LAKEHEAD UNIVERSITY
Faculty of Natural Resources Management

NRMT/BIOLOGY 2110 Forest Soils and Water Autumn 2019

Lectures Monday and Wednesday 13:30-14:30 RC 1001;
Lab Meet in BB 1022. Tuesday OR Wednesday (pick one)14:30-17:30
Field Labs require hard hat, steel-toed boots, safety glasses and safety vest.

Faculty: Dr. W.L. Meyer
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Office hours for academic counseling: Tuesday, Wednesday, Friday 1030-1130

Outline 2019

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 leaning exercises.
2. To understand the concept of soil as a '**living**' three-dimensional **body** and as a **portion of the natural landscape**;
3. To **analyze** and **interpret** basic **soil physical, chemical, and biological** properties as part of case studies (Five indoor lab assignmnets).

FIELD LABS MUST BE DONE TO COMPLETE COURSE

FULL PPE, APPROPRITE SEASONAL CLOTHING (RAINGEAR WHEN NECESSARY) REQUIRED

EVALUATION OF STUDENT PERFORMANCE

Five Field Exercises (best 4 out of 5 used to calculate mark)	25 %
Five Indoor Exercises (each worth 5)	25 %
Midterm (late October – early November)	15 %
Final Examination	35 %
	100 %

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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)

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GUIDES SUGGESTED FOR COURSE (no required textbook)

Meyer, W. L. 2009. Field Guide to Forest Soils-Lab manual.

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. & Tecnol. 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 (10th ed.). Prentice Hall, Inc. New Jersey. 621 pp.

Gardiner, D.T. and R.W. Miller. 2004. Soils in Our Environment (10th 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. Devlop. Unit, Thunder Bay, Ont. Tech. Rep. No. 49 / For. Can. Ont. Region Sault Ste. Marie, Ont. COFRDA Rep. 3303, 36 p.

Black, C.A. 1957. Soil-plant Relationships. Wiley, New York. W.H Freeman, San Francisco.

Brady, N.C. and R.R. Weil. 1999. The Nature and Properties of Soils (12th 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., Duboque, 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 Press Co., New York. 537 pp.