**Course Outline Form: Fall 2017**

# General Information

**Course Title:** Soil organic matter and biochemistry; ENVS\*6350

**Course Description:** Soil organic matter characterization, dynamics of soil organic matter, nutrient cycling.

**Credit Weight**: 0.5

**Academic Department (or campus):** School of Environmental Sciences

**Campus:** Guelph

**Semester Offering:** Fall 2017 **Class Schedule and Location:** TBD  **Instructor Information**

Instructor Name: Professor Paul Voroney

Instructor E[mail: pvoroney@uoguelph.ca](mailto:pvoroney@uoguelph.ca)

Office location and office hours: ALEX 217; by appointment

# Course Content

The learning activities during the semester will involve lectures, readings, and student seminars to provide students with the background for a modeling exercise of a soil/crop agricultural system. During the latter half of the course, students will work on the progressive construction of a Century model of their chosen soil/crop system for describing agricultural management effects on C/N/P dynamics.

## Learning Objectives:

1. *Critical and Creative Thinking:*
   1. Reinforcement of *Inquiry and Analysis* through critical review of scientific journal articles.
   2. Reinforcement of *Integrative and Applied Learning* through a research topic which evaluates potential effects of management practices to the problem of maintaining and enhancing soil organic matter stocks.
2. Literacy:
   1. Reinforcement of Collaborative Literacy through the selection of a group topic for research and oral presentation.
   2. Reinforcement of Depth and Breadth of Understanding through individual research for oral and written project.
3. Global Understanding:
   1. Introduction of Global Knowledge through research and review of relevant scientific literature describing contrasting agroecosystems, e.g. tropical soils.
   2. Introduction of Intercultural Knowledge and Competence through research and review of relevant scientific literature describing contrasting management systems.
4. Communicating:
   1. Reinforcement of Oral Communication through oral presentations associated with selected topics in soil organic matter.
   2. Reinforcement of Reading Comprehension through individual research topics and written paper.
5. Professional and Ethical Behavior:
   1. Reinforcement of Teamwork through selection of research topics of interest to the class and promotion of active participation in classroom.

## Lecture Content:

Students will be assigned scientific articles to critically review and lead a seminar/ discussion of the articles. The seminar should be a maximum of 20-25 min (~10-12 power point slides) with

~20 min devoted to questions and discussion.

## Course outline:

1. Introduction- what is soil organic matter (SOM)
2. Carbon cycling and SOM
   * long term carbon cycle
   * short term carbon cycle
3. Nature (chemical, physical and biological) and dynamics (pool sizes and kinetics) of the components of SOM
4. components of SOM
5. methods for studying pool sizes/dynamics of SOM
   * tracer techniques: 14C, 13C, 15N (natural and enriched)
   * chemical methods
   * physical methods
6. modeling the dynamics of soil organic matter (SOM)
   * general approach and utility
   * specific models: CENTURY (DayCent); ROTHC
7. Processes affecting SOM
8. cultivation and annual cropping
9. inputs of plant residues, light fraction & particulate organic matter
10. decomposition of plant residues
11. synthesis of microbial biomass, carbon-use efficiency
12. stabilization of organic matter, physical protection, chemical recalcitrance
13. aggregation and soil texture
14. Importance of SOM in:
15. soil physical, chemical and biological properties
16. soil fertility (with special reference to N and P):
17. internal nutrient cycle: MIT
18. greenhouse gas emissions (CO2, N2O, NH3, CH4)
19. C and N sequestration

## Course Assignments and Tests:

|  |  |  |  |
| --- | --- | --- | --- |
| Assignment | Due Date | Contribution to Final Mark (%) | Learning Outcomes Assessed |
| Student led seminars(2) | Beginning Oct 10 | 30 | 1.2,2.1,3.1,3.2,4.1,5.1 |
| Quizzes (2) | Sept 21  Oct 5 | 20 | 1.1,2.1,2.2,3.1,3.2,4.1,3.1,3.2,4.1,5.1 |
| Century modeling exercise  (oral presentation) | Weeks 9-10 | 15 | 1.1,2.2,3.1,3.2,4.1,5.1 |
| Century modeling (written paper) | Last day of classes | 35 | 1.1,1.2,2.1,2.2,3.2,4.2,5.1 |

**Final examination date and time:** Not applicable

# Course Resources

**Required Texts:** None **Recommended Texts:** None **Lab Manual:** None

**Other Resources:** Students readings from scientific journal articles

**Field Trips:** Not applicable

# Course Policies

**Grading Policies:** Assignments are due on the date indicated and should be submitted at the start of the class or to my office (ALEX 217) by the end of the day. The penalty for late submission is -10% of the earned mark for submission anytime within the first 24 hours; -5% for

anytime within each subsequent 24 hours. Documentation for valid excuses for late or missing assignments needs to be provided.

**Course Policy on Group Work:** Not applicable

## Course Policy regarding use of electronic devices and recording of lectures:

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

# University Policies

## Academic Consideration:

The University of Guelph is committed to supporting students in their learning experiences and responding to their individual needs and is aware that a variety of situations or events beyond the student's control may affect academic performance. Support is provided to accommodate academic needs in the face of personal difficulties or unforeseen events in the form of Academic Consideration.

Information on regulations and procedures for Academic Consideration, Appeals and Petitions, including categories, grounds, timelines and appeals can be found in [Section VIII](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml)  [(Undergraduate Degree Regulations and Procedures) of the Undergraduate Calendar](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml).

## Academic Misconduct:

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Detailed information regarding the Academic Misconduct policy is available in [Section VIII](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml)  [(Undergraduate Degree Regulations and Procedures) of the Undergraduate Calendar](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml).

## Accessibility:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services (SAS), formerly Centre for Students with Disabilities (CSD), as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email [sas@uoguelph.ca](mailto:sas@uoguelph.ca) or visit the [Student Accessibility Services website (http://www.uoguelph.ca/csd/)](http://www.uoguelph.ca/csd/).

## Course Evaluation Information:

End of semester course and instructor evaluations provide students the opportunity to have their comments and opinions used as an important component in the Faculty Tenure and Promotion process, and as valuable feedback to help instructors enhance the quality of their teaching effectiveness and course delivery.

While many course evaluations are conducted in class others are now conducted online. Please refer to the [Course and Instructor Evaluation Website](https://courseeval.uoguelph.ca/) for more information.

## Drop period:

The drop period for single semester courses starts at the beginning of the add period and extends to the Fortieth (40th) class day of the current semester (the last date to drop a single semester courses without academic penalty) which is listed in [Section III (Schedule of Dates) of](https://www.uoguelph.ca/registrar/calendars/)  [the Undergraduate Calendar](https://www.uoguelph.ca/registrar/calendars/).

The drop period for two semester courses starts at the beginning of the add period in the first semester and extends to the last day of the add period in the second semester.

Information about Dropping Courses can be found in [Section VIII (Undergraduate Degree](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/)  [Regulations and Procedures) of the Undergraduate Calendar](https://www.uoguelph.ca/registrar/calendars/undergraduate/current/).

# Additional Course Information

* Class seminar/discussion/questioning

-assigned papers for review

-search out additional paper(s) on topic, annotate and share with class

-class presentation (~10 slides)

* Century simulation modeling exercise (go to NREL at Colorado State University)

[(htt](http://www.nrel.colostate.edu/))p[://www.nrel.colostate.edu/)](http://www.nrel.colostate.edu/)) and under Research

o List of NREL projects

Down load CENTURY 4 material<http://www.nrel.colostate.edu/projects/century/>

-major research paper related to thesis research

-testable research hypothesis

-computer modeling to do research

-class presentation

-format of a scientific article

* Annotated bibliography

-obtain appropriate software for reference organization and citing- e.g. Procite

- organize in terms of research topics/methodology/

-prepare brief summary of scientific articles

-should contain 20-40 articles by the end of the class

## Textbook

Soil microbiology, ecology and biochemistry. 2007. Editor E.A. Paul, 3rd Edition. Academic Press.

- Chapters 1, 2, 12, 13, 14, 15 and 16

Soil microbiology, ecology and biochemistry. 2014. Editor E.A. Paul, 4th Edition. Academic Press.

- Chapters 1, 2, 12, 13, 14, and 17