UNIVERSITY OF SASKATCHEWAN
Distance Education Unit
DISTANCEEDUCATION.USASK.CA

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Please Note: This *Class Syllabus* is an important step in updating the format of our distance classes. If for any reason the *Class Syllabus* does not match the online class information, the *Class Syllabus* shall be taken as correct.

CLASS SYLLABUS (NON CREDIT)

COURSE TITLE:	Soil Sampling: Design and Implementation		
COURSE CODE:	EVSC 204	**TERM:**	Winter 2018
COURSE CREDITS:	1	**DELIVERY:**	Online
COURSE SECTION:	W02-W99	**START DATE:**	February 26, 2018
		END DATE:	April 3, 2018

Course Description

The official course description and prerequisites are in the U of S Course and Program Catalogue available at http://www.usask.ca/calendar/coursecat/

Course Learning Outcomes

Upon completion of this course, students should be able to

1. Explain how soil sampling is used to provide reliable evidence in the environmental and agricultural sciences.
2. Predict the likely range of variability in properties associated with different soils and how human activity such as agricultural and resource development affects variability.
3. Quantitatively express the variability associated with different properties using appropriate statistics and apply these statistics in the design of sampling plans.
4. Select the appropriate approach to field sampling for different situations.
5. Design a sampling program that meets specific regulatory and reliability requirements.
6. Determine the most appropriate field sampling tools to meet specific sampling requirements.
7. Handle the units associated with common properties measured in the field.

Course Overview

This is a course focused on skills related to the field description of soils. Students will learn the how to complete a field description of soil properties and the relationship between these properties and various management issues that require information about soils. The course also requires students to use information from existing soil profile descriptions to develop management recommendations for various environmental and agricultural management problems.

Each module in the course focuses on one aspect of the soil profile description. The main properties covered are soil colour, soil texture, soil structure and consistence, soluble salts and carbonates, and organic horizons. In each module, the property itself is defined and the method used in the Canadian system of Soil Classification to describe it covered. Then the relevance of the property for soil management is explained. Finally, assignments in each module require the student to take the information from existing soil profiles and apply it to provide data for a management decision. The assignments are an integral part of the course.

The course does not cover the assignment of horizon labels to each horizon or the genesis of the soil properties. The development of an accurate profile description is, however, the essential foundation for horizon labeling and soil classification.

Your Instructor

Amy Gainer, MSc, PhD Student, PAg

Contact Information

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The best way to contact me is by email.

Office Hours

TBD

Instructor Profile

I am currently a PhD student in the Department of Soil Science and Toxicology Centre. I completed my Bachelors in Environmental and Conservational Science in Land Reclamation and a Masters in Soil Science. I worked in the environmental consulting industry for three years before starting my post-doctoral degree. My areas of expertise are in contaminated soil and groundwater management, soil toxicology and environmental risk assessments. I also have experience as a teaching assistant for numerous classes including soil sciences and renewable resource management. My teaching philosophy is to prepare students for careers by applying concepts to real world scenarios they may encounter as environmental soil scientists.

Required Activities Outside of Class Time

Students will be expected to use time outside of the 13 lecture hours (class time) for reading and understanding the required readings and notes. Students are expected to spend up to 2 hours per lecture hour or an additional 26 hours reviewing this material and completing assignments. Preparation for the quizzes is also expected to be done within this time, outside of class.

Required Resources

Electronic Resources

Videos are used in all modules for the course.

Carter and E.G. Gregorich (Eds.) Soil Sampling and Methods of Analysis. CRC Press Taylor and Francis Group. Boca Raton FL USA. Link below:

http://www.niordc.ir/uploads%5C86_106_Binder1.pdf

Supplementary Resources

1. Understanding confidence intervals: Statistics Help: https://www.youtube.com/watch?v=tFWsuO9f74o Statistics Learning Center
2. Standard deviation – Explained and Visualized : Jeremy Jones https://www.youtube.com/watch?v=MRqtXL2WX2M
3. Visual Sample Plan. Pacific Northwest National Laboratories. Available at: http://vsp.pnnl.gov (Accessed March 7, 2016)
4. Pennock, D.J. 2004. Designing field studies in soil science. Canadian Journal of Soil Science 84: 1-10.
5. Bélanger, N., and K.C.J. Van Rees. 2008. Chapter 2 Sampling Forest Soils. pp. 15-24. In M.R. Carter and E.G. Gregorich (Eds.) Soil Sampling and Methods of Analysis. CRC Press Taylor and Francis Group. Boca Raton FL USA.

   (link to pdf listed in electronic resources)
6. Sheppard, S.C., and J. A. Addison. 2008. Chapter 4 Soil Sample Handling and Storage. pp. 39-50. In M.R. Carter and E.G. Gregorich (Eds.) Soil Sampling and Methods of Analysis. CRC Press Taylor and Francis Group. Boca Raton FL USA.

   (link to pdf listed in electronic resources)

Mobile Access

Blackboard Mobile Learn™ is an app that is available on many devices including iOS® and Android™ for those occasional times when you may want mobile access. It is still recommended that you use a laptop or desktop computer for the majority of your online studies.

Class Schedule

No Evaluations due on the following dates:
Friday, March 30, 2018 Good Friday – University closed

Week of	Module	Readings	Evaluation Due Date
Feb 25	1 Why do we need to sample?	Converting Concentrations of Elements to Mass per Area Units section from Reference Handbook (Pennock, D. 2016. Reference Handout. Department of Soil Science, University of Saskatchewan). **[PDF in Blackboard]**	Assignment 1 (Mar. 12 by 4:30 pm)
Mar 11	2 Causes of soil variability	Converting Concentrations of Elements to Mass per Area Units section from Reference Handbook (Pennock, D. 2016. Reference Handout. Department of Soil Science, University of Saskatchewan). **[PDF in Blackboard]** Classes of Parent materials: (5:18) https://www.youtube.com/watch?v=BYBBE6KzHLM **[Online]** Pipeline DisturbanceBack Fill CRC-Evans Pipeline International https://www.youtube.com/watch?v=H4Kx84DO4KU **[Online]** Glacio-marine sediments (4:59) http://landscape.soilweb.ca/glacio-marine/ **[Online]** Glacio-fluvial sediments: https://www.youtube.com/watch?v=zJ97vE5SzWM **[Online]**	Assignment 2 (Mar. 19 by 4:30 pm)
Mar 18	3 Statistics for Variability and Sample Numbers	Pennock, D., T. Yates, and J. Braidek. 2008. Chapter 1 Soil Sampling Designs. pp. 1-24. In M.R. Carter and E.G. Gregorich (Eds.) Soil Sampling and Methods of Analysis. CRC Press Taylor and Francis Group. Boca Raton FL USA. **[PDF in Blackboard]** Descriptive statistics and the presentation of data section from Reference Handbook (Pennock, D. 2016. Reference Handout. Department of Soil Science, University of Saskatchewan). **[PDF in Blackboard]**	Assignment 3 (Mar. 26 by 4:30 pm)

Mar 25	4 Design of Sampling Plans	Pennock, D., T. Yates, and J. Braidek. 2008. Chapter 1 Soil Sampling Designs. pp. 1-14. In M.R. Carter and E.G. Gregorich (Eds.) Soil Sampling and Methods of Analysis. CRC Press Taylor and Francis Group. Boca Raton FL USA. **[PDF in Blackboard]** Environment and Sustainable Resource Development (ESRD). 2013. 2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands (Updated July 2013). Edmonton, Alberta. 92 pp. https://open.alberta.ca/publications/9780778589853 **[Online]**	Assignment 4 (April 3 by 4:30 pm)
April 1	5 Field Sampling Methods	Environment Canada. 2012. Guidance document on the sampling and preparation of contaminated soil for use in biological testing. EPS 1/RM/53. Science and Technology Branch. Environment Canada. Ottawa, Ontario. Available at: http://publications.gc.ca/site/eng/9.575304/publication.html **[Online]**	

Note: If for any reason the Class Syllabus Reading List does not match the Module Reading List, the Class Syllabus shall be taken as correct.

Evaluation Components

As a non-credit student you are encouraged to participate in the discussions and complete the assignments, however you will not be able to write the final exam, nor will you be graded or receive a final mark in the class.

Assignment 1: Calculating soil organic carbon stores

Value: See Grading Scheme

Due Date: See Class Schedule

Type: This assignment introduces students to organic carbon storage and provide practice in converting between units.

Description: Working with different units is an essential numeracy skill associated with soil sampling. In this assignment students convert basic units for soil organic carbon storage into more useful soil carbon density measurements. They compare their results to published values for different soil zones in Saskatchewan.

Assignment 2: Calculating Plant-Available Nitrogen

Value: See Grading Scheme

Due Date: See Class Schedule

Type: This assignment involves further recalculations and practice with conversion between units.

Description: The objective of Assignment 2 is to further develop skills in converting between units and in converting values to more user-friendly forms. In this exercise the student works with plant-available nitrogen and uses it to illustrate the concept of temporal variability.

Assignment 3: Calculation of Descriptive Statistics

Value: See Grading Scheme

Due Date: See Class Schedule

Type: This assignment involves the calculation of standard descriptive statistics for soil properties.

Description: The statistical summary of soil variability is an essential part of the design of any sampling program.

Assignment 4 Designing a Soil Sampling Plan for Well Site Disturbance

Value: See Grading Scheme

Due Date: See Class Schedule

Type: This assignment integrates methods learned in the previous assignment to design a sampling program in accordance with a regulatory framework for assessment of well site disturbance.

Description: The design of sampling programs is often determined in part by the regulatory framework for specific activities. In this assignment students will use the regulations for assessing well site disturbance in Alberta to design and critique a sampling plan.

Discussions

Value: See Grading Scheme

Date: Ongoing

Length: N/A

Type: N/A

Description: Participation marks.

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Module Objectives

Module 1: Why do we sample?

1. Explain why sampling is required in soil and environmental science.
2. Describe the distinction between the form of soil as observed in the field and properties of soil that must be measured on samples.
3. Distinguish between a sample drawn from a population and a physical sample of soil.
4. Define the major types of natural resource management questions that require field sampling of soils.
5. Identify the common field or laboratory measurements associated with each type of problem.
6. Perform simple calculations that combine field measurements with laboratory results: soil organic carbon storage.
7. Explain how sampling relates to significant societal issues by discussing different perspectives on soil pollution.

Module 2: Causes of Variability in Soil Properties

1. Define the main soil parent materials, rank them in terms of variability, and explain this ranking.
2. Identify the major processes involved in soil formation and explain how these processes affect variability of soils.
3. Discuss the main effects of agriculture, forestry, resource development, and contamination on the variability of soil properties.
4. Use the example of plant-available nutrients to explain temporal variability.

Module 3: Statistics for Variability and Sample Numbers

1. Define in non-mathematical terms what the mean, standard deviation, and coefficient of variation are and why we use them.
2. Calculate the mean, standard deviation, and coefficient of variation for various soil properties.
3. Rank the CVs common soil properties.
4. Relate the ranking of CVs to the causes of variability covered in Module 2.
5. Calculate the number of samples required to achieve a specified level of confidence.

Module 4: Design of Sampling Plans

1. Define haphazard, judgment, search, and probability-based sampling.
2. Critique each of the four main approaches.
3. Apply your understanding of spatial variability to develop a stratified sampling plan.
4. Sketch several main systematic sampling plans.
5. Analyze and critique a sampling design for wellsite reclamation.

Module 5: Field Sampling Methods

1. Determine if individual point samples should be analyzed separately or if a composite sample can be taken.
2. Identify where cross-contamination of samples is a concern and what specialized implements are required in these situations.
3. Explain the difference between fixed-depth and horizon-based sampling.
4. Identify situations where grab samples are appropriate and where bulk-density (core) samples are required.
5. Identify the advantages and disadvantages associated with the main implements used in soil sampling: grab samples with screw-type implements and bulk-density (core) sampling using cores.
6. Distinguish between samples that require special post-sampling handling and those that do not.

Acknowledgements

Course Author

Dan Pennock, Ph.D., Professor Emeritus
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Instructional Design and Class Development

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