

GGR302H1S – Soil and Water Landscape Processes

INSTRUCTOR: Roger Phillips, Ph.D., P.Geo.
Email: roger.phillips@utoronto.ca
Office: Earth Sciences Centre 2124
Office Hours: Tuesdays 4-5 p.m.; Thursdays 1-2 p.m.
or by appointment

LECTURE and DISCUSSIONS : Thursdays 10:00 a.m. – 1:00 p.m. **Location:** ES2119

TEACHING ASSISTANT: Sydney Baker
Email: sydney.baker@mail.utoronto.ca

COURSE DESCRIPTION: An introduction to physical and chemical processes operating at micro- to landscape scales and their effects on soil and water quality. Discussion of anthropogenic impacts and management and conservation issues. Local and international case studies.

COURSE OBJECTIVES:

- 1) Gain a deeper scientific knowledge in hydrology, soil science, biogeochemistry, and hydrogeology
- 2) Critically assess scientific literature given differing perspectives, methods, and conclusions
- 3) Build competence and skills in reading and writing about technical scientific research
- 4) Appreciate scientific uncertainty and professional ethics in environmental management
- 5) Engage with current practices, guidelines, and government regulations in industry

COURSE TOPICS and FORMAT: This course will be taught using a combination of lectures and discussions of scientific literature to explore soil and water landscape processes, building on the disciplines of soil science, hydrology, biogeochemistry, hydrogeology, geomorphology, and environmental engineering. The four main topics to be covered are 1) watershed hydrology; 2) riparian biogeochemistry; 3) hydrogeology; and 4) urban stormwater management. The overarching themes are scale (process to landscape) and sustainable environmental management, with a particular emphasis on urban environments.

This is a READING course, with at about three (3) assigned readings per week—you must complete the weekly readings to participate and be successful in the this course! Students are required to develop at least two (2) discussion questions each week based on the readings. About half of the class time will be used to discuss the readings in the class. Selected readings in some weeks will also require students to submit written summaries based on standardized questions.

The last three weeks of the term will focus on urban environments and will incorporate topics presented at the 2018 TRIECA conference in Brampton March 21–22 (www.trieca.com). TRIECA is an industry conference organized by Toronto and Region Conservation (TRCA) and the Canadian Chapter of the International Erosion Control Association (IECA). The TRIECA conference topics focus on stormwater management, erosion and sediment control, and river engineering.

RECOMMENDED PREPARATION: 8.0 FCE's including GGR205H1 and GGR206H1

EVALUATION:	Participation (10 weeks x 1%)	10%
	Reading Summaries (6 weeks x 5%)	30%
	Midterm (take-home Feb 15–March 1)	20%
	TRIECA Discussion Topic Summary and Presentation	10%
	Final Exam	30%

Note: Excluding week 1, students are required to submit 2 discussion questions each week before class. Discussion questions will be evaluated as part of the Participation and Reading Summary marks.

USE OF BLACKBOARD: Course information, assignments, and links to required course readings will be posted on the Blackboard system.

REQUIRED READINGS: Weekly readings will be assigned and posted on Blackboard. Most course readings will be available at the beginning of the term, but some additional readings may be assigned during the semester. Typically three (3) papers will be assigned for reading each week and up to half of the class time will be dedicated to discussing the readings. Six weeks are identified in the detailed course schedule (below), where two (2) papers will require written summaries to be submitted by students in advance of class time.

Course Schedule

Jan 4 – Introduction to course topics and themes

Jan 11 – Watershed and isotope hydrology, introduction to hydrogeology

Jan 18* – Rainfall-runoff processes, the representative elementary area (REA) concept

Jan 25* – Hydrological flow paths, isotopic hydrograph separation (IHS)

Feb 1 – Biogeochemical cycles, carbon, nitrogen, phosphorus

Feb 8* – Riparian biogeochemistry and denitrification

Feb 15* – Water quality, phosphorus and mercury

Feb 15–March 1: Take-home Midterm Exam

March 1 – Surface geology and hydrogeology

March 8* – Hydrogeology and hydrostratigraphy

March 15* – Geochemistry and groundwater contamination, urban hydrology

March 21–22 – TRIECA conference topics (see program www.trieca.com)

March 29 – Urban stormwater management, erosion control, stream restoration

April 9–30: Final Exam Period

***Note:** the six weeks identified will include written summaries for 2 assigned readings to be submitted by students in advance of class.

PROFESSIONAL GEOSCIENCE: The course is intended to provide students an environmental geoscience perspective in terms of the application of science, government regulation, and professional ethics. This offering of GGR302 is potentially eligible to be an accepted course under APGO knowledge requirements for professional geoscience registration (P.Ge.) in Group 2C (Earth Systems) within the Environmental Geoscience stream.

For more information about Professional Geoscience accreditation, students are encouraged to visit www.apgo.net and to sign-up for free as a student member.

SPRING 2018 Lecture and Reading Schedule:

Week	Date	Lecture Topics and Readings
1	Jan 4	Introduction to course topics and themes <i>Background Reading:</i> Schoonover <i>et al.</i> 2015. <i>An Introduction to Soil Concepts and the Role of Soils in Watershed Management.</i>
2	Jan 11	Watershed and isotope hydrology, introduction to hydrogeology <i>Background Reading:</i> Brassington, 2007. <i>Field Hydrogeology</i> (only Chapter one this week). Edwards <i>et al.</i> 2015. <i>Fundamentals of Watershed Hydrology.</i> Gibson <i>et al.</i> 2005. <i>Progress in isotope tracer hydrology in Canada.</i>
3	Jan 18*	Rainfall-runoff processes, the representative elementary area (REA) concept <i>Background Reading:</i> Fan and Bras, 1995. <i>On the concept of a representative elementary area in catchment runoff.</i> <i>*Readings to Summarize:</i> Ditszun and Uhlenbrook, 2008. <i>Scaling of dominant runoff generation processes: Nested catchments approach using multiple tracers.</i> Asano and Uchida, 2010. <i>Is representative elementary area defined by a simple mixing of variable small streams in headwater catchments?</i>
4	Jan 25*	Hydrological flow paths, isotopic hydrograph separation (IHS) <i>Background Reading:</i> Klaus and McDonnell, 2013. <i>Hydrograph separation using stable isotopes: Review and evaluation.</i> <i>*Readings to Summarize:</i> Laudon <i>et al.</i> 2004. <i>Hydrological flow paths during snowmelt: Congruence between hydrometric measurements and oxygen 18 in meltwater, soil water, and runoff.</i> Kirchner, 2016. <i>Aggregation in environmental systems – Part 2: Catchment mean transit times and young water fractions under hydrologic nonstationarity.</i>
5	Feb 1	Biogeochemical cycles, carbon, nitrogen, phosphorus <i>Background Reading:</i> Vidon <i>et al.</i> 2010. <i>Hot spots and hot moments in riparian zones: Potential for improved water quality management.</i>
6	Feb 8*	Riparian biogeochemistry and denitrification <i>Background Reading:</i> Vidon and Hill, 2004. <i>Landscape controls on nitrate removal in stream riparian zones.</i> <i>*Readings to Summarize:</i> Hill <i>et al.</i> 2014. <i>Long-term nitrate removal in a stream riparian zone.</i> Tesoriero <i>et al.</i> 2013. <i>Vulnerability of streams to legacy nitrate sources.</i>

7	<p>Feb 15* Water quality, phosphorus and mercury</p> <p><u>*Readings to Summarize:</u> Mitchell <i>et al.</i> 2008. <i>Spatial characteristics of net methylmercury production hot spots in peatlands</i></p> <p>Dupas <i>et al.</i> 2015. <i>Distinct export dynamics for dissolved and particulate phosphorus reveal independent transport mechanisms in an arable headwater catchment.</i></p> <p>Start take-home midterm — Feb 15 to March 1 (online submission due Feb 28 at 11:59 pm)</p>
Reading Week Feb 19–23	
8	<p>Mar 1 Surface geology and hydrogeology (<u>hardcopy midterm papers due in class at 10 am</u>)</p> <p><u>Background Reading:</u> Brassington, 2007. <i>Field Hydrogeology.</i></p> <p>Carrera <i>et al.</i> 2005. <i>Inverse problem in hydrogeology.</i></p>
9	<p>Mar 8* Physical hydrogeology and hydrostratigraphy</p> <p><u>Background Reading:</u> Eaton, 2006. <i>On the importance of geological heterogeneity for flow simulation.</i></p> <p><u>*Readings to Summarize:</u> Gerber and Howard, 2002. <i>Hydrogeology of the Oak Ridges Moraine aquifer system: Implications for protection and management from the Duffins Creek watershed.</i></p> <p>Bajc <i>et al.</i> 2014. <i>A three-dimensional hydrostratigraphic model of the Waterloo Moraine area, southern Ontario, Canada.</i></p>
10	<p>Mar 15* Geochemistry and groundwater contamination, urban hydrology</p> <p><u>Background Reading:</u> Haile-Meskale and Holysh, 2016. <i>Some aspects of the origin of the naturally occurring sodium chloride waters in eastern Ontario.</i></p> <p><u>*Readings to Summarize:</u> Stotler <i>et al.</i> 2014. <i>Insights gained from geochemical studies in the Waterloo Moraine: Indications and implications for anthropogenic loading.</i></p> <p>Meriano <i>et al.</i> 2014. <i>Hydrogeological impacts of road salt from Canada's busiest highway on a Lake Ontario watershed (Frenchman's Bay) and lagoon, City of Pickering.</i></p>
11	<p>Mar 22 TRIECA conference (see program at www.trieca.com)</p> <p><u>Background Reading:</u> Dietz, 2007. <i>Low Impact Development practices: A review of current research and recommendations for future directions.</i></p> <p>Davis <i>et al.</i> 2009. <i>Bioretention technology: Overview of current practice and future needs.</i></p> <p>Ahiablame <i>et al.</i> 2012. <i>Effectiveness of Low Impact Development practices: Literature review and suggestions for future research.</i></p> <p>Burns <i>et al.</i> 2012. <i>Hydrologic shortcomings of conventional urban stormwater management and opportunities for reform.</i></p>
12	<p>Mar 29 Urban stormwater management, erosion control, stream restoration TRIECA debrief and student presentations</p>

COURSE POLICIES

Attendance and participation: It is expected that students will attend class, having completed the assigned readings. Students will need to sign an attendance sheet in each class in order to be evaluated on their term participation mark (10%). Most weeks will also require students to submit discussion questions in advance of class that will be evaluated as part of their participation mark. For classes that include discussion of reading summary assignments (*six weeks identified), student attendance in class will be required to be evaluated on their assignments (6 x 5% = 30%). With permission from the instructor within 24 hours of class (before or after), absence from one (1) class may be allowed without penalty on the assignment, but assignment due dates will not be changed without formal accommodation procedures (see Late Assignment policies below).

*As described above, please note that **40% of the term mark** is tied to class attendance.*

Class conduct: Respectful behaviour towards the instructor and your classmates is mandatory during class and in all correspondences dealing with the course. This includes arriving in class on time, not talking during lectures, and limiting cell phone use (please set to silent). Use of laptop computers for note taking is acceptable. To avoid distracting other students, please limit internet browsing, email, and other social media during class time.

Copyright in instructional settings: No photography, sound-recording, or video-recording will be permitted during lecture or discussion sessions. If a student wishes to reproduce lecture presentations, course notes, or other similar materials provided by the instructor and TA's, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited. In the case of private use by students with accessibility needs, the instructor's consent will not be unreasonably withheld.

Communication and email: Students are encouraged to ask questions in class and office hours. All emails must be from a UofT account, and include GGR302 in the subject heading with your full name signed in text. Emails will normally be returned within 48 hrs. Questions that require extensive responses are to be asked during office hours or in class, not via email.

ASSIGNMENT SUBMISSIONS

All assignment and midterm submissions will be due by Wednesday 11:59 pm to **Blackboard and Turnitin.com** the day before the Thursday class time indicated for each assignment. Hardcopy assignments are also to be submitted in the Thursday class.

Blackboard submission instructions: <http://portalinfo.utoronto.ca/content/submitting-assignments>

Turnitin.com: *"Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site."*

Turnitin.com instructions: <http://portalinfo.utoronto.ca/content/submit-turnitin-assignment>

Weekly discussion questions: are to be submitted on Blackboard in advance of class (Wed 11:59 pm), with hardcopies also submitted in class (Turnitin.com not required for discussion questions).

Late assignments: Late assignments will be penalized **5% per day, including weekends and holidays, and will not be accepted if more than 1 week late.** Late assignments may be submitted to Blackboard with hardcopies submitted to the Geography Department drop box (SSH 5047) or directly to the instructor during office hours. Submission time will be based on the online Blackboard submission. Blackboard submissions within 24 hours after Wednesday 11:59 pm will be considered 1 day late (5% penalty) even if the submission is made before class on Thursday at 10:00 am.

Extensions without penalty are only granted in cases of illness or family emergency. If accommodation is required for late submission of assignments or a missed midterm examination, students will be required to do the following:

- Inform the instructor by email within 24 hours of the due date/time (before or after); and
- Submit a UofT Medical Certificate to the Instructor or Department of Geography within 5 days of the missed assignment or midterm exam.

Failure to comply with this policy can result in a grade of zero for the assignment or midterm in question. Deferred final exams and family emergencies are dealt with by the Registrar's office of your college or faculty.

Returning marked assignments and course drop deadline: The instructor and TA will make every effort to return marked Lab Assignments within one or two weeks after the submission date or students will be notified by email of the expected return date using the Blackboard class list. Please note that **March 14th, 2018** is the deadline to drop S courses. It is expected that the marks for the first four reading summary assignments (20% of final grade) and for the midterm (20% of final grade) will be available on or before Tuesday March 13th, 2018.

Academic integrity: Academic dishonesty, including plagiarism, will not be accepted. It is recommended that you consult the 'How not to plagiarize' website at:

<http://www.artsci.utoronto.ca/newstudents/transition/academic/plagiarism>

Please review the "Rules and Regulations" section of the Arts and Science Calendar for further information: http://www.artsandscience.utoronto.ca/ofr/calendar/Rules_&_Regulations.html

Writing centres: additional resources for writing can be found at:

<http://www.writing.utoronto.ca/writing-centres/arts-and-science>.

Accessibility: The University of Toronto is committed to accessibility. Students requiring accommodation are encouraged to discuss their needs with the instructor within the first two weeks of class, and should register with Accessibility Services in the Robarts library, 1st floor, 130 St. George Street, Toronto (<http://www.accessibility.utoronto.ca>).

Accommodations for religious observances: Please alert the instructor at least 2 weeks in advance if assignment due dates or examinations conflict with religious holidays, so alternate arrangements can be made. For further policy information from the university see:

<http://www.viceprovoststudents.utoronto.ca/publicationsandpolicies/guidelines/religiousobservances.htm>