

## **GEOG 5001            MODELLING ENVIRONMENTAL SYSTEMS    FALL TERM 2021**

This course will be delivered in 2021 IN PERSON. If conditions change, it may be necessary to quickly adjust delivery to a SYNCHRONOS on-line course using the Zoom platform. Such an adjustment will only take place after instructions from the Dean of Arts and Social Sciences.

**Instructor:**            Dr C.R. Burn; A330 Loeb Building  
                                 520-2600 ex.3784; [Christopher.Burn@carleton.ca](mailto:Christopher.Burn@carleton.ca)  
**Office Hours:**        Tuesday, Thursday 10:00-11:00 Via Zoom  
**Lectures:**              Tuesday, Thursday 16:05-17:25 Via Zoom

**Textbooks:**    There is no single textbook for the course but Chalmers (2013) is as close as one might come. You need to acquire:

Winchester, S. 2001. *The map that changed the world*. (Paperback)  
Darwin, C. 1859. *On the origin of species*. (Many editions)  
Maslin, M. 2021. *Climate Change. A very short introduction*. 4<sup>th</sup> ed. (available mid-Sept.)  
Chalmers, A.F. 2013. *What is this thing called science?* 4<sup>th</sup> ed.

There are some copies of these books in MacOdrum Library, but if you cannot access them you will have to buy them. We will read *The map that changed the world* in September, *On the origin of species* in October, and *Climate Change* at the end of the course. Throughout the course you will also be asked to read papers from the refereed literature that are associated with the week's theme.

There is much more reading in this course than in most undergraduate courses you have taken. Over the term you will be exposed to many new ideas. It is imperative that you keep up with the reading. The pace is a significant step up from undergraduate studies. If you fall behind it will be difficult to restore your position, although the fall break will help.

**Objectives:**    *Models are the best we can do, everything else is ballpark back-of-the-envelope stuff. This means we should use models to educate ourselves about possibilities, realizing that their output produces probabilities not measurements.*

([http://earthguide.ucsd.edu/virtualmuseum/climatechange2/07\\_1.shtml](http://earthguide.ucsd.edu/virtualmuseum/climatechange2/07_1.shtml))

The course aims to provide students beginning their graduate program with a structured and comprehensive overview of epistemological frameworks in the environmental earth sciences. It is a course that studies how we construct knowledge in the natural sciences and the belief system, *naturalism*, that governs this epistemology. We consider spatial and temporal variability of environmental data and the scales at which environmental processes occur. We discuss model building and validation of theoretical structures. Towards the end of the semester we discuss science and scientists in the public realm and their role with respect to societal issues. The course is geared to increasing students' ability to evaluate the quality of research they encounter and conduct, and to identify suitable research methods for specific problems. We will also discuss presentation of research.

By the end of the course you will have an understanding of critical approaches to natural science. You will know the key elements of a scientific paper and what you need to examine in

judging its utility. You will have been exposed to various views on the nature of natural science and how it is constructed. One paper that you will be assigned each week concerns the assumptions and beliefs upon which natural science is built and/or aspects of how natural science functions as an activity in society.

**Course topics:** Identifying an environmental system  
 Spatial variability of environmental data  
 Temporal variability of environmental data  
 Evidence  
 Hypotheses  
 Models of environmental systems  
 Experimental method  
 Deterministic and stochastic systems  
 Extreme events  
 Earth history  
 Social role of science

**Program:** Lectures as per schedule  
 Reading as assigned  
 Two book reviews  
 One term paper and presentation  
 Final examination

<b>Evaluation:</b>	Book reviews	2 x 10% = 20%
	Term paper	40%
	Examination	<u>40%</u>
		100%

### Assignments

- 1) Book reviews.** Each month we will read and discuss a book listed on p. 1. Students will prepare reviews of the first two books. Each review will be about 1500 words in length. The review will summarize the contents of the book (400 words) and then comment on the book in the context of the course material (1100 words). The purpose of each review is to illustrate themes in the development of science that represent how we use and consider evidence, to comment on the nature of the arguments that are constructed in the books, and to discuss the limits of the scientific method. The dates for submission of reviews are: October 8<sup>th</sup> and November 5<sup>th</sup>. The reviews should be submitted before 11:59 pm (Eastern). The reviews should be in pdf format, 12 pt Times New Roman font, and double spaced. The submissions should be sent by email directly to the instructor.
- 2) Literature criticism.** Students are required to present a critical assessment of two key papers in their field that are to be chosen in consultation with their supervisor. The assignment is due before 5:00 pm (Eastern) on December 10<sup>th</sup>. The assignment involves review and critique of the methods, results, and overall presentation of the papers. The assignment needs to be positioned in the context of the course material we will cover this term. The paper must be submitted as a pdf by email and should be approximately 3,000

words long. Copies of the papers examined must be provided with the submission.

- 3) A **3-hour examination** will be held in the final exam period. The exam will comprise questions on topics covered in the course and will require knowledge of material covered in lectures and assigned readings. You should read Chalmers (2013) during the term in preparation for the examination. The examination is scheduled by central services, not the instructor. The examination schedule will be released by October 8<sup>th</sup>. The examination will be in open book format. If the University determines that in person examinations will not be possible, the examination will be administered online.
- 4) **Readings** will be assigned on the topics to be covered in the course. Class periods will generally alternate between lecture material and a seminar discussion, led by students, on readings assigned beforehand. All members of the class are required to read the material assigned in preparation for the seminar, and the leadership will rotate through the group. Leaders for the seminar will be selected at the start of the seminar period.

The readings for each week will be two research papers or book chapters concerned with the topic for the week and one article chosen to inform your perspective on science as an intellectual activity. These will represent two strands of reading through the term. Readings will be assigned from journals that are available through the library or through Ares, the MacOdrum library's e-reserve management system:

<https://library.carleton.ca/services/library-reserves-students/e-reserves-ares>

### Plagiarism

The University Senate defines plagiarism as “*presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.*” This may include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks;
- handing in "substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs."

Plagiarism is a serious offence which cannot be resolved directly with or by the course’s instructor. The Associate Dean of the Faculty of Graduate and Postdoctoral Affairs conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They may include a final grade of "F" for the course.

### **Academic Accommodation**

You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. Please review the course outline promptly and forward any requests for academic accommodation to the Instructor during the first two weeks of class, or as soon as possible after the need for accommodation arises.

Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities (PMC) for a formal evaluation of disability-related needs. Documented disabilities could include but are not limited to mobility/physical impairments, specific Learning Disabilities (LD), psychiatric/psychological disabilities, sensory disabilities, Attention Deficit Hyperactivity Disorder (ADHD), and chronic medical conditions. Registered PMC students are required to contact the PMC, 613-520-6608, every term to ensure that the Instructor receives the Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. If you only require accommodations for your formally scheduled exam in this course, you must submit your request for accommodations to PMC by Nov. 12, 2021.

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at <http://carleton.ca/equity/accommodation>.

**Cell phones and social media:** Students must turn off their cell phones before each class. Interruption of classes by users of cell phones is disruptive for instructors and students alike. This includes inattention due to texting during the class. Consultation of social media during classes is similarly inappropriate. It is almost impossible for the Instructor to police such behaviour, but you will find that there will be questions for individual students throughout the on-line meetings and distracted behaviour will become obvious. If it is evident that students prefer social media to the lecture, the instructor will oblige them by leaving the room.

**Uploading of course materials:** Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Reading lists and weekly topic summaries will be distributed via Brightspace.

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

**Key dates:**

- S 09 First class
- S 22 Last day to register in GEOG 5001
- S 30 Last day to withdraw with full fee adjustment and no annotation on transcript
- D 10 Last day to withdraw from GEOG 5001
- D 11 Examination period begins

Other important dates are included elsewhere in this outline.

**Timetable:** we shall adhere to this schedule as much as possible.

- Week 1 S09 Course overview; metaphysics.
- Week 2 S14 Defining environmental systems  
S16 Metaphysics and scientific culture - discussion
- Week 3 S21 Environmental systems – discussion  
S23 Homogeneity, heterogeneity, and spatial scale
- Week 4 S28 Continuity, change, and temporal scale  
S30 Spatial variability – seminar
- Week 5 O05 *The map that changed the world* – discussion  
O07 Hypotheses
- Week 6 O12 Time scales – discussion  
O14 Models of environmental systems
- Week 7 O19 Experimental methods  
O21 Models of environmental systems – discussion
- Week 8 O26 Fall break  
O28 Fall break
- Week 9 N02 *On the origin of species* – discussion  
N04 Fieldwork in environmental science
- Week 10 N09 Hypotheses, proposals, fieldwork - discussion  
N11 Non-deterministic systems - lecture
- Week 11 N16 Experimental methods – discussion  
N18 Singular events - lecture
- Week 12 N23 Non-deterministic systems – discussion  
N25 Singular events - discussion
- Week 13 N30 Student presentations  
D02 Student presentations
- Week 14 D07 Science and society - lecture  
D09 Science and society - seminar