

**SCIENCE AND POLICY OF GLOBAL ENVIRONMENTAL CHANGE
EEB and FR 5146**

**Course Syllabus
Spring 2009**

LOCATION AND TIME

Classroom Office Bldg B30
Tuesdays and Thursdays from 10:15 to 11:30AM

INSTRUCTORS

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COURSE WEBSITE: Link to course WebVista site through MyUPortal: My Courses

OFFICE HOURS:

In person: *by appointment.*

Via email: *Anytime.* We encourage you to use email to contact us (and your classmates) with any questions, concerns, or comments. Email is the surest way to receive a prompt reply (usually within the day) and is the easiest way to set up an appointment to meet with us.

OBJECTIVES

- A. To explore a range of scientific and policy issues related to global environmental changes as they influence ecosystem processes at multiple scales.
- B. To gain expertise in evaluating ecosystem responses to and policy decisions regarding a variety of environmental and global change factors.
- C. To learn how to read, interpret, and critically evaluate the primary scientific literature.
- D. To learn how to think critically about the intended and unintended consequences of alternative environmental policies.
- E. To gain experience effectively communicating environmental science and policy issues to lay audiences.

COURSE DESCRIPTION

Through readings, lectures, discussions, written assignments, and presentations this course will introduce the critical issues underpinning global change and its biological implications. The course will examine current scientific literature in exploring evidence for human-induced global change and its potential effects on a wide range of biological processes, focusing on (but not limited to) terrestrial ecosystems. We will also examine some of the economic drivers, economic consequences, and political processes related to global change, including local, national and international laws and policies that impact global change.

COURSE SCHEDULE

(This schedule is tentative and subject to change)

Assignment Due Dates

Feb 12	Science Brief #1 (SB1) rough draft due (3 hard copies and WebVista)
Feb 17	In-Class Peer Workshop of SB1 rough drafts (15 min)
Feb 24	Science Brief #1 (SB1) final draft due (Webvista)
March 5	Policy Brief #1 (PB1) rough draft due (3 hard copies and WebVista)
March 10	In-Class Peer Workshop of PB1 rough drafts (15 min)
March 24	Policy Brief #1 (PB1) final draft due (Webvista)
April 7	Science Brief #2 (SB2) final draft due (Webvista)
April 23	Policy Brief #2 (PB2) final draft due (Webvista)
Apr 9,13,21,23,40, May 5	Student Group Presentations

Lecture Topics, Readings, Daily Question Due Dates, and Assignments
(D.Q.: Daily Questions)

Date	Day	Topic (Lecturer) Readings	D. Q.	ASSIGNMENTS (SB: Science Brief PB: Policy Brief)
I. THE CHANGING CARBON CYCLE AND CLIMATE CHANGE				
20-Jan	T	Overview, Intro to Climate Policy (ALL) Reading: none		
22-Jan	Th	Climate Change: Introduction to Climate Change (SH) Reading: IPCC (2007) WG1 Technical Summary (Solomon et al. 2007)	Due	
27-Jan	T	Global Carbon Cycle, Part I (SH) Reading: IPCC (2007) WG1 Chapter 7 (Denman et al. 2007, section 7.3 only)	Due	
29-Jan	Th	Global Carbon Cycle, Part II (PR) Reading: see Jan 27		
3-Feb	T	Climate Change: Projections and Uncertainties (SH) Reading: see Jan 22		
5-Feb	Th	Climate Change: Ecological and Human Welfare Consequences, Part I (PR) Reading: IPCC (2007) WG2 Technical Summary (Parry et al. 2007)	Due	
10-Feb	T	Climate Change: Ecological and Human Welfare Consequences, Part II (PR) Reading: see Feb 5		
12-Feb	Th	Climate Change Solutions: Overview (EW) Reading: Socolow et al. 2004, Raupach et al. 2007	Due	SB1 First Draft Due
17-Feb	T	Geoengineering (SH) Reading: Morton 2007	Due	SB1 Peer Response Workshop
19-Feb	Th	Geologic Carbon Capture and Storage (EW) Reading: Wilson et al. 2007	Due	
24-Feb	T	Land Management for Carbon Sequestration (PR) Reading: TBA	Due	SB1 final draft due
26-Feb	Th	Emissions Reductions: Costs, Benefits and Discounting (Guest: Jay Coggins) Reading: Petson 2006, Nordhaus 2007, Stern and Taylor 2007		
3-Mar	T	Climate Change in Developing Countries (EW) Reading: TBA	Due	
5-Mar	Th	Politics and Economics of Climate Negotiations (EW) Reading: Aldy et al. 2003, Bodansky 2003	Due	PB1 First Draft Due
10-Mar	T	Energy from Biomass (Guest: John Sheehan) Reading: TBA		PB1 Peer Response Workshop

Date	Day	Topic (Lecturer) Readings	D. Q.	ASSIGNMENTS (SB: Science Brief PB: Policy Brief)
II. LAND USE CHANGE AND BIOTIC EXCHANGE AND CHANGE				
12-Mar	Th	Land Use Change: Patterns and Ecological Consequences (Guest: Jon Foley) Reading: Foley et al. 2005, Ellis and Ramankutty 2008		
24-Mar	T	Biotic Exchange and Change (PR) Reading: Yiming and Wilcove 2005, Mack et al. 2000	Due	PB1 final draft due
26-Mar	Th	Ecosystem Services (EW) Reading: Millenium Ecosystem Assessment 2005	Due	
III. OTHER CHANGE IN ATMOSPHERIC CHEMISTRY (PLUS STUDENT GROUP PRESENTATIONS)				
31-Mar	T	Human Impacts on the Global Nitrogen Cycle: Introduction (SH) Reading: Chapter 9 from Chapin et al. 2002 (optional)		
2-Apr	Th	Nitrogen Deposition: Causes and Consequences (SH) Reading: Galloway et al. 2003	Due	
7-Apr	T	Agriculture's Role in the Global N Cycle (Guest: Michael Russelle) Reading: TBA		SB2 final draft due
9-Apr	Th	Group Presentation 1 (students)		
14-Apr	T	Group Presentation 2 (students)		
16-Apr	Th	Tropospheric Ozone: Ecological Consequences (PR) Reading: Felzer et al. 2004 (required), Wittig et al. 2007 (optional)	Due	
21-Apr	T	Group Presentation 3 (students)		PB2 final draft due
23-Apr	Th	Group Presentation 4 (students)		
28-Apr	T	Clean Air Act (EW) Reading: Burtraw et al. 2005	Due	
30-Apr	Th	Group Presentation 5 (students)		
5-May	T	Group Presentation 6 (students)		
7-May	Th	Wrap-Up Session (ALL)		

RESPONSIBILITIES AND EVALUATION

Class Participation

This course brings together diverse instructor and student perspectives, representing wide-ranging knowledge, expertise, and insight. In addition, the topics we cover in the course are extremely current, and it is impossible for any one person to stay abreast of recent developments for all of the topics that we cover. Therefore, for all of us to learn as much as we can in the course, it is important that everyone participate in class fully, by attending class regularly, asking questions, sharing their knowledge and expertise and being actively engaged in the class discussions. Active engagement means both speaking up, and making substantive contributions—drawing from the course readings, outside lectures, and relevant experience.

Your participation will be scored 1=poor; 2=good; 3=exceptional, where "poor" means that you attend class semi-regularly but do not ask questions or participate in discussions; "good" means you attend class regularly, and ask questions and participate in discussion a few times over the course of the semester; and "exceptional" means you attend class regularly and ask questions and bring an informed perspective to class discussion frequently.

Required Reading

Throughout the course we will supplement lectures and discussions with current readings, mainly from the primary literature. We expect you to read assigned material before each class period and participate in discussions. Readings are available through **e-Reserves** (access instructions are included below). Therefore, attendance at all class sessions is expected. Our lectures will usually focus on the same topics, but may address either the specific reading or completely different materials, depending on the comprehensiveness or importance of the reading, its difficulty, and the total information that needs to be covered. Therefore, do not assume that materials in the readings will be covered in class. Sometimes they will, sometimes not.

Daily Questions/Insights

For the assigned readings indicated in the "Lecture Topics..." above, prepare at least one brief question or comment. These daily questions or comments should be 3-5 sentences in length, and should be posted in your WebVista journal by 8pm the night before each class when daily questions are due. Note that the questions can only be read by the course instructors. Questions will be scored 1=poor; 2=good; 3=exceptional.

The objectives of these required "daily questions" are:

- to provide practice at critical thinking
- to give us constant feedback on your level of understanding
- to help move classroom focus to issues you find interesting and important
- to increase the likelihood that required reading will be completed in a timely fashion

What types of questions?

A question should indicate some depth of thought, and not just be, "why did the author want to study ABC?" A question could be something you don't understand (e.g., "what is soil nitrogen mineralization and why should it vary with nitrogen deposition?"), or that seems to contradict something else we've heard (e.g., "how can we reconcile these results with those of Sarah Smith

who found opposite results in Borneo?") or something that was not clarified by the paper in question. Comments could for instance, indicate what you think is a novel approach by the author; highlight an important, but underemphasized point; make a linkage with another paper we read previously, etc. Or perhaps you might disagree with either the data, interpretation of data, speculation, methods, or extrapolation.

Group Student Presentations

During the last section of the course, students will form groups to develop presentations on some issue related to global environmental change. Groups should work together to come up with a topic that explores in greater detail and in more depth an issue raised in class or one related to the course content that was not covered in class. The purpose of this assignment is for you to get the opportunity to explore some issue in greater depth than we have time to cover in lectures. Examples of possible topics include: "Evaluation of Carbon Offset Programs", "Review/critique of laws and legislation in MN related to renewable energy", "Review of status of global fisheries", "Evaluation of 'eating local' culture on the global C cycle", or many others of your choice. Each team will be responsible for one class period with its presentation, but the team can decide how to divide that time between lecture and discussion of relevant articles.

Writing Assignments

The writing assignments in the course all take the form of science and policy "briefs". These are relatively short writing assignments that require you to distill down some complex scientific or policy issue into plain, clear language that is understandable by someone without advanced training in science or policy. The objective of these assignments is two-fold: (1) to give you a chance to research in some depth a science or policy topic of your choice that relates to global change, and (2) to help you understand and overcome the challenges of communicating science and policy to lay audiences. We have provided examples of excellent briefs written in past years on the website.

The first two writing assignments consist of writing one Science Brief and one Policy Brief using only the readings and materials covered in class. The word limit for each brief is 800 words (maximum). Because they are due relatively early in the semester, we don't expect you to do outside research for these briefs. You will have a chance to revise these two briefs after receiving responses and suggestions from your peers in a brief in-class workshop.

The second two writing assignments again consist of writing a Science Brief and a Policy Brief. However, the word limit for each brief is somewhat longer (1000 words maximum), and you should go into more depth than for the first two briefs, drawing on literature from outside of class. We will provide more details later in the semester.

Evaluation

Assignment	Points
Daily questions	10
Class participation	10
SB1	15
PB1	15
SB2	18.75

PB2	18.75
Peer Workshop Participation	2.5
Group Presentation	10
Total	100

POLICIES

Late Assignments All assignments are due at the beginning of class on the due date. If you have extenuating circumstances that prevent you from turning an assignment in on time, you must make arrangements with the instructor **ahead of time**. Students who turn in assignments after the due date will have their grades reduced by one grade for each late day after the due date, with one exception: NO drafts of science or policy briefs will be accepted after the due date. Students who don't hand in drafts on time will forgo the chance to participate in peer response workshops and receive instructor response and will lose that portion of their participation grade.

Academic Dishonesty and Plagiarism The University of Minnesota's Student Conduct Code classifies scholastic dishonesty as a disciplinary offense actionable by the University. Scholastic dishonesty is defined as "Submission of false records of academic achievement; cheating on assignments or examinations; plagiarizing; altering, forging, or misusing a University academic record; taking, acquiring, or using test materials without faculty permission; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement." Plagiarism is deliberately handing in another person's work as your own. It may be something you pulled off the internet, the work of a classmate, or that of another scientist whose work you read while researching a topic. It may be overt, in the form of copying answers from a colleagues' test, or it may be subtle, in the form of quoting or paraphrasing information from another source without properly acknowledging that source. If you want to use *the exact wording* from a published work, because you think it effectively makes a point, you must put the passage in quotation marks and cite the reference. More often, you will want to paraphrase another's ideas. Paraphrasing consists of expressing what an author is saying in your own words. In this case you should include reference to the author you paraphrase to indicate that the ideas are someone else's and not yours. If you are not clear about the differences between scholarly citation, collaboration and paraphrasing, please consult me or see the resources available at <http://writing.umn.edu/tww/plagiarism/index.htm>. Evidence of academic dishonesty in any form will be forwarded to the Student Scholastic Conduct Committee. According to University policy, academic dishonesty in any portion of academic work shall be grounds for awarding a grade of F for the entire course. We will use SafeAssign to check for plagiarism of rough and final drafts.

Grading Grades will be assigned as follows based on the total number of points possible, weighted as shown above: 90-100 A, 80-89 B, 70-79 C, 60-69 D, 0-59 F. We may lower grading criteria at the end of the semester if assignments or exams are more difficult than we intended in order to achieve the University Grading Standards, outlined as follows: **A** - achievement that is outstanding relative to the level necessary to meet course requirements. **B** - achievement that is significantly above the level necessary to meet course requirements. **C** - achievement that meets the course requirements in every respect. **D** - achievement that is worthy of credit even though it fails to meet fully the course requirements. **S** - achievement that is satisfactory, which is

equivalent to a C- or better (achievement required for an S is at the discretion of the instructor but may be no lower than a C-). **F** (or **N**) - Represents failure (or no credit) and signifies that the work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I. **I** (Incomplete) - Assigned at the discretion of the instructor when, due to extraordinary circumstances, e.g., hospitalization, a student is prevented from completing the work of the course on time. Requires a written agreement between instructor and student.

Credits and Workload Expectations One credit is defined as equivalent to an average of three hours of learning effort per week (over a full semester) necessary for an average student to achieve an average grade in the course. For example, a student taking a three credit course that meets for three hours a week should expect to spend an additional six hours a week on coursework outside the classroom.

Students with Disabilities that affect their capacity to participate fully in class or to meet all course requirements are encouraged to bring this to the instructors' attention so that we can arrange appropriate accommodations.

Instructions for accessing EReserves

1) Use direct link to your ERes course page (listed under Hobbie):

<http://eres.lib.umn.edu/eres/coursepage.aspx?cid=458>

or go to the ERes main page and search for the course by department, instructor, or course number. The ERes main page is located at:

<http://eres.lib.umn.edu/eres/default.aspx>

2) At copyright acceptance page, enter course password and click "Accept".

COURSE PASSWORD: Mit22bi

3) To view course information, select "Course Info" tab.

4) To view readings, select "Documents" tab.

5) Click on reading in "Title" column:

Most .pdf documents will automatically open. For readings with multiple parts, the "Document Info" window will open: click on each linked file name to open the reading's parts.

For links to most online resources, the "Document Info" window will open. Click on the "Click here to access online readings" link. The "Find It" window will open: click on one of the "electronic full text available" links to access the reading.

For links to some online resources, the "Document Info" window will open, and may include directions under "Description". Click on "Click here to access online resource" link, then follow directions under Description to locate the reading.

A Few Reminders:

* To view most documents placed on ERes, students will need to have installed the Adobe Acrobat Reader. The Reader can be downloaded for multiple platforms from the Adobe site at: <http://get.adobe.com/reader/#reader>

* While we try to minimize the file sizes of scanned documents, some of the files remain quite large (20-50KB per page). For this reason, it is recommended that students access these documents with a minimum 28.8 speed modem to reduce downloading times.

NOTE: Distribution of this password is limited to students enrolled in the course. Due to copyright restrictions you may not share the course password with anyone not enrolled in the course. Password protection creates a secure environment for access to copyrighted works that allows University Libraries to make materials available to students under the provisions of fair use. Limiting access to students registered in the class helps assure that materials are used only for educational purposes, and minimizes any impact on the market for the original work. This restriction is essential to a good faith assertion of fair use in electronic reserves service.

E-Reserve Readings for EEB/FR 5146, Spring 2009

Aldy, J.E., R. Baron and L. Tubiana. 2003. Addressing cost: the political economy of climate change. In: Beyond Kyoto: Advancing the International Effort Against Climate Change, Pew Center on Global Climate Change, Arlington, VA.

<http://www.pewclimate.org/docUploads/Beyond%20Kyoto.pdf>

- Bodansky, D. 2003. Climate commitments: assessing the options. In *Beyond Kyoto: Advancing the International Effort against Climate Change*. Pew Center on Global Climate Change, Arlington, VA.
- Burtraw, D., D.A. Evans, A. Krupnick, K. Palmer and R. Toth. 2005. Economics of pollution trading for SO₂ and Nox. *Annual Review of Environment and Resources* **30**: 253–89.
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- Denman, K. L., G. Brasseur, A. Chidthaisong, P. Ciais, P. M. Cox, R. E. Dickinson, D. Hauglustaine, C. Heinze, E. Holland, D. Jacob, U. Lohmann, S. Ramachandran, P. L. da Silva Dias, S. C. Wofsy, and X. Zhang. 2007. Couplings between changes in the climate system and biogeochemistry. *in* S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. *Climate Change 2007: The Physical Science Basis, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom.
- <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter7.pdf>
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- Mack, R. N., D. Simberloff, W. M. Lonsdale, H. Evans, M. Clout, and F. I. Bazzaz. 2000. Biotic invasions: Causes, epidemiology, global consequences, and control. *Ecological Applications* **10**:689-710.
- Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. Island Press, Washington, DC.
- www.millenniumassessment.org/en/Products.Synthesis.aspx
- Morton, O. 2007. Is this what it takes to save the world? *Nature* **447**: 132-136.
- Nordhaus, W. 2007. The *Stern Review* on the economics of climate change. *Journal of Economic Literature* **XLV**: 686–702.
- Parry, M. L., O. F. Canziani, J. P. Palutikof, and Co-authors. 2007. Technical Summary. Pages 23-78 *in* M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, editors. *Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom.
- <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-ts.pdf>
- Peston, R. 2006. Report's stark warning on climate. BBC.

<http://news.bbc.co.uk/2/hi/business/6096594.stm>

- Raupach, M. R., G. Marland, P. Ciais, C. Le Quere, J. G. Canadell, G. Klepper, and C. B. Field. 2007. Global and regional drivers of accelerating CO₂ emissions. *Proceedings of the National Academy of Sciences* **104**:10288-10293.
- Socolow, R., R. Hotinkski, J. B. Greenblatt, and S. Pacala. 2004. Solving the climate problem: technologies available to curb CO₂ emissions. *Environment* **46**:8-19.
- Solomon, S., D. Qin, M. Manning, R. B. Alley, T. Berntsen, N. L. Bindoff, Z. Chen, A. Chidthaisong, J. M. Gregory, G. C. Hegerl, M. Heimann, B. Hewitson, B. J. Hoskins, F. Joos, J. Jouzel, V. Kattsov, U. Lohmann, T. Matsuno, M. Molina, N. Nicholls, J. Overpeck, G. Raga, V. Ramaswamy, J. Ren, M. Rusticucci, R. Somerville, T. F. Stocker, P. Whetton, R. A. Wood, and D. Wratt. 2007. Technical Summary. *in* S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, editors. *Climate Change 2007: The Physical Science Basis, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom.
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- Yiming, L. and D. S. Wilcove. 2005. Threats to vertebrate species in China and the United States. *Bioscience* **55**(2):147-153