

McGill University

Department of Geography

GEOG 505 Global Biogeochemistry 2015

Instructor: Nigel Roulet, BH 620, 398-4945, nigel.roulet@mcgill.ca

Tim Moore, BH626, 398-4961, tim.moore@mcgill.ca

Class time: Tuesday 9:05 – 12.05 Room 426 Burnside Hall

Office hours: Roulet - by appointment

Moore - by appointment

Outline and Format

This course will focus on biogeochemistry, with an emphasis on biogeochemical cycling at two different scales: plot to catchment, and the globe. We shall examine the storage and pathways of major elements and chemical species, their role in controlling catchment and global systems and the effect of human activity on these cycles. At the global scale, we will focus on carbon and at the catchment to plot scale, we will focus on nitrogen.

The course comprises a number of lectures and several student and/or professor-led discussions reviewing recent articles from journals such as *Global Biogeochemical Cycles*, *JGR-Biogeosciences*, *Ecosystems*, *Nature* and *Science*. For the student-led discussions students will be responsible for critically summarizing 3 to 4 papers over the duration of the course. Each student will lead a 10 to 15 minute discussion of the papers they are assigned. This entails an introduction to the paper and its context, the scientific questions asked, the important findings and conclusions, and the points of debate (e.g., contradictions with other results etc.). Whether the discussion is being led by a student or one of the professors, students are expected to have read all the papers for that week.

There will be two group projects where the group will attempt to resolve the cycle of an elemental or chemical species cycle at either the global scale or catchment/ecosystem scale. The group projects should be prepared using papers in the primary literature as the major source. The finding of the group project will be presented by the group in class. Each member of the group will produce a written report describing their subcomponent of the global or catchment/ecosystem cycle and contribute to a collective executive summary where the group has to resolve the element budget the best it can based on the evidence in the literature. The individual subsections and executive summary should be collated and submitted as a single group report. The subsections should be short and concise (maximum length of 6 pages, typed, double spaced, excluding tables and diagrams). The executive summary should be a maximum of length of 5 pages (typed, double spaced, including tables and diagrams). The executive summary should also include a statement on the sources of uncertainty and where biogeochemists should invest their efforts to improve the budget. On February 24 and April 7 the group will have 40 minutes to present their major findings (5 minutes for each subsection, 5 minutes for the presentation of the summary, and 10 minutes for questions). The written submissions are due March 10 and April 14, 2015.

The course is open to graduate and advanced undergraduate (with permission) students.

Readings

Three books are of value for an overview of the material presented in the course:

Aber, J. and J. Melillo 1993. *Terrestrial Ecology*. Saunders College Press.

Jacobson, M. C., R. J. Charlson, *et al.* (eds.) 2003. *Earth System Science: From Biogeochemical Cycles to Global Change*. International Geophysics Series. San Diego, Academic Press.

Schlesinger, W.H. and E.S. Bernhardt 2013. *Biogeochemistry: an Analysis of Global Change*. Academic Press, 3rd Ed.

The main readings will be a series of papers, accessible through *MyCourses*.

Grading

Class participation: 20% (paper summaries and quality of discussion)

Group project: 40% (written subsection, executive summary and seminar presentation) for each of the two projects.

Schedule and Topics

Jan. 06 Wk 1 Overview (Roulet)

Jan. 13 Wk 2 Introduction to global biogeochemical cycles; allocation of papers (Moore/Roulet)

Jan. 20 Wk 3 Four foundational papers (group discussions – papers presented by NTR & TRM) and research workshop (Jennifer Zhao)

Jan. 27 Wk 4 Global carbon cycle; assemble budget groups (Roulet) and global budget workshop

Feb. 03 Wk 5 C cycling: feedbacks in the global C cycle (student/professor discussions)

Feb. 10 Wk 6 Soil C (professor discussions) and workshop on progress on budgets

Feb. 17 Wk 7 Dissolved organic carbon (Moore) and 2nd global budget workshop

Feb. 24 Wk 8 Group global biogeochemical ‘budget’ presentations

Mar. 03 ‘Reading week’

Mar 10 Wk 9 Ecosystem – catchment N cycle (Moore) and catchment/ecosystem budget workshop

Mar. 17 Wk 10 N cycling: budgets (student/professor discussions)

Mar. 24 Wk 11 N cycling: inputs to terrestrial ecosystems (student/professor discussions)

Mar. 31 Wk 12 N cycling: head water catchments to continental scale (Roulet)

Apr. 07 Wk 13 Group catchment/ecosystem biogeochemical ‘budget’ presentations

Academic Integrity

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/students/srr for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce qu'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site www.mcgill.ca/students/srr).

Course Communications

On January 1, 2004, McGill University instituted a policy that e-mail will be the official channel of communication (see <http://www.mcgill.ca/email-policy/>). Each student is assigned a unique e-mail address on registration and the instructors will use this address to periodically communicate important information to students. If you do not use the McGill e-mail either arrange to have your messages forwarded to the address you use or inform the instructors of an alternative e-mail address.

In GEOG 505 the instructors use the McGill University *MyCourses* system. You will find the course outline and the reading list on the GEOG 505 course page. With the assistance of the Schulich Library of Science and Engineering staff, the reading list will contain ‘hot links’ to the journal papers we review in this course. The instructors will also post announcements on the course home page so it is important that you regularly check the home page.

Course Evaluations

Course evaluations at McGill University are now done on-line through the Mercury system. Completing the evaluation is voluntary but the results of the evaluation are extremely useful to the instructors and can provide guidance for student who may wish to take this course in the future. We encourage you to participate in the evaluation of this course. The instructor will notify you when the evaluation period opens and will remind you periodically during the evaluation period of the value of completing the evaluations. Thank you.