Global Environmental Science

ENVS 30 Fall 2017
Dr. David Lutz

Meetings:	M,W,F	12:50 - 1:55 PM		
201 Life Science Center	X Tu.	1:20 - 2:10 PM		
Office Hours:	Tu:	2:10 - 3:30 PM	Th:	8:30 - 9:45 AM

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Course Description and Rationale

The planet faces a litany of environmental issues that appear to magnify every day. Articles about global climate change, pollution, and biodiversity loss are now front page material in news sources across the world. Correspondingly, many governments and advocacy groups are becoming involved in efforts to mitigate these environmental harms. However, solving environmental problems is a grand challenge in that it requires individuals working together across many different fields in the physical and social environmental sciences. Practically, this presents a challenge in that there is often a divide regarding the knowledge bases of these disparate practitioners. For instance, environmental social science oriented scholars often learn how policies can be measured with respect to their efficacy and deployment, yet their background is frequently devoid of the empirical intricacies of planetary and ecosystem processes. Similarly, environmental and biological scientists may be capable of, say, calculating net ecosystem production values in forest ecosystems, yet are not often exposed to social science concepts that are necessary to enact effective change.

To address this issue, this class will be focused on teaching you the biogeochemical and physical processes that govern global ecosystems. Specifically, it will investigate how human activity (e.g. land use change, air and water pollution, climate change) can disrupt their functionality in a variety of ways. Furthermore, we will briefly explore ongoing environmental governance and policy mechanisms that aim to limit disruption of the global environment. This will provide us with an interdisciplinary lens by which to discuss ongoing anthropogenic environmental issues and thereby understand how the natural and social sciences can work together to most effectively address environmental challenges.

Learning Outcomes

By the end of this course, you should be able to:

1. Describe the physical mechanisms which underpin the Earth's geologic and hydrologic systems;
2. Display a detailed understanding of planetary energy balance, atmospheric circulation and composition, and the Earth's climate system;
3. Navigate and explain the major biogeochemical cycles including the inorganic and organic carbon, nitrogen, and phosphorous cycles;
4. Characterize and explain the impact of anthropogenic land-use change, air and water pollution, and greenhouse gas emissions on ecosystem processes and functioning;
5. Discuss several key contemporary environmental governance and policy frameworks that attempt to address these issues, integrating your knowledge of environmental science.

Teaching Philosophy and My Expectations for You

Generally, our meetings will involve a presentation of material that focuses on a set issue for each class. In each class period, I will use digital slides to help explain key concepts, integrating your assigned reading(s) as well as other material from scientific papers and presentations to help provide many ways for you to grasp each idea. For this methodology to be effective, it is essential for you to read the assigned work before class time. Reading for class will provide you with an opportunity to ask questions or ask for clarification regarding any aspects that were challenging. At the beginning of each of our meetings I will provide you with a blank set of handouts for you to use to take notes during class time and then, after class, I'll upload the slide deck to Canvas for you to have. One practice that I have found works well for students is to take 15 minutes after class to synthesize notes with the slide deck to further reinforce the critical components of the day's lecture.

In order to maximize your learning experience, it is crucial that we develop a collegial atmosphere in our classroom. Each student should feel comfortable presenting their questions and comments during our meetings. In order to achieve that, cell phone and computer use not integral to our meetings and activities will be strictly prohibited. As M. Scott Peck said, "You cannot truly listen to anyone and do anything else at the same time." I expect you to come to class having read the material for the day. Participation in our meetings is required and will constitute a percentage (10%) or your grade. Additionally, attendance to class is mandatory unless you have specifically provided me with advanced notice. Unexcused absences will result in adjustments to your participation grade.

My job is to help you learn, so if you have a question during our meetings, please raise your hand and *don't be afraid to ask it*. I am always happy to provide clarification and other background should you need it. I generally do my best to be available by email, however, the absolute best way to guarantee getting in touch with me is through office hours. I have set that time aside specifically to be there to help with any questions that you may have!

Text and Resources:

We will be using one main textbook throughout this course: *The Earth System*, by Kump, Kasting, and Crane (3rd edition). There will be many readings from this text, so it will beneficial for you to have your own copy, although copies are on reserve in Kresge Library for you. Kump can be found for purchase at Wheelock Books as used online at a general price of $100, although renting is a less expensive option too (it is also possible to find English International editions at low prices online). In addition, we'll have many other readings from a variety of sources. I'll upload these readings to Canvas in .pdf format for you.

Class Assessment and Assignments:

We will have 4 graded assignments that will require you to practice the concepts and techniques you've learned in your readings and in our meetings. These assignments will be due in paper format at the beginning of class for the date listed. Occasionally, we will use the x-hour to discuss the skills you will need in Excel to finish the assignments. *No late assignments will be accepted for full credit unless I have given explicit permission*.

Assignment 1:	A numerical problem set centered on atmospheric and geophysical scientific principles. 30 points (7.5%)
Assignment 2:	A set of exercises and questions focused on an Excel-based climate model. 30 points (7.5%)
Assignment 3:	A group assignment surrounding a particular contemporary environmental issue. Class presentations will be given during two designated class periods. 40 points (10%)
Assignment 4:	A short individually-written two-page essay on mitigation and adaptation policies surrounding the environmental issue of your group. 20 points (5%)
Examinations (2):	A full class period examination that assesses your understanding of the material covered in the preceding weeks. These occur at week 4 and week 9. 100 points each (25% each)
Final Evaluation:	A series of integrated questions that challenge you to integrate the interwoven concepts you've learned throughout the class. Given during the exam period. 40 points (10%)

Throughout the term, I will note your attendance, discussion in class and during exercises, and participation in group activities. Participation in class will constitute the remaining 40 points (10%). Your final grade will be the sum total of these eight components.

Grading Policies

All assignments are due in class (and digial copy on Canvas) on the due date stated. *No late assignments will be accepted for full credit unless I have given explicit permission.* If you have a conflict, let me know at least *two* weeks in advance, preferably at the start of the term so that we can find alternative arrangements - this includes expected absences due to athletic engagements. For each day late, I will deduct 10% from your overall grade on the assignment.

Honor Principle:
Students must adhere to Dartmouth's honor principle and all conduct throughout the class (assignments, exams, final assessment) should follow these principles. If you need a refresher on Dartmouth's honor codes, I am happy to discuss them during office hours, or, you can visit:

http://www.dartmouth.edu/~uja/honor/

Religious Observances:
If you have a religious observance that conflicts with your participation in this course, please meet with me at the beginning of the term to discuss appropriate accommodations regarding class meetings and assignments.

Student Accessibility Needs:

Students with disabilities who may need disability-related academic adjustments and services for this course should make an appointment to see me *as early in the term as possible*. Students requiring disability-related academic adjustments and services must consult the Student Accessibility Services office (205 Collis Student Center, 646-9900, email: Student.Accessibility.Services@dartmouth.edu), then provide me with the originally signed SAS Services and Consent Form and/or a letter on SAS letterhead. As a first step, if you have questions about whether you qualify to receive academic adjustments and services, you should contact the SAS office. All inquires and discussions will remain confidential.

Course Schedule

Week #1		
Monday, September 11th	Overview of the course, review syllabus, course policies, and goals.	Syllabus Sign up for Canvas
Wednesday, September 13th	Evolution of the Solar System, Earth, and Life	Brownlee (2), Kump (10) Schlesinger (2)
Friday, September 15th	More Origins: The Atmosphere, Oceans, and Metabolic Pathways	Schlesinger (2)
Week #2		
Monday, September 18th	Plate Tectonics and Earth Science	Kump (7)
Tuesday, September 19th	X-hour: Chemistry Essentials	Eby (1)
Wednesday, September 20th	Electromagnetic Radiation Basics **Assignment #1: due 9/29**	Kump (3), Campbell (10)
Friday, September 22nd	Atmospheric Composition and Structure	Kump (3),Schlesinger (3)
Week #3		
Monday, September 25th	Atmospheric Circulation	Kump (4)
Tuesday, September 26th	X-hour: Precipitation and Water Vapor	Kump (4), Campbell (3)
Wednesday, September 27th	Biogeochemical Modeling in Excel **Assignment #2: due 10/9**	Download .xls from Canvas
Friday, September 29th	Oceans: Circulation and Composition	Kump (5)
Week #4		
Monday, October 2nd	Carbon cycling: Inorganic	Kump (8)
Tuesday, October 3rd	X-hour: Carbon cycling: Organic	Schlesinger (5)
Wednesday, October 4th	Nitrogen and Phosphorous Cycling	Schlesinger (12)
Friday, October 6th	Guest Lecture: Fiona Jevon PhD Candidate	TBD
Week #5		
Monday, October 9th	Nutrient Cycling	Schlesinger (6)
Wednesday, October 11th	Global Estimates of NPP, Ecosystems	Schl. (5), Townsend (11)
Friday, October 13th	**Examination #1**	Good Luck!!

Course Schedule

Week #6		
Monday, October 16th	Remote Sensing of the Environment **Assignment #3 due 10/27,30**	Jensen Readings
Wednesday, October 18th	Ecosystems and Biodiversity	Kump (9),Townsend (10)
Friday, October 20th	Deforestation	Hansen et al. 2013, Perry Readings
Week #7		
Monday, October 23rd	Agriculture and Land Use	Foley et al. 2005, Blann Readings
Tuesday, October 24th	X-hour Air Pollution **Assignment #4 due 11/1**	Greaver et al. 2012
Wednesday, October 25th	Biodiversity, Trophic Cascades	Pace et al. 1999, Townsend (9)
Friday, October 27th	Group Presentations	
Week #8		
Monday, October 30th	Group Presentations	
Tuesday, October 31st	Xhr: Climate Change 1: Long-term GHGs	Kump (12, *14*)
Wednesday, November 1st	Climate Change 2: Impacts, Models	Kump (15)
Friday, November 3rd	Climate Change 3: Impacts	Kump (16)
Week #9		
Monday, November 6th	**Examination #2**	Good Luck!!
Wednesday November 8th	Mitigation Efforts 1	Miles and Kapos, 2008
Friday, November 10th	Climate Change Economics/Policy	TBD
Week #10		
Monday, November 14th	Mitigation Efforts 2	Lui and Wang, 2013
Monday, November 22nd	**Final Synthesis/Evaluation**	Location: TBD