SOIL 3610: Field Methods in Land Resource Science

Course Description

General Description:
This 3-credit-hour course provides students with training in field methods used in soil science and related sciences (hydrology, meteorology, ecology, geomorphology, and environmental science). Students participate in a biophysical survey and in a study of the management, assessment and monitoring of land resources. Students are required to carry out independent preparation for the course. Three days are spent training at field sites in the Winnipeg area, and this is followed by three days of training and surveying at field sites in the South Tobacco Creek Watershed near Miami, Manitoba. Students will work in small groups to carry out the survey and associated assignments in the field. Independent study will be required to complete additional assignments and a final report.

Learning Outcomes:
On completion of this course, students will be able to: identify current equipment, practices and techniques used in the field; understand the scientific principles that underlie these techniques; develop sampling strategies; operate a variety of field equipment, safely and competently; collect, handle and store samples, including field records; process, store, interpret and report field data; and work more effectively both independently and in groups.

Programs Served:
The course serves science programs: Agronomy, Agroecology, Environmental Science, and Physical Geography at the University of Manitoba. The course will also benefit students from Environmental Studies, Botany, Ecology, Environmental Engineering and Agronomy. This course is eligible for credit in the Soil Science Minor Program.

Pre-requisites:
The pre-requisite for the course is SOIL 3600 Soils and Landscapes in Our Environment, or its equivalent, or permission of the instructor.

Scheduling:
The course is offered as part of the University of Manitoba’s Summer Session and it is scheduled at the end of August, prior to the Labour Day weekend. In 2014, field activities are scheduled from Wednesday August 20th to Friday August 22nd and from Monday August 25th to Wednesday August 27th, with preparatory and follow up course work by the students.

Costs and Space:
The costs of travel and teaching supplies are covered by student field course fees. The cost per student is $350 in addition to regular tuition. Spaces in the course are limited.

Instruction:
The course instructor is David Lobb from the Department of Soil Science. Additional instruction will be provided by other staff members from the University of Manitoba and by staff of federal, provincial, non-government, consulting and industry agencies.
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Evaluation of Student Performance

Components of Evaluation:
Each student’s overall performance will be evaluated based on several components of the course:

- Quiz on preparatory readings (morning of August 20th) 10 %
- Short assignments (end of August 20th, 21st, and 22nd) 15 %
- Participation, group evaluation (end of August 22nd) 5 %
- Participation, instructor evaluation (end of August 22nd) 5 %
- Participation, group evaluation (end of August 27th) 10 %
- Participation, instructor evaluation (August 27th) 10 %
- Field report (end of September 3rd) 10 %
- Overall performance 100 %

Grading:
Student performance will be assessed as a percentage and translated into a letter-grade as follows:

- A+ >90 %
- A 80-89 %
- B+ 75-79 %
- B 70-74 %
- C+ 65-69 %
- C 60-64 %
- D 50-59 %
- F <50 %

Preparatory Readings and Quiz
Prior to course students are encouraged to review the materials from SOIL 3600, the prerequisite course for SOIL 3610.

Students are required to read the following sections from the Nature and Properties of Soils by Brady and Weil, the required textbook for SOIL 3600:

- Chapter 1 (1.1, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14 and 1.15)
- Chapter 2 (2.2, 2.3, 2.6 and 2.9)
- Chapter 4 (4.1, 4.2, 4.3 and 4.4)
- Chapter 5 (5.4, 5.6 and 5.8)

These reading should take no more than 3 to 4 hours to complete. The purpose of these readings is to refresh the memory on topics that will be relevant to the methods that are demonstrated to and used by students in the course.

One the morning of Day 1, students will have a short quiz on the required readings. This quiz will be short (about 20 minutes in length) and will be made up fill-in-the-blank, true-and-false and multiple-choice questions. This quiz will constitute 10 % of the students’ overall evaluation of performance in the course.
Assignments:
Over the first three days of the course students will have three short assignments. Students will be given the assignment at the start of each day. Assignments will consist of short-answer questions and/or simple numerical exercises that students will address over the course of the day. At the end of each day, students will have time to complete their assignments and submit them. These assignments will constitute 15% of the students’ overall evaluation of performance in the course.

Participation:
Students will be organized into two groups for the first half of the course and into three groups for the second half. Students will evaluate the participation of students in their respective groups at the end of the first half of the course and again the end of the second half. Instructors will also evaluate each student’s participation at the end of the first half of the course and again the end of the second half. Participation will constitute 30% of the students’ overall evaluation of performance in the course.

Participation will be assessed based on preparedness for field activities, attentiveness during activities, effectiveness of the techniques used in the field (including organization and cleanup), contribution to group activities, and, of course, collegiality and professionalism.

Report:
The major activity in the course is a biophysical survey. This survey will be carried out in the South Tobacco Creek Watershed near Miami, Manitoba. Students will be trained to use standard field methods to survey topography, vegetation and soil. Students will work in three groups to carry out the survey of topography, vegetation and soils along two sets of three transects which traverse the creek, extending from a cropped field, through the riparian area of the stream, to the stream channel. The students will prepare a short field report based on the biophysical survey. The information that students report will be used by scientists to characterize the biophysical properties of the watershed and interpret the influence of land use and land management on the quantity and quality of the water within and leaving the watershed.

The report will consist of:
- a brief description of the study which the students’ activities contribute to (200-300 words).
- a brief description of the environmental setting of the watershed (300-500 words).
- a description of the field methods used (500-1000 words).
- plan-view maps illustrating the biophysical units.
- profile-view diagrams illustrating the biophysical units.
- detailed data sheets for topography, soil and geomorphology.

The report will constitute the major component of the students’ performance evaluation, 45%. Students will work in groups to collect the data and information for the report and may work in groups to carry out some of the preliminary work on the report while in the field. Students will have additional time at the University of Manitoba following the field work to complete their independent final reports.

Academic Penalties:
Evaluation marks will be reduced by 10% per day past the submission date. Students are referred to University of Manitoba policies regarding plagiarism, cheating, impersonation and attendance.
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Tentative Itinerary

**Day 1  Wednesday, August 20th**

8:30  Meet at the Ellis Building on the Fort Garry Campus

8:30  Introductions (in 318 Ellis Building)
-  Personal introductions of students and instructors and support staff.
-  Review course outline and objectives.

9:00  Quiz on preparatory readings

1)  **Preparations for Field Work**

9:30  Soil Science Shed, east of Ellis Building

   **1 a) Etiquette in the Field** (with David Lobb)
   -  Waste, fences, working around farm animals, vehicles, flagging, pits, etc.

   **1 b) Health and Safety** (with Tim Stem)
   -  Getting to the field: notification of colleagues, contact information, cell phone, GPS, transportation, securing equipment within vehicle, hauling equipment.
   -  Safety in the field: notification of land owner/land manager, working alone, using ATVs, emergency first aid, plants, insects, wild animals, hunters, and other hazards.

   Exercise: preparing health and safety supplies, loading equipment and supplies into vehicles, attaching trailers, loading and unloading equipment onto trailers.

11:30  Lunch Break (in 344 Ellis Building)
Background presentation on the biophysical survey in South Tobacco Creek Watershed.

1:00  **1 c) Tracking Down Information Before Going to the Field** (with David Lobb)
   -  Collecting maps, air photos, etc.

1:45  **1 d) Geo-referencing** (with Bo Pan)
   -  Maps, markers and Global Positioning Systems (GPS)

2:30  **1 e) Topographic Surveying** (with Bo Pan)
   -  The basics (tape line and level, inclinometer, rod and level), using a total station.

3:15  **1 f) Soil Sampling Equipment** (with Tim Stem)
   -  Shovels, augers, corers; using the Giddings.

   Exercise: Navigation with GPS, surveying with total station, soil coring, sampling strategies.

4:00  Complete and submit assignments (in 318 Ellis Building)
The assignment will to prepare short written answers to a few technical questions provided to students at the beginning of the day and/or to prepare a short quantitative answer based on data collected by the students during the exercises.

5:00  End of Day 1
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**Tentative Itinerary, continued**

**Day 2  Thursday, August 21st**

8:00  Meet at Ellis Building on Fort Garry Campus

8:15  Depart for Carman Research Station

9:15  Arrive at Carman Research Station and Introduction by Alvin Iverson

**2) Soil and Water**

9:30  **2a) Soil-Water Status** (with Paul Bullock)

Demonstrations: TDR probes, hydrosense probes, tensiometer.

Exercises: Installation, calibration and use TDR probes, hydrosense probes.

11:45  Lunch Break

12:45  **2b) Soil-Water Processes** (with David Lobb)

Demonstrations: permeameter, rainulator, infiltrometer.

Exercises: Installation and use of rainulator.

3:00  Return to Winnipeg

4:00  Complete and submit assignments (in 318 Ellis Building)

The assignment will to prepare short written answers to a few technical questions provided to students at the beginning of the day and/or to prepare a short quantitative answer based on data collected by the students during the exercises.

5:00  End of Day 2

Note: Activities for Day 2 and Day 3 may be switched if weather conditions for Day 3 will be wet and wetter than Day 2 – the Glenlea Research Station can be extremely difficult to access if the ground is wet.
Day 3  Friday, August 22nd

8:00  Meet at Ellis Building on Fort Garry Campus
8:15  Depart for Glenlea Research Station
8:45  Arrive at Glenlea Research Station and Introduction by Mario Tenuta (to be confirmed)

3) Soil and Atmospheric Environment

9:00  3a) Soil Environment and Meteorology (with Paul Bullock)
     Demonstrations: meteorologic stations (soil and atmosphere temperature, wind speed, humidity, etc.), data loggers.
     Exercises: Installation and calibration of soil and air temperature and precipitation monitoring equipment.

11:45 Lunch Break

12:45 3b) Soil-Atmosphere Trace Gas Exchange (with Mario Tenuta and David Lobb)
     Demonstrations: tuneable diode lasers (TDLs), soil surface flux chambers, soil profile gas samplers.
     Exercises: Installation of surface flux chambers and gas sampling.

3:30 Return to Winnipeg

4:00  Complete and submit assignments (in 318 Ellis Building)
     The assignment will to prepare short written answers to a few technical questions provided to students at the beginning of the day and/or to prepare short numerical answers based on data collected by the students.

5:00  End of Day 3

Note: Activities for Day 2 and Day 3 may be switched if weather conditions for Day 3 will be wet and wetter than Day 2 – the Glenlea Research Station can be extremely difficult to access if the ground is wet.
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Tentative Itinerary, continued

Day 4  Monday, August 25th

4) Biophysical Survey

Resource persons for the biophysical survey:  David Lobb, Halya Petzold, Bo Pan, Don Cruickshank, Mitch Timmerman and others

7:30  Meet at Ellis Building on Fort Garry Campus
7:45  Depart for South Tobacco Creek Watershed
9:00  Introduction to the watershed at Miami Station (with Don Cruickshank)
9:15  Tour of the watershed (with Don Cruickshank and David Lobb)
      Overview of the climate, geology, soils, vegetation, topography, hydrology and land use.
11:00 Establishment sampling transects (37W field site): identification of general biophysical units and
      sampling points, georeferencing, characterization of topography.
12:00 Lunch and Bathroom Break in Miami
1:00  Establishment sampling transects (Graham Crossing field site): identification of general
      biophysical units and sampling points, georeferencing, characterization of topography.
5:00  Depart for Oxbow Inn in Carman
6:00  Supper in Carman
7:30  Review data and preliminary work on the report

Day 5  Tuesday, August 26th

4) Biophysical Survey Cont’d

8:00  Depart from Carman for South Tobacco Creek Watershed
8:30  Biophysical survey (37W field site): identification of geomorphic units, description of soil
      profiles.
12:00 Lunch and Bathroom Break in Miami
1:00  Biophysical survey (Graham Crossing field site): identification of geomorphic units, description
      of soil profiles.
5:30  Depart for Oxbow Inn in Carman
6:00  Supper in Carman
7:30  Review data and preliminary work on the report
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Tentative Itinerary, continued

**Day 6  Wednesday, August 27th**

4) **Biophysical Survey Cont’d**

8:00  Depart from Carman for South Tobacco Creek Watershed

8:30  Biophysical survey (Graham Crossing field site): description of soil profiles.

12:00  Lunch and Bathroom Break in Carman

1:00  Biophysical survey (Graham Crossing field site): description of soil profiles.

4:30  Depart for Winnipeg

6:00  Return to Winnipeg

**Post-Field Trip: Thursday, August 30th to Wednesday, September 3rd**

Completion of the Field Trip Report

The field trip report must be submitted no later than September 3rd to allow the assessment of the final grades. Work on the report will begin during the evenings of August 25th and 26th, but about one additional day of work is expected for completion of the report. The instructor will be available in Room 318 Ellis Building on Thursday, August 28th and Friday, August 29th to assist students in completing the reports.
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Personal Gear for the Field

The first three days of the course will take place in the Winnipeg area and will be based out of the University of Manitoba. The last three days in the course will take place in the South Tobacco Creek Watershed near Miami and will be based out of Carman. Students must bring appropriate clothing and other required supplies to keep themselves comfortable and healthy while in the field for varying durations and under a range of weather conditions.

☐ Hat
☐ Short and long sleeved shirts
☐ Short and long pants
☐ Jacket
☐ Rain coat
☐ Hiking shoes or boots
☐ Rubber boots
☐ Extra socks, for the inevitable soaker
☐ Sun screen
☐ Bug dope
☐ Water bottle
☐ Day pack for clothes, food and water
☐ Cash for food
☐ Camera, if possible
☐ Laptop computer (for use in classrooms and hotel), if possible

Note: Students must make the instructors aware of any medical conditions and must bring any required medications.

Note: For the first three days of the course, while based out of Winnipeg, students must bring their lunches.

Note: For the second three days, while based out of Carman, students will have lunch provided at a restaurant in Miami, however, students should bring some food and water to the field. Students are responsible for their own breakfasts and suppers. Some of the hotel rooms have kitchenettes to store and prepare food and beverages. There are restaurants and grocery stores in Carman.

Note: While based out of Carman, students will stay at the Oxbow Inn (www.oxbowinn.ca). In each room there are two double beds and there will be two students per room. As noted above, some rooms have kitchenettes, which all students will share. All rooms have wireless internet.
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Course Gear for the Biophysical Survey

Students will be organized into groups to carry out the biophysical survey. Each group will have a field kit which consists of many items listed below:

**Group Field Kit:**

- Field guide (1) (map, air photos, geology, soil and vegetation information)
- Field note book (1)
- Clip board (1)
- Survey sheets (20)
- Pencils (2) and pens (2)
- Pails (2)
- Rubbermaid tub (1)
- Sample bags (100 large and 20 small)
- Labels (100)
- Markers (2)
- Trail marking tape (2 rolls)
- Marking flags (50)
- Meter stick (1)
- Tape line (5 m) (1)
- Tape line (50 m) (1)
- Inclinometer (1)
- Bubble level (1)
- GPS (1)
- Compass (1)
- Dutch Auger (1) and extension (1)
- Backsaver Handle and Probe (1) and spare probe (1)
- Shovels (2)
- Trowel (1) and knives (2)
- Work gloves (3 pair)
- Munsell colour chart (1)
- Acid bottle (1)
- Soil thermometer (1)
- Stopwatch (1)
- Shoulder bag (1)
- First Aid Kit (1)
- Two-way radio (1)
- Whistle (1)
- Toilet paper roll (1)
- Garbage bags (2)
In addition to the group field kits, there will be many items listed below which all students will have access to:

**Course Field Gear:**

- Course Field Kit (one additional set of all of the above)
- Two, 7-person vans and trailer
- ATV and trailer
- First Aid kit, one per vehicle
- Calamine lotion
- Soap
- Anti histamine
- Polysporin
- Sugar
- Cooler for food
- Extra food
- Extra water
- Cell phone, and battery charger
- Two-way radio, and battery charger
- Camera
- Video Camera
- Total Station, and battery charger and spare batteries
- DGPS, and battery charger and spare batteries
- Three GPS, hand-held and spare batteries
- Percussion corer, and generator and fuel
- Water EC and temperature meter
- Steven’s Hydroprobe