

Draft Outline – ESYS 200 Earth System Processes – 01/10/2012

Overview: The Earth has been transforming itself ever since it formed. People have been altering the Earth ever since our earliest ancestors appeared, but in the 20th century humanity became a significant driver of global change. Earth system science seeks to understand these anthropogenic transformations in the context of the interconnected history and dynamics of the fluid, solid, and living Earth.

Throughout the course, students will progress from descriptive to analytical systems thinking. Upon finishing the course, they will have a scientific understanding of how key interactions among hydrospheric, geologic, and biospheric processes shape the underlying structure of the Earth System, and of the unprecedented modification of that structure by anthropogenic processes.

A pair of Earth system scientists from the departments of Earth and Planetary Sciences and Geography will teach the course. They will incorporate recent scientific discoveries, debates, and policy issues from the perspective of Earth System Science (ESS).

Contact info: Bernhard Lehner [**BL**] – Burnside 612
bernhard.lehner@mcgill.ca – 514 398 8794
Office hours – Whenever the office door is open or by appointment

Boz Wing [**BW**] – FDA 335
boswell.wing@mcgill.ca - 514 398 6772
Office hours – Whenever the office door is open or by appointment

TA: Thi Hao Bui – FDA 349
thi.h.bui@mcgill.ca
Office hours – by appointment

Where: Wong Building 1050

When: Tuesday & Thursday, 10:00-11:30AM

Textbook:

The Earth System, 3/E (2009) by Lee R. Kump, James F. Kasting & Robert G. Crane.
Available at Librairie Paragraphe (2220 McGill College, corner of Sherbrooke Street) and on reserve at the Schulich Library.

Class structure:

ESYS 200 will be taught in two distinct parts. The first part of the course (weeks 1-4) establishes the scientific vocabulary of ESS, enabling us to 'speak the same language' for the second part of the course. While we will touch on many important topics in lecture, the readings from your textbook will present the necessary information in more depth. Material from lectures and readings will be covered in the midterm examination. The lectures from this part of the course will be structured around an ESS

‘toolkit’: a set of concepts, facts, and techniques that Earth System Scientists use to approach their subject.

The second part of the course (weeks 5-13) consists of a sequence of detailed case studies that focus on issues of climate, biodiversity, biogeochemical cycles, and resources from an ESS perspective. The Tuesday class of every week will present an overview of the case study. At the end of class on the previous Thursday, we will hand out an accessible (and short) paper (or set of papers) from the contemporary scientific literature. These papers will review the case study in detail, and will form the basis of the discussion that will take place during the Thursday class of every week. This discussion and your understanding will be facilitated in three ways. We will hand out a short set of questions – due at the beginning of Thursday's class – that will direct your reading of the papers. In addition, each of you will prepare a short presentation on the week's reading once during the semester. These presentations will be given during Thursday's class. Finally, the end of class on Thursday will be taken up with a brief written reflection that summarizes interesting aspects of the case study and discussion.

Expected Learning Outcomes: At the end of this course, students will be able to:

- Distinguish the operating principles of ESS
- Describe the historical development of ESS
- Recognize modern observing and modeling techniques of ESS
- Define the various 'spheres' that make up the Earth System
- Identify and explain important processes taking place within the Earth System
- Evaluate how different processes directly link the spheres of the Earth System
- Appraise topics in climate, biodiversity, biogeochemical cycles, and resources from an Earth System perspective
- Reflect critically and knowledgeably on complex global Earth issues

Tentative lecture schedule: Note that this schedule may be rearranged due to unforeseen conflicts (for example, babies, scientific conferences, train derailments).

Week	Dates	Tu Lecture	Th Lecture
1	Jan 10/12	What is ESS? BL, BW	The ESS Toolkit 1 BW
2	Jan 17/19	The ESS Toolkit 2 BW	The ESS Toolkit 3 BW
3	Jan 24/26	The ESS Toolkit 4 BL	The ESS Toolkit 5 BL
4	Jan 31/Feb 2	The ESS Toolkit 6 BL	Midterm Exam

Lectures on the ESS ‘toolkit’ will be based on readings from *The Earth System 3/E*, which will form the basis for the midterm examination questions.

5	Feb 7/9	Reservoirs: a human benefit or burden to the Earth System? BL	
6	Feb 14/16	Global food resources and/or alternative energies BL	
--	Feb 21/23	Spring Break	
7	Feb 28/Mar 1	Human alterations of the nitrogen cycle BL	
8	Mar 6/8	Rapid decline of sea ice in the high Arctic BL	
9	Mar 13/15	Brave new world: the finite nature of petroleum resources BW	
10	Mar 20/22	Global biospheric catastrophe: Permo-Triassic mass extinction BW	

11	Mar 27/29	Breath of life: Origin of Earth's O ₂ -rich atmosphere BW
12	Apr 3/5	ESS Rosetta stone: Neoproterozoic Snowball Earth BW
13	Apr 10/12	ESS wrap-up

Assessment:

Grades will be awarded on the basis of 5 different aspects of your performance in the class. These are outlined below. Each aspect has been assigned a certain number of points out of a total of 100. The points from each aspect will be totaled and the final percentage will be converted into letter grades following Faculty of Science guidelines.

1. Midterm examination: 20% of total grade (**20** points)

Mostly short questions/answers based on content of lectures and course readings.

2. Short answers to questions about weekly paper: 24% of total grade (**24** points)

These questions will primarily be there to guide your reading of the weekly paper in weeks 5 - 13. There will be ~1 point awarded per question and ~3 questions for each paper. A missed assignment will receive 0 points. Assignments will be due at beginning of Thursday classes.

3. Scheduled short presentation once during the term: 20% of total grade (**20** points)

Evaluation will be based on the following four categories (5 points each):

- i. Understanding and answering the question
- ii. Format of presentation (within time/slide limits: maximum 10-15 min. presentation, 5-10 power point slides or equivalent)
- iii. Responses to Q&A
- iv. Peer evaluation (audience fills in a short questionnaire at end of class)

4. Short (one paragraph) in-class reflections: 5% of total grade (**5** points)

Reflections will be written up and handed in during the last 10-15 minutes of Thursday classes in weeks 5-13. A missed assignment will receive 0 points.

5. Final exam: 25% of total grade (**25** points)

The final exam will be held during the official Winter Term exam period. It will consist of essay answers to questions on material from the 8 case studies, and it is thus important for students to attend the Tuesday lectures.

6. General course participation: 6% of total grade (6 points)

For the general class and discussion participation we will apply the following grading scheme (modified from Anderson & Speck 1998):

- A A student receiving an A (6 points) comes to class prepared; contributes readily to the conversation but doesn't dominate it: makes thoughtful contributions that advance the conversation; shows interest in and respect for others' views; participates actively in small groups.
- A- Comes to class prepared and makes thoughtful comments when called upon, contributes occasionally without prompting: shows interest in and respect for

others' views; participates actively in small groups. An A- score (5 points) may also be appropriate to an active participant whose contributions are less developed or cogent than those of an A but still advance the conversation.

- B+/B A student receiving a B+/B (4 points) comes to class prepared, but does not voluntarily contribute to discussions and gives only minimal answers when called upon. Nevertheless these students show interest in the discussion, listen attentively, and take notes. Students in this category may be shy or introverted. The instructor may choose to give such students an A- if they participate fully in small group discussions or if they make progress in overcoming shyness as the course progresses. Sympathetic counseling of such students often helps.
- B/B- A student receiving a B/B- (3 points) participates in discussion, but in a problematic way. Such students may talk too much, make rambling or tangential contributions, continually interrupt the instructor with digressive questions, bluff their way when unprepared, or otherwise dominate discussions, not acknowledging cues of annoyance from instructor or students. Students in this category often profit from a conference with the instructor.
- C-D Students in this range often seem on the margins of the class and may have a negative effect on the participation of others. Students receiving a C (2 points) often don't participate because they haven't read the material or done the homework. Students receiving a D (1 point) may be actually disruptive, radiating negative energy via hostile or bored body language, or be overtly rude.

NOTE. This scoring guide assumes regular attendance: the instructor may lower participation scores for absences or tardiness.

Other Matters

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 <http://www.mcgill.ca/integrity/> for more information).

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.

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

If you have a disability please contact the instructor to arrange a time to discuss your situation. It would be helpful if you contact the Office for Students with Disabilities at 514-398-6009 before you do this.

Additional policies governing academic issues which affect students can be found in the McGill Charter of Students' Rights (Chapter One of the Student Rights and Responsibilities Handbook available as a PDF on www.mcgill.ca/files/secretariat/Student-Handbook-2008-English.pdf).

McGill University shall strive to be recognized as an environmentally safe and responsible institution, and as a model of environmentally responsible living. (see www.mcgill.ca/tls/policy/environmental_policy)