, Brunisols) (lect. 6)

**2. SOIL FORMING FACTORS (ALSO IN LAB LECTURES)**

- 2.1 Climate, vegetation, and topography (lect. 7)
- 2.2 Time as a factor in soil formation (lect. 7)
- 2.3 Soil parent material and landform
  - 2.3.1 Weathering of rocks and minerals (& water cycle) (lect. 7)
  - 2.3.2 Transport and redeposition of weathering products (lect. 8)
  - 2.3.3 Common landform features (lect. 8)
- 2.4 Microbial and animal influences (lect. 9)

**3. SOIL FIELD CHARACTERISTICS (Soil physical properties)**

- 3.1 Differentiation and classification of the soil profile (labs, lect. 10)
- 3.1 Soil as a three-phase system (labs, lect. 10)
- 3.2 Soil texture (labs, lect. 10)
- 3.3 Soil structure and consistence (labs, lect. 11)
- 3.4 Soil volume and weight relationships - bulk density (labs, lect. 12)
- 3.5 Soil moisture and temperature (labs, lect. 13)

**4. SOIL WATER**

- 4.1 Water molecule (lect. 14)
- 4.2 Water cycle (lect. 14)
  - 4.1.1 Water in the forest canopy (lect. 14)
  - 4.1.2 Water in the soil (lect. 15)

**5. SOIL CHEMICAL PROPERTIES (ALSO IN LAB LECTURES)**

- 5.1 Mineralogical and chemical composition of soil (labs, lect. 15)
- 5.2 Cation exchange reaction, cation exchange capacity (CEC), and base saturation of soil (labs, lect. 16-18)
- 5.3 Soil reaction (pH) (labs, lect. 19)
- 5.4 Chemistry of plant nutrients (lect. 20+21)

### **GUIDES SUGGESTED FOR COURSE** (no required textbook)

- Meyer, W. L. 2009. Field Guide to Forest Soils-Lab manual (emailed to you and on D2L).
- Sims, R.A., W.D. Towill K.A. Baldwin P. Uhlig and G.M. Wickware. 1997. Field guide to the forest ecosystem classification for northwestern Ontario. Ont. Min. Natur. Resour. Northwest Sci. & Technol. Thunder Bay, Ont. Field Guide FG-03. 176 pp (APPROXIMATE COST: \$20).

### **REFERENCES IN BB 1021**

- Brady, N.C. 1990. The Nature and Properties of Soils (10<sup>th</sup> ed.). Prentice Hall, Inc. New Jersey. 621 pp.
- Gardiner, D.T. and R.W. Miller. 2004. Soils in Our Environment (10<sup>th</sup> Ed.). Pearson/Prentice Hall. Upper Saddle River, NJ. 641 pp.
- Singer, M. J. and D. N. Munns. 1991. Soils: An Introduction. 2nd. Ed. Collier MacMillan Canada. 473 pp.

### **OTHER USEFUL REFERENCES**

- Armson, K.A. 1977. Forest Soils: Properties and Processes. Univ. of Toronto Press, Toronto.
- Baldwin, K. A., J. A. Johnson, R. A. Sims, and G. M. Wickware. 1990. Common landform toposequences of Northwestern Ontario. Ont. Min. Nat. Resour., Northwestern Ont. For. Tech. Develop. Unit, Thunder Bay, Ont. Tech. Rep. No. 49 / For. Can. Ont. Region Sault Ste. Marie, Ont. COFRDA Rep. 3303, 36 p.
- Brady, N.C. and R.R. Weil. 1999. The Nature and Properties of Soils (12<sup>th</sup> ed.). Prentice Hall, Inc. New Jersey. 881 pp.
- Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Agric. and Agri-Food Can. Publ. 1646 (Revised). 187 pp.
- Fitzpatrick, E.A. 1971. Pedology: A Systematic Approach to Soil Science. Oliver Boyd, Edinburgh, UK.
- Hausenbruiller, R.L. 1978. Soil Science, Principles and Practices (2nd ed.). W.C. Brown Co., Duboquet, Iowa.
- Hunt, C. B. 1972. Geology of Soils. W.H. Freeman and Co. San Francisco. 344 pp.
- Kimmins, J.P., 1987. Forest Ecology. Macmillan Publ. Co., New York, NY., 531 pp.
- Pritchett, W.L. and R.F. Fisher. 1987. Properties and management of forest soils. 2nd Edition. John Wiley & Sons, Toronto.
- Rowell, D. L. 1994. Soil Science: Methods and Applications. Addison Wesley Longman Ltd. Essex, England. 350 pp.
- Sims, R. A. and K. A. Baldwin. 1991. Landform features in Northwestern Ontario. For. Can. Ont. Region Sault Ste. Marie, Ont. COFRDA Rep. 3312, Ont. Min. Nat. Resour., Thunder Bay, Ont. NWOFTDU Tech Rep. 60. 63 pp.
- Thompson, L.M. and F.R. Troeh. 1978. Soils and Soil Fertility. McGraw Hill, New York.
- Wilde, S. A. 1958. Forest Soils. Ronald PreLAKEHEAD UNIVERSITY Faculty of Natural Resources Management

**We ask that you read the following:**

*"In NRMT 2110, in the context of remote instruction and participation, video and audio recordings of class activities will be made to ensure students' and instructors' easy and comprehensive access to those activities. The recordings are confidential and are intended only for the use of the course students and instructors. They may otherwise not be used or disclosed. During recording, to protect others' privacy, each student should ensure that no one else is present in the location where they are being recorded without that non-student's consent. The recordings are made under the authority of sections 3 and 14 of The Lakehead University Act, 1965. Questions about the collection of the images and sounds in the recordings may be directed to W.L. Meyer of NRM, 755 Oliver Road, (807) 343-8445".*