

## **Draft Outline – ESYS 500: Earth System Applications**

**Overview:** The Earth has been transforming itself ever since it formed. Moreover, people have been altering our planet ever since our earliest ancestors appeared. In the 20<sup>th</sup> century humanity became a significant driver of global environmental change. Earth system science (ESS) 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 collaborate with a team of Earth system scientists from the departments of Atmospheric and Oceanic Sciences, Earth and Planetary Sciences, and Geography. This collaboration will examine a current, real-world issue in Earth system science. Students and faculty will divide into smaller groups and research the chosen issue from different perspectives. They will present and discuss their findings with the entire group, synthesize the results, and prepare a final group manuscript.

**Expected Learning Outcomes:** At the end of this course, students will be able to critically and knowledgeably examine complex global Earth system issues. Through a specific case study, they will develop an understanding of the links among the biological, chemical, physical and human spheres of the Earth System, and the time scales and spatial scales on which they operate.

**Topic for Fall 2007:** *The future of global energy resources*

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

**Course content:** In Fall 2007, the topic for the course will be *'The future of global energy resources'*. We will attempt specific answers to such general questions as: *How will future global demands for energy change? How will this energy demand be met? What are the anticipated Earth system impacts of future energy use? What mix of conventional and renewable energy will be required to minimize the Earth system consequences of future energy use?*

**Class structure:** ESYS 500 will be taught in two distinct parts. One part of the class will involve weekly meetings of the entire cohort of students and faculty, and will involve in-class presentations and discussions of published and original ESS research. The second part of the class will involve the preparation and completion of research projects by 3 small sub-groups of students co-supervised by 2 faculty in each small group. These two components are reflected in the weekly breakdown of the class presented below.

**Tentative class schedule:** Note that this schedule may be rearranged due to unforeseen conflicts (for example, babies, scientific conferences, train derailments). The Tue group meeting activities will take place during class time. The small group activities will take place during class time and/or outside of class. Unless otherwise noted, assignments will be due at the **start** of class on the relevant Tue.

<b>Week</b>	<b>Dates</b>	<b>Tue Group meeting</b>	<b>Small Group activities/Due dates</b>
1	Sept 4	Class Intro	Research question prep
2	Sept 11	Group Lit Disc led by Faculty	<b>Project topic due</b> /Lit review
3	Sept 18	Group Lit Disc led by Faculty	<b>Lit review due</b> /Proposal prep
4	Sept 25	Group Lit Disc led by Faculty	Proposal prep/ <b>Proposal due (09/28)</b>
5	Oct 2	Panel Peer Review of proposals	Review prep/ <b>Reviews due (10/05)</b>
6	Oct 9	Monday schedule (Thanksgiving)	Research project prep
7	Oct 16	How to write a scientific ms	Research project prep
8	Oct 23	Group Disc led by Students	Research project prep
9	Oct 30	Group Disc led by Students	Research project prep
10	Nov 6	Group Disc led by Students	Research project prep
11	Nov 13	Research discussions	<b>1<sup>st</sup> draft ms due</b>
12	Nov 20	Research project presentation	Ms revisions
13	Nov 27	Synthesis discussions	<b>Final ms due</b>
14	Dec 4	Synthesis discussions	<b>Synthesis paper due (Date TBD)</b>

**Assignments (general descriptions – more specific descriptions will be provided in class):**

1. Project topic decision (small group activity)

Parts of the 1<sup>st</sup> and 2<sup>nd</sup> class meetings will be devoted to choosing your research topic for the semester. The selection of a topic of interest will proceed through discussions with the entire class and discussions within small groups.

2. Lit review for project proposal (small group activity):

Each small group member should **briefly** summarize 2 articles that have been written since the beginning of 1998 that provide an overview of critical issues related to your chosen research topic. The summaries should capture the main points of the article and should be limited to ~1

page (double spaced) each. The individual summaries should be submitted together by the small group.

### 3. Project Proposal (small group activity)

Each small group will prepare a short proposal (~ 4 pages, double spaced) about the research question that will be examined during the term. Examples of actual proposals will be provided to guide your preparation.

The proposal will include:

- Statement of, and brief introduction to, the research question
- Review of literature outlining critical findings and current gaps in knowledge
- Proposed work including a description of how the research question will be answered
- Presentation of research methods and work plan outlining individual responsibilities
- Proposed timeline of research progress

### 4. Peer review of proposal and feedback (small group activity)

The entire class will participate in a peer-review panel that will evaluate the different research proposals. Each small group will upload their proposal to WebCT. Each class member will read all proposals and make notes about strengths and weaknesses. Each small group will discuss the proposals of the other groups and prepare a written summary of group feedback.

### 5. Student-led seminar discussion (small group activity, but individually graded)

Each small group will be responsible for leading an in-class discussion related to their research topic. The discussion can focus on a relevant article, or group of articles, from the scientific literature. Other topics of discussion are possible but must be prearranged with the faculty leaders of your small group.

### 6. Research project (small group activity)

Each small group will prepare a final report on the results of their proposed research (~10 pages text, double spaced). The final report will be submitted first as a draft and will be reviewed by the faculty leaders of your small group. A final version will be submitted after faculty comments have been incorporated. The submitted document, jointly prepared by group members, should follow the standard format for a scientific research paper (i.e., Introduction, Methods, Results, Discussion, and Conclusions). A how-to review of writing scientific research manuscripts will be presented in class.

### 7. Presentation of project (small group activity, but individually graded)

Each small group will jointly develop their project presentation. Each student will take responsibility for one aspect of the presentation. Presentations should be practiced with the faculty leaders of your small group before they are given to the entire class.

### 8. Synthesis paper (individual activity)

Each student will prepare a short paper (max. 5 pages text, double spaced) that synthesizes the research results from different small groups. These contributions will identify the linkages among the small group research results, and may discuss future research directions motivated by these interconnections.

**Assessment plan:** Grades will be awarded on the basis of different group and individual activities. Each activity is worth percentage of the final grade, which will be determined following Faculty of Science guidelines for interconverting percentages and letter grades. The process by which each activity will be evaluated is described below. Some general assessment criteria are also given. More specific assessment criteria will be provided in class.

Assignment	Process	Assessment Criteria	Value
Project topic decision	Decided through small group discussions	<ul style="list-style-type: none"> <li>○ Appropriate for course</li> </ul>	Complete/ incomplete
Lit review for project proposal	Small group submission to small group instructors for feedback	<ul style="list-style-type: none"> <li>○ Two post-1998 articles summarized by each group member</li> <li>○ Critical issues identified in each article summary</li> </ul>	Formative feedback
Project proposal	Small group submission to small group instructors for grade. Peer review feedback will be incorporated into assessment.	<ul style="list-style-type: none"> <li>○ Structure and organization of the proposal</li> <li>○ Likelihood of completion</li> <li>○ Scientific merit</li> </ul>	15% of final grade
Student-led group discussion	All instructors will evaluate individual contributions during student-led discussions.	<ul style="list-style-type: none"> <li>○ Facilitation of group discussion</li> <li>○ Understanding of topic under discussion</li> </ul>	5% of final grade
Project manuscript	Small group submission to small group instructors for comments on first draft. Re-submission of final version to small group instructors for grade. Evaluations from other instructors will be incorporated into assessment.	<ul style="list-style-type: none"> <li>○ Originality of research project</li> <li>○ Structure and organization of the overall manuscript</li> <li>○ Evidence to support assertions</li> <li>○ Incorporation of revision suggestions in final version</li> </ul>	30% of final grade
Presentation of project	All instructors will evaluate individual contributions during presentations of projects.	<ul style="list-style-type: none"> <li>○ Structure and organization of the presentation</li> <li>○ Responses to in-class questions</li> <li>○ Understanding of material</li> <li>○ Presentation rehearsal</li> </ul>	10% of final grade
Synthesis paper	Individual submission to be evaluated by all course instructors. A single grade will be determined through the consensus of all instructors.	<ul style="list-style-type: none"> <li>○ Understanding of research results from each small group</li> <li>○ Identification of linkages among research results from each small group</li> </ul>	30% of final grade
Participation	The instructors for each small group will track participation for the students in their group.	<ul style="list-style-type: none"> <li>○ Equal contribution to peer review process</li> <li>○ Interest in, and respect for, views of others</li> <li>○ Advancing class discussions through comments and questions</li> </ul>	10% of final grade