

McGill University

Department of Geography

GEOG 505 Global Biogeochemistry 2017

Instructors: Tim Moore, BH 626, 398-4961, tim.moore@mcgill.ca
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Class time: Thursday 08:35 - 11:25, Room 426 Burnside Hall
Office hours: 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; at the catchment to plot scale, we will focus on nitrogen.

The course comprises three lectures leading into six student-led discussions reviewing recent journal articles, such as those in *Global Biogeochemical Cycles*, *JGR-Biogeosciences*, *Ecosystems*, *Nature* and *Science*. Students will be responsible for critically summarizing 2 to 3 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.). Students are expected to read all the papers reviewed each week and contribute to the discussion.

There will be a group project (4 students/group) where the groups will attempt to resolve an elemental or chemical species cycle at the global scale, drawing upon the primary literature, and presenting their findings to the class (March 9). Each member of a group will produce a written report describing their subcomponent of the global cycle and contribute to a collective executive summary where an attempt is made to resolve the global budget. 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 March 8, each 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 submission is due March 16, 2017.

Finally, each student is required to write a major paper (maximum length of 15 pages, typed, double spaced, excluding diagrams and tables) on an aspect of biogeochemistry that is of personal interest. The topic for the paper needs to be approved by an instructor. The paper should be an in-depth, critical synthesis of the primary literature of the subject area. On April 06, each student will present a short talk (maximum length of 12 minutes, with 3 minutes for questions; this pattern occurs at major scientific meetings) on the subject of his or her major paper. The paper is due by 16:00, April 10, 2017.

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*. 3rd edition. Elsevier. 688 pp.

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

Grading

Class participation 30% (paper summaries and quality of discussion)

Group project 40% (written subsection, executive summary and seminar presentation)

Term paper 30% (paper and seminar presentation)

Schedule and Topics

Jan. 05 Wk 1 Overview and brief introduction to global biogeochemistry (Roulet/Moore)

Jan. 12 Wk 2 Four foundational papers - papers presented by Roulet & Moore

Jan. 19 Wk 3 Introduction to global biogeochemical cycles; allocation of papers (Moore) and advice on library research by Jennifer Zhao, Schulich Science and Engineering Librarian

Jan. 26 Wk 4 Global carbon cycle; assemble budget group(s) (Roulet)

Feb. 02 Wk 5 Carbon cycling: feedbacks in the global carbon cycle (student discussions)

Feb. 09 Wk 6 Soil carbon (student discussions)

Feb. 16 Wk 7 Dissolved organic carbon (student discussions)

Feb. 23 Wk 8 Ecosystem - catchment N cycle (Moore)

Mar. 02 Reading week

Mar. 09 Wk 9 Group biogeochemical 'budget' presentations

Mar. 16 Wk 10 N cycling: budgets (student discussions)

Mar. 23 Wk 11 N cycling: inputs to terrestrial ecosystems (student discussions)

Mar. 30 Wk 12 N cycling: head water catchments to continental scale (student discussions)

Apr. 06 Wk 13 Student symposium: presentation of term papers

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/honest/ for more information, approved by Senate, 29 January 2003). In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded (approved by Senate, 21 January 2009) - see also the section in this document on assignments and evaluation. For information on university and department policies for student assessment, please go to

<http://www.mcgill.ca/geography/studentassessment>

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.